8TH EDITION

PEDRETTI'S

Occupational Therapy

PRACTICE SKILLS FOR PHYSICAL DYSFUNCTION

EDITED BY

Heidi McHugh Pendleton | Winifred Schultz-Krohn

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Pedretti's Occupational Therapy

Practice Skills for Physical Dysfunction

8TH EDITION

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Dedication

We are honored to dedicate this eighth edition of *Pedretti's Occupational Therapy: Practice Skills for Physical Dysfunction* to Lorraine Williams Pedretti. Lorraine Williams Pedretti was selected by the American Occupational Therapy Association as one of the 100 Influential People in the field of occupational therapy as part of the profession's centennial celebration. Her thoughtfulness, love of her profession, and dedication to the education of her students provided the impetus to embark on the daunting task of writing and editing an original textbook (and ensuing editions) for evaluation and treatment of adults with physical disabilities. As academic colleagues of Professor Pedretti, we were inspired by her example and challenged to accept the responsibility to continue in her footsteps to contribute to the advancement of the profession. It is our hope that our efforts have honored her example and lived up to her faith in us.

We would also like to dedicate this edition to occupational therapy students (past, present, and future) who are the future of our wonderful profession: may you find the happiness and fulfillment that we have as proud occupational therapists.

Foreword

It is an honor and a privilege to write the foreword to the eighth edition of *Pedretti's Occupational Therapy: Practice Skills for Physical Dysfunction*. I was the book's original author and the primary editor of the first five editions. The book was first published in 1981. It has been widely used by occupational therapy students in the United States and abroad for 36 years. Over this time, it has enjoyed a reputation for its practical and comprehensible writing, and for covering the essential theoretical and practical information needed for clinical practice. As editions progressed, the text evolved to keep pace with changes in the rapidly growing body of knowledge and expanding areas of clinical practice in occupational therapy. It is very gratifying for me to know that this book continues to be an important resource for students, occupational therapy educators, and clinicians in the profession.

I was very pleased that my professional colleagues at San Jose State University, Dr. Heidi McHugh Pendleton and Dr. Winifred Schultz-Krohn, will continue as the book's editors. Dr. Pendleton, who was my student many years ago, joined the faculty of San Jose State University in 1987 after many years of clinical practice, working with clients with physical dysfunction. It was gratifying to witness her professional and academic development, to observe her numerous professional achievements, and to see her earn the doctorate in the field. After serving a term as Chair of the Department of Occupational Therapy at San Jose State University from 2008-2012, she returned to teaching courses in the history and theory of occupational therapy and professional development. She received the Lifetime Achievement Award from the Occupational Therapy Association of California in 2011.

Dr. Winifred Schultz-Krohn came to San Jose State University in 1996 with excellent credentials and qualifications. She has many years of clinical practice in pediatrics, is a board-certified pediatric occupational therapist, and has previous academic experience. She has extensive education and expertise in neurological dysfunction. Professor Schultz-Krohn was awarded the prestigious regional Jefferson Award for more than 17 years of pro bono occupational therapy services to the San Jose Family Homeless Shelter. Her tireless volunteer work ranged from developing and supervising a summer OT fieldwork program to providing practicum and research opportunities to hundreds of occupational therapy students. She received the Outstanding Professor Award for San Jose State University in 2014. Professor Schultz-Krohn is currently Chair of the Department of Occupational Therapy at San Jose State University.

These editors are professional and academic leaders in the field. They have published numerous articles and book chapters and have received many professional awards and recognitions. They have clinical and academic expertise and a wealth of professional knowledge that makes them eminently qualified for their editorial roles. They have done an excellent job in authoring chapters, editing, and coordinating the preparation of the sixth, seventh, and now the eighth editions.

These editors have assembled a roster of excellent contributors: leaders and experts in the occupational therapy profession who are well qualified to write on their respective subjects. As the profession grew and changed, the content and format of the textbook evolved to reflect those changes. Therefore, more contributors were invited to participate in the preparation of each edition. There are over 60 contributors in the eighth edition, 21 of whom are new contributors.

The content of the eighth edition reflects the substantive changes that have occurred in occupational therapy philosophy and practice. The content has been restructured and is based on the new Occupational Therapy Practice Framework-3, with expanded emphasis on evidence-based practice and emerging practice areas. The content reflects new research and theories, new techniques, and current trends in the profession while maintaining a focus on client-centered practice. This edition continues to include case studies, clinical reasoning skills, ethical questions and concerns, factors of cultural diversity, and practice notes that are threaded throughout the book. There is one new chapter: Chapter 49, *Occupational Therapy in Hospice and Palliative Care*; and a new section added to Chapter 7, Section 2, *The Therapeutic Use of Self: Embodying Mindfulness in Occupational Therapy*. The enhanced content will teach the student essential clinical reasoning skills and provoke thinking about potential ethical and cultural considerations in treatment. There is comprehensive coverage of physical dysfunction. Chapters on evaluation of joint range of motion (21) and muscle strength (22) have a whole new look with full color photos and drawings, as well as approaches to simplify and clarify the evaluation processes. Especially exciting is the accompanying Evolve website for students and instructors. This development brings this textbook into the electronic information age and has great potential for independent study by students and as a resource for occupational therapy educators.

Writing and editing a textbook is no small task. It takes a great deal of time, patience, and persistence. It involves dealing with numerous people—editors, contributors, vendors, models, photographers, and artists. I was so fortunate that my worthy colleagues agreed to adopt this textbook and keep the production going after my retirement. I am very grateful that they have produced this excellent work and so pleased that it will continue to be associated with the occupational therapy program of excellence at San Jose State University.

Lorraine Williams Pedretti MS, OT (retired) *Professor Emeritus San Jose State University*

Preface

It was a great honor to be asked to assume the editorship of the eighth edition of *Pedretti's Occupational Therapy: Practice Skills for Physical Dysfunction*. To continue to follow in the footsteps of the inimitable Lorraine Pedretti is at once an awesome responsibility and a rewarding journey. The opportunity to work with authors, each a leading expert in his or her field, continues to be an unparalleled experience of the exceptional ability of stellar occupational therapists to organize their time and unselfishly devote their scholarship to the education of future generations of the profession.

Since the publication of the seventh edition, there have been changes within the profession and within the clinical practice of occupational therapy for clients with physical dysfunction. Many of those changes served to shape the approach we took to the new edition and are reflected within the context of each of the chapters. Our mission and intention was to embrace these changes and continue to honor the primacy of occupation that has been the foundation of this textbook for the past several editions.

The eighth and latest edition is framed and guided by the Occupational Therapy Practice Framework: Domain and Process—3rd (OTPF-3), designed to describe the focus and dynamic process of the profession. Key to the OTPF-3 is its view of the overarching goal of occupational therapy; that is, engagement in occupation to support participation in life. This conceptualization of the importance of occupation is emphasized throughout the text. The concepts of process and practice, evaluation and intervention, performance skills and patterns, contexts and activity demands, client factors, and intervention applications are all thoroughly illustrated throughout.

To honor the centrality of the client to occupational therapy practice, the chapters begin with case studies, which are then threaded throughout, guiding the reader through the information and relating the content to the specific case descriptions. Thus, the reader is able to experience the clinical reasoning and decision-making skills of the expert clinicians who authored the chapters. Authors of individual chapters were asked to follow the initial presentation of their case studies by crafting several probative or "critical thinking" questions that would pique the readers' curiosity, further motivating their attention to and questioning of the chapter content and consequently facilitating the learning process. Direct answers to these critical thinking questions are provided either within or at the end of each of the chapters.

This textbook, written for an intended audience of occupational therapy graduate students and as a reference for practicing occupational therapists, has always been acknowledged for its practical application and focus on practice. Theory and evidence-based content are presented in each chapter and then applied using case descriptions as a foundation for practice. Occupational therapy's role in health and wellness, as well as prevention, is addressed throughout the text. Similarly, occupational therapy's commitment to the importance of considering cultural and ethnic diversity is reflected in every chapter.

The eighth edition continues to feature the OT Practice Notes and the Ethical Considerations boxes that are highlighted throughout many of the chapters. The information contained in these boxes (pulled from the chapter content) conveys ideas that are relevant to students' future practice areas and thoughts about some of the possible ethical dilemmas and decisions with which they might be confronted. New support materials include the Evolve website, which includes both a link to student-related materials as well as an instructor link with access to the Instructor's Resource Manual and a test bank.

During the process of editing this book, including the stages of envisioning and designing the content and format, selecting the authors, and reading and giving input to their work, we were guided by our commitment to honoring the occupational welfare of our clients, particularly adults with physical disabilities, through excellent preparation of their future occupational therapists. To that end we sought preeminent authors, those who not only had recognition for expertise in their topic area, but who also embraced the primary importance of occupation to their practice and scholarship. Our goal was to engender excitement in the reader for occupational therapy in the area of physical dysfunction, while providing cutting-edge information and promoting models of best practice. Our extensive and rewarding clinical and academic careers in the profession of occupational therapy and our experiences with hard-working and inspiring clients and students served as the inspiration for our best efforts, which we trust are evident in this book.

Heidi McHugh Pendleton

Winifred Schultz-Krohn

Acknowledgments

We would like to thank the authors, past and present, for their exceptional contributions and willingness to continue the tradition of excellence that has come to be associated with the Pedretti book. The impressive list of authors for the eighth edition continues the Pedretti reputation for including nationally and internationally known experts in their topic areas and disciplines. We are fortunate to feature contributions from new authors and included among them are administrators, educators, researchers, and master clinicians.

We would also like to acknowledge the superb contribution of the dedicated editors and staff at Elsevier. We are especially grateful to Jolynn Gower, Content Development Manager; Kellie White, Executive Content Strategist; and Courtney Sprehe, Senior Content Development Specialist, who patiently and painstakingly mentored us through the long and arduous editing process. They are simply outstanding! Our thanks go to Rich Barber, Senior Project Manager, who, with exceptional attention to detail, made sure that the final product reflected the efforts of all involved.

To those publishers and vendors who permitted us to use material from their publications, we extend our sincere gratitude. Photographers and artists, and the clients and models who posed for photographs, are gratefully acknowledged. We are grateful to the contributors who were particularly generous in finding just the right photographs to capture the importance of occupation to participation in life—we thank you!

Finally, we would like to extend heartfelt appreciation to our colleagues, friends, and families, without whose help and support this accomplishment could not have been achieved. Special expressions of *thank you* go to the faculty and staff at San Jose State University, who could be counted upon for their support and good wishes during this process.

Heidi McHugh Pendleton extends her gratitude to her husband, Forrest Pendleton (for immeasurable love and support without which this endeavor could never have succeeded) and to her sisters, Deirdre McHugh and Kathleen McHugh (for a lifetime of support). Her love and appreciation go to all of her nieces, nephews, and stepson, including Dar, Jim, Nicky, Elizabeth, Jimmy D, Megan, Kelsey, Jamie, Jessica, and Katie—their love and enthusiasm make everything possible. She would like to also extend gratitude to her brother-in-law, H. Duncan Mason, MD, and to occupational therapy student, Morgan Gralla, from Towson University, who contributed their expertise to identify and correct inadvertent misinformation in a chapter from the last edition. It is always our intention to present the best information available, and we deeply appreciate feedback from our readers.

Winifred Schultz-Krohn extends a huge thank you to her always supportive, ever-patient husband, Kermit Krohn. His tireless love made the project possible. She is also very grateful for the support and encouragement received from her brother, Tom Schultz; his wife, Barb Fraser; and niece, Sarah; her sister, Donna Friedrich; husband, Don; nephews, Brian and Andrew; Andrew's wife, Kirsten; and grand nephew, Zachary; sister, Nancy Yamasaki; and husband, Bryan.

The co-editors would like to thank each other—great friends at the beginning of the process—we were able to be there for each other, make our own unique contributions, and ultimately sustain our friendship throughout the process, emerging even better friends in the joy of our accomplishment.

PART I

Overview: Occupational Therapy Foundations for Physical Dysfunction

OUTLINE

The Occupational Therapy Practice Framework and the Practice of Occupational Therapy for People With Physical Disabilities

Heidi McHugh Pendleton, Winifred Schultz-Krohn

CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Briefly describe the evolution of the Occupational Therapy Practice Framework, from the original OTPF through the OTPF-3.
2. Describe the need for the OTPF-3 in the practice of occupational therapy (OT) for persons with physical disabilities.
3. Describe the fit between the OTPF-3 and the ICF, and explain how they inform and enhance the occupational therapist's understanding of physical disability.
4. Describe the elements of the OTPF-3, including domain and process and their relationship to each other.
5. List and describe the components that make up the OT domain and give examples of each.
6. List and describe the components that make up the OT process and give examples of each.
7. Briefly describe the OT intervention levels, and give an example of each as it might be used in a physical disability practice setting.

KEY TERMS

Client factors
Contexts
Domain
Environment
Evaluation
***International Classification of Functioning, Disability, and Health* (ICF)**
Intervention
Occupations
Performance patterns
Performance skills
Process
Targeted outcomes
"The Occupational Therapy Practice Framework: Domain and Process," third edition

Threaded Case Study

Kent and Karen, Part 1

Kent is a highly skilled and very competent occupational therapist with more than 25 years of clinical experience. He works in a large rehabilitation center with adult clients who have physical disabilities. He currently is the supervising occupational therapist on the spinal cord injury (SCI) unit. Through his reading of OT publications,[3,14,15,18,23] attendance at conferences and workshops, and interactions with his OT staff and interning OT students, he has become increasingly knowledgeable about the Occupational Therapy Practice Framework (OTPF) and its current version, the OTPF-3. When the OTPF-3 was published, he initially was annoyed that, among the many challenges to his professional time and efforts, he would have to learn, yet again, a new "language" to provide competent interventions, and that even before he had mastered the first two models, a third, updated edition had appeared. He couldn't help thinking, "Why fix something that isn't broken?" He reluctantly acknowledged the necessity for the change. Now, however, he is impressed by what he has learned so far, and he is convinced that he can no longer postpone delving into and really learning the OTPF-3 and integrating it into his clinical practice.

Throughout his practice, Kent has found it helpful to relate new or novel OT information he is learning to the relevant circumstances that either he or one of his clients is experiencing; in this way he considers the impact the new information might have on either his own life or that of his client.

Kent has decided that, as he works on learning the OTPF-3 (also referred to as the *Framework*), he will keep in mind one of his recently admitted clients, Karen. Karen is a single, 25-year-old woman who lives alone in her own apartment and works as an administrative assistant for a busy law office. Karen incurred a cervical SCI and now has C6 functional quadriplegia/tetraplegia that necessitates use of a wheelchair for mobility. By keeping Karen in mind, Kent expects not only to learn the changes and updates to the Framework, but also to reinforce his new knowledge by putting it to immediate use in his practice.

Critical Thinking Questions

As you read through the chapter, keep in mind the challenges that learning the OTPF-3 and integrating it into his practice will pose for Kent. Think of strategies you might recommend or use yourself to learn and integrate the information into your practice. In addition, consider the objectives for the chapter, outlined previously, and also these questions:

1. Why was there a need for the OTPF and its subsequent second and third versions, and how do they fill that need?

2. How might the specific information presented about the OTPF-3 apply to Kent or Karen?

3. Are there tools that Kent and other OT practitioners can use to help them learn the OTPF-3 and integrate it into their practice?

The Occupational Therapy Practice Framework: Domain and Process, Third Edition (OTPF-3)—Overview

Many changes have occurred in the practice of occupational therapy for persons with physical disabilities since the publication of the previous edition of *Occupational Therapy: Practice Skills for Physical Dysfunction* in 2014. OT practice settings are increasingly moving away from traditional healthcare environments, such as the hospital and rehabilitation center, and have made significant strides moving more toward the home and community milieus. The provision of OT service has become progressively more client centered, and the concept of occupation is increasingly and proudly named as both the preferred intervention and the desired outcome of the services. Clinicians, researchers, and scholars have sought to implement evidence-based practice by learning more about the benefits of occupation not only to remediate problems after the onset of physical disability, but also to anticipate and prevent physical disability and promote wellness. Not surprisingly, economic concerns have severely shortened the amount of time allotted for OT services, thus necessitating more deliberate and resourceful decisions about how these services can be delivered most effectively.

In response to these changes and many other practice advances, came a change, or evolution, in the language that occupational therapists use to describe what they do and how they do it. This change, in turn, resulted in the document "The Occupational Therapy Practice Framework: Domain and Process," published in 2002 by the American Occupational Therapy Association (AOTA) in the *American Journal of Occupational Therapy* (AJOT).[1] (The model set forth in the document is commonly referred to as the Occupational Therapy Practice Framework [OTPF] or just the Framework.)

The OTPF is a tool developed by the OT profession to more clearly articulate and enhance the understanding of what OT practitioners do (occupational therapy domain) and how they do it (occupational therapy process). The intended beneficiaries of all three editions of the OTPF were envisioned as including not only OT practitioners (an internal audience), but also the recipients of OT services (referred to as clients), other healthcare professionals, and those providing reimbursement for OT services (an external audience).

The first version of the Framework was put into practice, and its relevance and efficacy were assessed; this evaluation resulted in the OTPF-2,[2] which was published in the AJOT in 2008. The same rigorous examination was applied to produce the current version, **"The Occupational Therapy Practice Framework: Domain and Process," third edition (OTPF-3)**, which appeared in the AJOT in 2014.[3]

The OTPF-3 is an important document that every OT practitioner should have and consult frequently. It can be downloaded from the AOTA website (*http://www.aota.org*) by selecting AJOT (under Publications & News at the top of the homepage) and then the March/April 2014 issue; a PDF copy of this document can be downloaded and printed for convenience to members of the AOTA. Another helpful tool for learning the Framework is the introductory article by Youngstrom titled, "The Occupational Therapy Practice Framework: The Evolution of Our Professional Language,"[27] which appeared in the November/December 2002 issue of the AJOT.

It is not the intention of this chapter to supplant the comprehensive OTPF-3 document, but rather, to describe the model and increase the reader's understanding of the OTPF-3 and its relationship to the practice of occupational therapy with adults with physical disabilities. To achieve this, the chapter begins with a discussion of the history of the OTPF-3, followed by sections describing the need for the OTPF-3 and the fit between the OTPF and the World Health Organization's (WHO) ***International Classification of Functioning, Disability, and Health*** **(ICF)**. Next, a detailed description of the Framework is presented, with emphasis on explicating the domain of occupational therapy through examples from the case study and introducing the OT process (discussed in depth in Chapter 3) in the application of the Framework to individuals with physical dysfunction. The types of OT intervention proposed by the Framework 3 are examined and illustrated by examples typically used in physical disabilities practice settings. The chapter concludes with suggestions and strategies for learning the OTPF-3 and an overview of how the latest version of the Framework is integrated as a unifying thread throughout the remaining chapters in the book.

Evolution of the Occupational Therapy Practice Framework

In 1999 the AOTA's Commission on Practice (COP) was charged with reviewing the "Uniform Terminology for Occupational Therapy," third edition (UT-III), a document that had been published by the association 5 years earlier.[4] Under the leadership of its chair, Mary Jane Youngstrom, the COP sought feedback from numerous OT practitioners, scholars, and leaders in the profession about the continued suitability of the UT-III, to determine whether to update the document or to rescind it. Previous editions of the UT, in 1979 and 1989, had been similarly reviewed and updated to reflect changes and the evolving progress of the profession. The reviewers found that the UT-III, although considered a valuable tool for occupational therapists, lacked clarity for both consumers and professionals in associated fields about what occupational therapists do and how they do it. Furthermore, they found that the UT-III did not adequately describe or emphasize OT's focus on occupation, the foundation of the profession.[12]

Given the feedback from the review, the COP determined that a new document was needed, one that would preserve the intent of the UT-III (outlining and naming the constructs of the profession) while providing increased clarity about what occupational therapists and OT assistants do and how they do it. Additionally, it was determined that the new document would refocus attention on the primacy of occupation as the cornerstone of the profession and desired intervention outcomes, in addition to showing the process occupational therapists use to help their clients achieve their occupational goals.

Need for the Occupational Therapy Practice Framework

The original OTPF and the revised versions (OTPF-2 and OTPF-3) make it clear that the profession's central focus and actions are grounded in the concept of occupation. Although some of what occupational therapists do could be construed by clients and other healthcare professionals as similar to or even duplication of the treatment efforts of other disciplines, formally delineating occupation as the overarching goal of all that OT does, and clearly documenting supportive goals intended to achieve that main goal, establishes the profession's unique contribution to client intervention.

This is not to say that before the OTPF, OT practitioners did not recognize or focus on occupation or occupational goals with their clients—most did. However, in the physical disabilities practice setting, with the reductionistic, bottom-up approach and pervasive influence of the medical model, occupation was seldom mentioned or linked to what was being done in OT. A premium seemed to be placed on "medical speak," and it was difficult, if not impossible, to document occupational performance or occupational goals using the types of documentation characteristic of physical disabilities practice settings. Kent, the therapist from the case study, still occasionally experiences the medical team members' heightened interest when he reports muscle grades and sensory status, and their quizzical, glazed-over looks when he describes his clients' difficulties resuming homemaking, leisure, or other home and community skills. The OTPF-3 provides a means of communicating to healthcare professionals who are not occupational therapists that engagement in occupation should be the primary outcome of all intervention.

The OTPF-3 provides a language and structure that communicates occupation more meaningfully. It empowers occupational therapists to restructure evaluation, progress, and other documentation forms to reflect the primacy of occupation in what OT does, and it shows the interaction of all the aspects that contribute to supporting or constraining the client's participation. Thus, by clearly showing and articulating the comprehensive nature of OT's domain of practice to clients, healthcare professionals, and other interested parties, occupational therapists enlist support and demand for their services and, most importantly, ensure that clients receive the unique and important services that OT provides. Equally important, the OTPF-3 positions the client as a collaborator with the occupational therapist at every step of the process, thereby empowering the individual as a change agent and reframing the image of the client as a passive recipient of services.[13]

Fit Between the OTPF-3 and the *International Classification of Functioning, Disability, and Health* (ICF)

There appears to be an excellent fit between the OTPF (all editions) and the ICF. About the same time the UT-III was being studied for continued suitability for contemporary language and practice, the World Health Organization (WHO) was revising its language and classification model. The result, the *International Classification of Functioning, Disability, and Health*, contributes to the understanding of the complexity of having a physical disability.[26] The ICF "moved away from being a 'consequences of disease' classification to become a 'components of health' classification,"[26] progressing from impairment, disability, and handicap to body functions and structures, activities, and participation. In the ICF, *body structures* refers to the anatomic parts of the body, and *body functions* refers to a person's physiological and psychological functions. Also considered in this model is the impact of environmental and personal factors as they relate to functioning. The ICF adopted a universal model that considers health along a continuum that shows the potential for everyone to have a disability. WHO perceived this as a radical shift—from emphasizing people's disabilities to focusing on their level of health.

The ICF also provides support and reinforcement for OT to specifically address activity and activity limitations encountered by people with disabilities.[26] In addition, it describes the importance of participation in life situations, or *domains,* including (1) learning and applying knowledge; (2) general tasks and task demands; (3) communication; (4) movement; (5) self-care; (6) domestic life areas; (7) interpersonal interactions; (8) major life areas associated with work, school, and family life; and (9) community, social, and civic life. All of these domains are historically familiar areas of concern and intervention for the OT profession. Although a physical disability may compromise a person's ability to reach up to brush his or her hair, the ICF redirects the service provider to also consider activity limitations that may result in restricted participation in desired life situations, such as sports or parenting. A problem with a person's bodily structure, such as paralysis or a missing limb, is recognized as a potentially limiting factor, but that is not the focus of intervention.

OT practitioners believe that intervention provided for people with physical disabilities should extend beyond a focus on recovery of physical skills and address the person's engagement, or active participation, in occupations. This viewpoint is the cornerstone of the OTPF-3 and previous versions. Such active participation in occupation is interdependent on the client's psychological and social well-being, which must be simultaneously addressed through the OT intervention. This orientation is congruent with the emphasis reflected in the ICF.

In many instances the language of the UT-III was different from that used and understood by the external audience of other healthcare professionals. Similarly, the terminology of the previous WHO classification frequently differed from that used by the audience with which the organization was trying to communicate (eg, healthcare professionals and other service providers). The goals of the new WHO classifications, the ICF, are to increase communication and understanding about the experience of having a disability and unify services. In a similar manner, the original OTPF, and now the updated OTPF-3, was designed to increase others' knowledge and understanding of the OT profession and, where appropriate, to incorporate the language of the ICF, as will be seen in the following discussion of the OT domain and process.

Detailed information on the ICF can be found in the document referenced in this chapter,[26] or an overview of the document can be downloaded from *http://www.who.int/icf/cfm*. A helpful resource for learning the ICF is the Beginners Guide to the ICF, which can also be accessed at the website *http://www.who.int/classifications/icf*. Additional and annually updated documents on the ICF also are available at this website.

The OTPF-3: Description

The OTPF-3 is composed of two interrelated parts, the domain and the process. The **domain** comprises the focus and factors addressed by the profession, and the **process** describes how occupational therapy does what it does (evaluation, intervention, and outcomes)—in other words, how it puts the domain into practice. Central to both parts is the essential concept of occupation. The definition of occupation used by the developers of the original Framework is:

Activities … of everyday life, named, organized, and given value and meaning by individuals and a culture. Occupation is everything people do to occupy themselves, including looking after themselves, … enjoying life, … and contributing to the social and economic fabric of their communities.[16]

The revised Frameworks (both the OTPF-2 and OTPF-3), rather than adopting a single definition, used several definitions found in the OT literature[2,3] (OTPF-3, pp. S5–S6). The committee charged with producing the OTPF-3 ultimately suggested that an array of selected definitions of the term *occupation*, offered by the scholars of the profession, would add to an understanding of this core concept (see OTPF-3, pp. S5–S6).[3] In adopting the essence of these definitions, the developers of the OTPF-3 characterized the profession's focus on occupation in a dynamic and action-oriented form, which they articulated as "achieving health, well-being and participation in life through engagement in occupation"[3] (OTPF-3, p. S2). This phrase links the two parts of the Framework, providing the unifying theme or focus of the OT domain and the overarching target outcome of the OT process—an inextricable linkage between domain and process that the authors of the OTPF-3 described as "transactional"[3] (OTPF-3, p. S4).

The Occupational Therapy Domain

The domain of occupational therapy encompasses the gamut of what occupational therapists do, along with the primary concern and focus of the profession's efforts. Everything that occupational therapy does or is concerned about, as depicted in the domain of the OTPF-3, is directed at supporting the client's engagement in meaningful occupation that ultimately affects the health, well-being, and life satisfaction of that individual.

The five broad areas, or categories, of concern that constitute the OT domain are occupations, client factors, performance skills, performance patterns, and context and environment (Fig. 1.1). In the first two editions of the Framework, activity demands constituted a sixth category in the domain. However, in the OTPF-3, it was removed from that position and "placed in the overview of the process to augment the discussion of the occupational therapy practitioner's basic skill of activity analysis"[3] (OTPF-3, p. S2). The developers of the OTPF-3 pointed out that there is a complex interplay among all of these areas or aspects of the domain, that no single part is more critical than another, and that all aspects are viewed as influencing engagement in occupations. Furthermore, the success of the OT process (evaluation, intervention, and targeted outcomes) is incumbent on the occupational therapist's expert knowledge of all aspects of the domain. The expert practice of occupational therapy requires the therapeutic use of self, clinical reasoning (knowledge of theory and evidence), and skills in activity analysis and activity demands to create the overview that guides each step of the process.

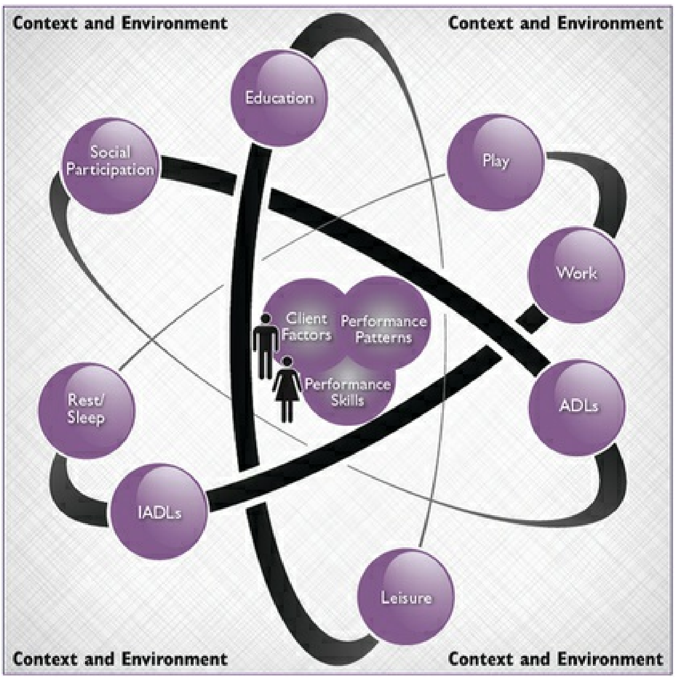

FIG 1.1 Occupational therapy domain. (From the American Occupational Therapy Association: Occupational therapy practice framework: domain and process, *Am J Occup Ther* March/April[Suppl]:S4, 2014.)

Occupations

Occupational therapists frequently use the terms *occupation* and *activity* interchangeably. In the Framework, the term *occupation* encompasses the term *activity*. **Occupations** may be characterized as being meaningful and goal directed but not necessarily considered by the individual to be of central importance to her or his life. Similarly, occupations may also be viewed as (1) activities in which the client engages, (2) activities that have the added qualitative criteria of giving meaning to the person's life and contributing to his or her identity, and (3) activities the individual looks forward to engaging in. For example, Karen, Kent's client with quadriplegia, regards herself as an excellent and dedicated clothes and accessories shopper; holidays and celebrations always include her engagement in her treasured occupation of shopping. Kent, on the other hand, regards the activity of shopping for clothes as important only to keep himself clothed and maintain social acceptance. Kent avoids the activity whenever possible. Each engages in this activity to support participation in life but with a qualitatively different attitude and level of enthusiasm. In the OTPF-3, both of these closely related terms are used, to recognize that individual clients determine the occupations he or she regards as meaningful and those that are simply necessary or are activities that support the person's participation in life. For Kent, shopping is a necessary occupation or activity, but for Karen, it is a favorite occupation.

The occupation category of the domain includes eight comprehensive types of human activities or occupations. Each is outlined in the following discussion; a list of typical activities included in each type is provided; and examples from the physical disability perspective, as provided by Karen's circumstances, are presented.

Threaded Case Study

Kent and Karen, Part 2

As Kent perused the list of activities of daily living (ADLs) in Table 1 of the OTPF-3, he noted that virtually every category, with the exception of eating (which involves the ability to keep and manipulate food in the mouth and the ability to swallow), would be a concern for his client, Karen, because of the nature and extent of her SCI disability. When Kent discussed this list with Karen, she viewed practically all as necessary activities, but she personally valued feeding, sexual activity, and personal hygiene and grooming as being extremely important to her satisfactory participation in life. Karen was a little surprised to learn that sexual activity was included. “So this is occupational therapy?” she thought. “Maybe I'll wait awhile before I talk about this topic, but it's good to know I'm expected to be interested.”

For the present, Karen turned her attention to and took particular interest in the activities included in the personal hygiene and grooming category and its detailed description:

Obtaining and using supplies, removing body hair (use of razors, tweezers, lotions, etc.), applying and removing cosmetics, washing, drying, combing, styling, brushing and trimming hair; caring for nails (hands and feet), caring for skin, ears, eyes, and nose, applying deodorant, cleaning mouth, brushing and flossing teeth; or removing, cleaning, and reinserting dental orthotics and prosthetics[3] (OTPF-3, p. S19).

The numerous details reminded her of how important all these grooming activities were to her, and they indicated the scope of the daily activities she would like to address in OT. Of particular concern to Karen were the grooming activities of plucking her eyebrows and styling her hair; these were bodily care activities she regarded as very personal. In fact, she was reluctant to let anyone do these for her. Although under similar circumstances Kent might have gladly deferred these two ADLs, it was clear that Karen would prioritize them as personally meaningful occupational goals.

In studying the list of ADLs, Kent noted that, just like personal hygiene and grooming, each ADL item listed had a similarly helpful definition and detailed list of examples in the tables throughout the OTPF-3 document. He remembered reading that these lists were provided to give a few examples, that they were not to be considered exhaustive, and in fact, that there was an expectation that the lists would be modified and expanded on as the Framework became more familiar and integrated into practice.

ADLs (also referred to as personal activities of daily living [PADLs] or *basic activities of daily living* [BADLs]) are activities that have to do with accomplishing one's own personal body care. The body care activities included in the ADL category are bathing/showering, toileting and toileting hygiene, dressing, swallowing/eating, feeding, functional mobility, personal device care, personal hygiene and grooming, and sexual activity.

Instrumental activities of daily living (IADLs) are “activities to support daily life within the home and community that often require more complex interactions than those used in ADLs”[3] (OTPF-3, p. S19). The specific IADLs included in the domain are care of others (including selecting and supervising caregivers), care of pets, childrearing, communication management, driving and community mobility, financial management, health management and maintenance, home establishment and management, meal preparation and cleanup, religious and spiritual activities and expression, safety and emergency maintenance, and shopping.

Knowing that the IADL shopping was certain to be a priority occupation for Karen, Kent made a note of the full description of shopping from the corresponding lists of IADLs in Table 1 of the OTPF-3. Shopping is described there as “Preparing shopping lists (grocery and other); selecting, purchasing, and transporting items; selecting method of payment and completing money transactions; included are Internet shopping and related use of electronic devices such as computers, cell phones and tablets”[3] (OTPF-3, p. S20). This is not as detailed as some descriptions, but it is a good start for looking at the related activities that would have to be addressed if Kent and Karen were to collaborate on Karen's resumption of engagement in shopping. Kent also noted that the occupation category of driving and community mobility included both driving and the use of public transportation, another IADL that would be important to explore with Karen as she contemplates returning to paid work. In fact, the entire list of IADLs held numerous concerns to be addressed in OT.

Rest and sleep, recognized as an occupation in the OTPF-3, “includes activities related to obtaining restorative rest and sleep to support healthy, active engagement in other occupations”[3] (OTPF-3, p. S20). The component activities constituting rest and sleep include rest, sleep preparation, and sleep participation (see Chapter 13 for an expanded discussion of this important occupation). Karen's sleep occupations will be significantly changed as a result of her diagnosis. To name just two of the concerns OT will have to address, she will need to be repositioned frequently during the night for skin precautions, and equipment will have to be set up to manage her bladder function while she sleeps.

Education is an occupation that includes “activities needed for learning and participating in the environment”[3] (OTPF-3, p. S20). Specific education activity subcategories include formal education participation, informal personal educational needs or interests exploration (beyond formal education), and informal personal education participation. Table 1 of the OTPF-3 includes more details about the specific activities in each of these subcategories.

Work includes activities associated with both paid work and volunteer efforts (see Chapter 14). Specific categories of activities and concerns related to the occupation of work include employment interests and pursuits, employment seeking and acquisition, job performance, retirement preparation and adjustment, volunteer exploration, and volunteer participation[3] (OTPF-3, pp. S20–S21).

Activities associated with the occupation play are described as "any spontaneous or organized activity that provides enjoyment, entertainment, amusement, or diversion."[19] Considered under this area of occupation are play exploration and play participation[3] (OTPF-3, p. S21).

Leisure is defined as "nonobligatory activity that is intrinsically motivated and engaged in during discretionary time, that is, time not committed to obligatory occupations such as work, self-care or sleep."[19] Leisure exploration and leisure participation are the major categories of activity in leisure occupations[3] (OTPF-3, p. S21) (see Chapter 16). Karen shared with Kent her interests in spending leisure time listening to music, traveling, antiquing, swimming, playing bridge, and reading books. As Kent was studying the description of leisure, it occurred to him that for Karen, shopping might be characterized as a leisure occupation in addition to an IADL. It probably would depend on the circumstances or context in which she engaged in the shopping, he thought—another parameter of the OTPF-3 domain he would be learning.

Social participation is another occupation that encompasses the "interweaving of occupations to support desired engagement in community and family activities as well as those involving peers and friends[7]; also, involvement in a subset of activities that involve social situations with others[5] and that support social interdependence.[7] Social participation can occur in person or through remote technologies, such as telephone calls, computer interaction, and video conferencing"[3] (OTPF-3, p. S21). The occupation of social participation further encompasses engaging in activities that result in successful interaction at the community, family, and peer/friend levels. (Just as for previously discussed occupations, see the OTPF-3, Table 1, for definitions and more detailed information about the breadth of activities that constitute OT's involvement in work, play, leisure, and social participation.)

Like Kent, readers currently learning the OTPF-3 could benefit from studying the expanded lists to broaden their understanding of the OT domain. As Kent studied these sections of Table 1, he found it helpful to make note of the content of each one that included specific activities that would be relevant to Karen when she engaged in the occupations. For example, Kent considered the range of job skills and work routines necessary for Karen to return to her paid position as an administrative assistant. He also made a list of similar concerns involved in resumption of her preferred play and leisure occupations, including swimming, reading, and board games. Kent was reminded of the importance of considering the activities that can support or constrain Karen's continued social participation in her community as a Girl Scout leader, in her family as the oldest daughter, and with her treasured circle of friends.

Performance Skills and Performance Patterns

Remember that throughout the OTPF-3 document, there is no correct or incorrect order in which to study or follow the areas of the domain—there is no hierarchy: "All aspects of the domain transact to support achieving health, well-being, and participation in life through engagement in occupation"[3] (OTPF-3, p. S4). With this in mind, the next main areas of the domain to consider are performance skills and performance patterns. Both are related to the client's performance capabilities in the areas of occupation previously described, and they can be viewed as the actions and behaviors observed by the occupational therapist as the client engages in occupations.

The category of performance skills includes three components of concern: motor skills, process skills, and social interaction skills. The client's successful engagement in occupation or occupational performance depends on his or her having or achieving adequate ability in performance skills. In the OTPF-3, performance skills are defined as "observable elements of action that have an implicit functional purpose; skills are considered a classification for actions, encompassing multiple capacities (body functions and bodily structures) and when combined, underlie the ability to participate in the desired occupations and activities"[3] (OTPF-3, p. S25). Briefly, **performance skills** are the abilities clients demonstrate in the actions they perform. Problems in any of the three areas of performance skills are the focus for formulating short-term goals or objectives to reach the long-term goal of addressing participation in occupation.

Motor skills consist of actions or behaviors a client uses to move and physically interact with tasks, objects, contexts, and environments, including planning, sequencing, and executing new and novel movements. In Table 3 of the OTPF-3, motor skills are defined as "occupational performance skills observed as the person interacts with and moves task objects and self around the task environment"[7] (eg, activity of daily living [ADL] motor skills, school motor skills). Examples of motor skills include coordinating body movements to complete a job task, anticipating or adjusting posture and body position in response to environmental circumstances such as obstacles, and manipulating keys or a lock to open a door.

Kent observed Karen as she played a game of bridge with friends one afternoon in the OT clinic. Observing her performance skills, particularly her motor skills, Kent noted that Karen looped one elbow around the upright of her wheelchair, leaned her trunk toward the table, reached her other arm toward the cardholder, and successfully grasped a card, using tenodesis grasp, after three unsuccessful attempts. Kent perceived this as indicating that Karen felt the need to calibrate her attempts and endure or persist (see Chapter 36).

The OTPF-3 defines process skills as "occupational performance skills (eg, ADL process skills, school process skills) observed as a person (1) selects, interacts with, and uses task tools and materials; (2) carries out individual actions and steps; and (3) modifies performance when problems are encountered."[7] Simply stated, process skills are observable actions taken to manage and modify the occupational task; for example, using knowledge, attending to and discerning solutions to problems with, and organizing the task, including choosing appropriate tools and methods for performing the task.

Kent also observed Karen's process skills as she set up her cardholder so that her cards were not visible to her opponents (selecting and gathering proper equipment and arranging the space), perused her cards, paused, rearranged them using her tenodesis hand splint/orthotic device (attending to the task, using knowledge of the rules of bridge, and selection of proper equipment), and then stated her bid (demonstrating discernment, choosing, and problem solving).

Social interaction skills, the third category of performance skills, are "skills observed during the ongoing stream of a social exchange."[7] These observable behaviors indicate how the client conveys his or her intentions and needs and coordinates social behavior to interact with people. Such skills could include asking for information, expressing emotion, and interacting with or relating to others in a manner that supports engagement in the occupation at hand.

During the card game Kent was able to observe a wide array of examples of Karen's social interaction skills. He saw Karen furrowing her brow; squinting her eyes shut in a thoughtful, cogitating manner; pursing her lips; and showing neither happiness nor despair on her face as she studied her cards in the cardholder (expressing affect consistent with the activity of card playing and thus demonstrating or displaying appropriate emotions and cognitive skill in determining her next strategy). As she reached for the cards, the holder moved out of her reach; she turned and asked the friend next to her to push it back, cautioning her in a smiling and light manner, "Don't you dare look!" (demonstrating her ability to multitask—asking for assistance and simultaneously using socially acceptable teasing behavior [social interaction skills] that enlists an opponent's cooperation in preserving the secrecy of her cards, thus conveying or disclosing the image of a savvy card player). Her observable performance skills supported Karen's continued inclusion with friends in a favorite leisure occupation.

Each of these particular motor skills, process skills, and social interaction skills categories has detailed lists of representative skills annotated with definitions, descriptions, and examples (see OTPF-3, Table 3).[3]

Performance patterns are observable patterns of behavior that support or constrain the client's engagement in occupation. Types or categories of patterns include habits, routines, roles, and rituals. In the OTPF-3, the habits of an individual are described as "automatic behavior that is integrated into more complex patterns that enable people to function on a day-to-day basis"[3]; they can be "useful, dominating, or impoverished and either support or interfere with performance in areas of occupation"[3] (OTPF-3, p. S27). Examples of habits listed in Table 4 of the OTPF-3 include automatically putting car keys in the same place and spontaneously looking both ways before crossing the street[3] (OTPF-3, p. S27). Routines reflect the "patterns of behavior that are observable, regular, repetitive, and that provide structure for daily life. Furthermore, routines can be satisfying, promoting, or damaging. Routines require momentary time commitment and are embedded in cultural and ecological contexts"[3] (OTPF-3, p. S27). Routines show how the individual configures or sequences occupations throughout his or her daily life. Habits typically contribute (positively or negatively) to a person's occupational routines, and both are established with repetition over time. The role category of performance patterns is regarded as being composed of "sets of behaviors expected by society, shaped by culture, and may be further conceptualized and defined by the client"[3] (OTPF-3, p. S27). Rituals are described as "symbolic actions with spiritual, cultural, or social meaning, contributing to the client's identity and reinforcing values and beliefs. Rituals have a strong affective component and represent a collection of events"[3] (OTPF-3, p. S27). Table 4 of the OTPF-3 outlines definitions and examples of performance patterns for organizations and populations (OTPF-3, p. S27).

Performance patterns for the individual, and the ways these can support (or, by inference, hinder) occupational performance, are further illustrated in Part 3 of the Kent and Karen case study.

Threaded Case Study

Kent and Karen, Part 3

Some might view Karen's engagement in the occupation of paid work as an example of the role of worker. Inherent in this role are accepted norms that customarily include regular attendance, timely adherence to schedules, and acceptance of responsibility for completing assignments. Karen's work role is consistent with the sets of behaviors that would be expected of an administrative assistant at a busy law firm, including arriving at work on time, handling e-mail and other correspondence in a professional manner, managing the office budget and payroll according to accepted audit practices, and interacting with her supervisors, co-workers, and supervisees in a fair and respectful manner, to name just a few. In tribute to her stellar work performance, a ritual that has evolved as part of Karen's work role experience at the law office is the annual Holiday Shopping Day. Karen and her three administrative assistant colleagues are given the Friday before the holiday off with pay. A town car picks them up at their homes and transports them to the downtown shopping district, where they are given a generous gift card, a spa morning, lunch at a downtown restaurant, an afternoon of shopping, and town car transportation home at the end of the day.

Karen's workday routine involves waking at 6:30 am; showering, grooming, and dressing; driving to work, with a stop for breakfast on the way; and arriving at her workplace early (at 7:45 am) for an 8:00 am expected work start. A habit that Karen regards as beneficial to her workday routine is her scrupulous use of her day planner to record appointments, phone numbers, and additions to her things-to-do list. Another habit she believes contributes to the success of her workday routine is selecting her clothes the night before to save time in the morning, thus ensuring a punctual arrival at work. A habit that negatively affects her daily work routine is hitting the snooze button on her cell phone clock app. Both Kent and Karen recognize that although Karen may resume her work occupation or worker role, her SCI has substantially altered her ability to carry out expected behaviors and her customary habits and routines; she will have to develop the ability to establish new and expanded habits and routines. Successful integration of these new habits and routines will undoubtedly determine the continuation of Karen's participation in the highly anticipated and beloved Holiday Shopping Day ritual.

Karen's occupational performance, performance skills, and patterns will be significantly influenced by the next two main areas of the domain to be discussed: contexts and environments, and client factors.

Contexts and Environments

The OTPF-3 states that a "client's engagement in occupation takes place within a social and physical environment situated within context."[3] **Environment** "refers to the external physical and social conditions that surround the client and in which the client's daily life occupations occur"[3] (OTPF-3, p. S28). The physical environment includes the natural and the constructed, nonhuman environments and the objects in them, and the social environment that encompasses the presence, relationships, and expectations of persons, groups, and organizations with whom the client has contact"[3] (OTPF-3, p. S28). **Contexts** are regarded as the variety of interrelated conditions, circumstances, or events that surround and influence the client and in which the client's daily life occupations take place. Contexts can either support or constrain health, well-being, and participation in life through engagement in occupation. In the OTPF-3 domain, contexts are composed of four categories, or types: cultural, personal, temporal, and virtual. One of the categories of context is regarded as external to the individual (ie, the virtual context); some are viewed as internal to the client (eg, personal context). Some contexts, such as culture, provide an external expectation of behavior that is often converted into an internal belief. Table 5 in the OTPF-3 provides detailed definitions and examples of each of these categories. For example, the category of context labeled "personal" context describes "features of the individual that are not part of the health status"[3] (OTPF-3, p. S28). Personal context includes age, gender, socioeconomic status, and educational status; it also can include group membership (eg, volunteers, employees) and population membership (eg, members of society)[3] (OTPF-3, p. S28).

Each of these contexts and environments, as they pertain to Karen's specific circumstances, will significantly affect her future engagement in occupation. Karen's physical environment includes aspects that will support her engagement in occupation, including an accessible work site; a reliable and accessible system of public transportation in her neighborhood; and a well-appointed downtown area of stores, shops, and restaurants within wheelchair distance. Aspects of her physical environment that may interfere with resumption of occupations include Karen's second floor apartment and small bathroom, which are inaccessible to a wheelchair. Supportive aspects of Karen's personal context are her college education in business and the fact that she has unemployment insurance, which will supplement her sick leave and continue her health coverage. From a social environment perspective, Karen is supported both by her family and her friends; additionally, her employer and co-workers are anxious to have her come back to the law firm. The mainstream American cultural context in which Karen was reared—which values and supports the concept of hard work overcoming adversity (doing rather than being) and the importance of independence (individualism)—seemingly motivates Karen to resume engagement in previous levels of occupation for full participation in all environments and contexts and, ultimately, occupations of her life.[7]

Given the difficulty that resuming Karen's shopping occupation may present, Kent suggested the possibility of using online shopping for some items. Although interested, Karen indicated that her preference was to shop "in the real world" instead of using the virtual context of computers and airways. Karen's ultimate decisions no doubt will be influenced by the changes she experiences in her temporal contexts as she experiences and adjusts to the increased amounts of time (and the scheduling of and around the time of others) required to accomplish basic daily routines that, in turn, support her engagement in preferred occupations.

Client Factors

The OTPF-3 describes **client factors** in a manner similar to the ICF.[3,20] There are three categories in this portion of the OTPF-3: values, beliefs, and spirituality; body functions; and body structures. These three elements are regarded as residing within the client, and they may affect or influence the performance of occupations.[3] Client factors may be affected by performance skills, performance patterns, and contexts and environments; in addition, they may have a cyclical/reciprocal relationship with and profound effect on the client's ability in those areas and, ultimately, satisfactory performance of occupations.

The client factor category of values, beliefs, and spirituality is described as encompassing the client's perceptions, motivations, and related meaning that influence or are influenced by engagement in occupations.[3] Table 2 of the OTPF-3 describes values as beliefs and commitments, derived from culture, about what is good, right, and important to do (eg, commitment to family), whereas beliefs are described as cognitive content held as true by the client (eg, hard work pays off).[3] The third aspect, spirituality, is described as representing "the way individuals seek and express meaning and purpose, and the way they experience connectedness to the moment, to self, to others, to nature, and to the significant or sacred."[17,22] For example, Karen's values, including her strong work ethic and her beliefs and spirituality, provide her the reassurance that her SCI was part of a higher power's plan for her and that she will be given the strength to cope and succeed.

The body structure category refers to the integrity of the actual body part, such as the integrity of the eye for vision (see Chapter 24) or the integrity of a limb (see Chapter 43). When the integrity of the body structure is compromised, this can affect function or require alternative approaches to engagement in activities, such as enlarged print for persons with macular degeneration or the use of a prosthesis for a person who sustained a below-elbow amputation. It is unlikely that this category of the domain would apply to Karen because the integrity of her body structures is not necessarily compromised by her diagnosis. Should she develop a pressure sore, a possible complication of SCI in which the integrity of a body structure (ie, the skin) is compromised, her ability to engage in occupation could become significantly limited, requiring alternative approaches, such as positioning devices and adaptive equipment to compensate for the need to stay off the pressure sore.

The body function category of client factors refers to the physiological and psychological functions of the body. It includes a variety of systems, such as neuromusculoskeletal and movement-related functions. This category of body functions includes muscle function, which in turn includes muscle strength. A distinction is made between body functions and performance skills. As was described earlier, performance skills are observed as the client engages in an occupation or activity. The category of body function refers to the available ability of the client's body to function. For example, a client may have the available neuromuscular function (client factor of body function; specifically, muscle strength) to hold a comb and bring the comb to the top of the head, and also the strength to pull the comb through the hair, but when you ask the client to comb his hair (an activity), you observe that he has difficulty with manipulating the comb in his hand (motor skill of manipulation) and with using the comb smoothly to comb his hair (motor skill of flow). In the OTPF-3, these motor skills are considered performance skills.

In Karen's case, the absence of functioning muscles in her hands necessitates the use of a functional hand splint or adaptive writing device to enable her to sign a credit card receipt, a required action in her shopping occupation. To use a wrist-driven flexor hinge (ie, tenodesis) hand splint to hold the pen, she must have adequate body function; in this case, fair or better muscle strength in her radial wrist extensors. However, Karen must also have adequate performance skills, including the motor skills to exert enough force to adequately write her name; the cognitive or discerning skills to select a type of pen that requires minimum effort to operate; and the social interaction skills to ask sales personnel for a firm writing surface (clipboard) for her lap to compensate for the inaccessibility of the checkout counter.

The mental functions group includes affective, cognitive, and perceptual abilities. This group also includes the experience of self and body image (see Chapters 6, 25, and 26). A client such as Karen who has sustained a physically disabling injury frequently may have an altered self-concept, lowered self-esteem, depression, anxiety, decreased coping skills, and other problems with emotional functions after the injury[21,22] (see Chapter 6). Sensory functions and pain also are included in the body functions category (see Chapters 23 and 28).

Neuromuscular and movement-related functions refer to the available strength range of motion and movement (see Chapters 19 through 22); however, they do not refer to the client's application of these factors to activities or occupations, as was seen in the example of Karen signing a credit card receipt as part of engaging in the occupation of shopping. The body functions category also refers to the ability of the cardiovascular, respiratory, digestive, metabolic, and genitourinary systems to function to support client participation. These are further described in both the OTPF-3 and the ICF. Table 2 in the OTPF-3 presents a more detailed description of each function included in this category.[3]

The Occupational Therapy Process

As mentioned, the OTPF-3 consists of two parts, the domain and the process. From a very general perspective, the domain describes the scope of practice, or answers the question, "What does an occupational therapist do?" The process describes the methods of providing OT services, or answers the question, "How does an occupational therapist provide occupational therapy services?"

The process is outlined briefly here for continuity (Fig. 1.2); the reader is referred to Chapter 3 for a more in-depth discussion. The primary focus of the OTPF-3 process is **evaluation** of the client's occupational abilities and needs to determine and provide services (**intervention**) that foster and support occupational performance (**targeted outcomes**). Throughout the process the focus is on occupation; the evaluation begins with determining the client's occupational profile and occupational history. Preferred intervention methods are occupation based, and the overall outcome of the process is achievement of the client's health, well-being, and participation in life through engagement in occupation. Throughout each step of the process, the therapist is guided by the knowledge and skills learned and perfected over the course of his or her career, including the skills associated with clinical reasoning, therapeutic use of self, activity analysis, and activity demands.

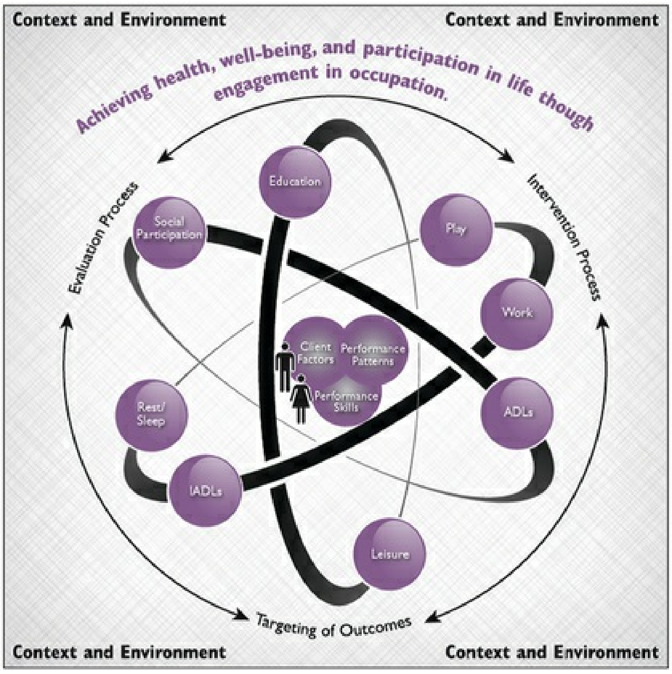

FIG 1.2 Occupational therapy process. (From the American Occupational Therapy Association: Occupational therapy practice framework: domain and process, *Am J Occup Ther* March/April[Suppl]:S10, 2014.)

Interventions also vary, depending on the client, whether person, organization, or population. In the practice of occupational therapy with adults with physical disabilities, the term *client,* at the person or individual level, may vary, depending on the treatment setting or environment. In a hospital or rehabilitation center, the person might be referred to as a *patient,* whereas in a community college post-stroke program, the person receiving occupational therapy may be referred to as a *student.* The term *client* or *consumer* might best describe the person who receives OT intervention at a center for independent living, where the individual typically lives in the community and seeks intervention for a specific, self-identified problem or issue.

Skills That Inform and Guide the Occupational Therapy Process

As mentioned previously, the therapist is guided in the OT process by the knowledge and skills acquired during his or her career; these skills include clinical reasoning, therapeutic use of self, activity analysis, and activity demands.

Clinical reasoning is described as the "process used by practitioners to plan, direct, perform and reflect on client care"—all necessary steps throughout the OT process.[3,7] OT therapists rely on the expertise and knowledge they have developed throughout their careers, including understanding of theory, research interpretation, and clinical skills.

The OTPF-3 describes the therapeutic use of self as "allowing occupational therapy practitioners to develop and manage their therapeutic relationship with clients by using narrative and clinical reasoning; empathy; and a client-centered, collaborative approach to service delivery."[3,25] The OT literature describes an occupational therapist who is successful in the therapeutic use of self as having the qualities or attributes of showing empathy (including sensitivity to the client's disability, age, gender, religion, socioeconomic status, education, and cultural background); being self-reflective and self-aware; being able to communicate effectively using active listening; and consistently keeping a client-centered perspective, which in turn engenders an atmosphere of trust.[8,11,20,25]

The very focus of the OT process provides a context that supports the therapeutic use of self by the occupational therapist. When the therapist uses a client-centered approach and begins the process with an evaluation that seeks information about the client's occupational history and occupational preferences, the client sees the therapist as being interested in what the client does (occupational performance), who the client is (contexts and environments, and client factors such as values, beliefs, and spirituality), and what occupations give meaning to the client's life. (Part 4 of the Kent and Karen case study, presented later in the chapter, describes how Kent demonstrates therapeutic use of self in each step of the therapeutic process.)

Activity analysis is recognized as an "important process occupational therapy practitioners use to understand the demands a specific activity places on a client"[3] (OTPF-3, p. S12). The analysis considers the importance of the occupation or activity to the client as paramount, bearing in mind the client's goals, interests, and abilities and the demands of the activity itself on body structures, body functions, performance skills, and performance patterns. Activity analysis and activity demands are inextricably linked; activity demands focus on what is required to engage in the activity or occupation. For the occupational therapist, this skill requires a knowledge of several aspects that must be addressed for a client to perform a specific activity, including the activity's relevance and importance to the client, the objects used and their properties, space demands, social demands, sequencing and timing, required actions and performance skills, required body functions, and required body structures. Table 7 of the OTPF-3 document provides a comprehensive list of definitions and examples for a clearer understanding of each of these categories.[3]

Consider Karen's keen interest in resuming the occupation of shopping in the "real world" instead of making clothing purchases online (ie, in a virtual context). The materials or tools needed are a purse or credit card holder. The space demands are the accessibility of the store or shopping mall and the dressing room for Karen to try on the clothes before making a purchase. The social demands include paying for the items before leaving the store. The sequence and timing process includes being able to make a selection, go to the register, potentially wait in line, place the clothing on the counter, pay for the item, and then leave the store. The required actions refer to the performance skills necessary to engage in this activity, such as the coordination needed to try on clothing, the process skills needed to select one sweater or blouse from a large array of possible choices, and the social interaction skills needed to ask for assistance or directions if needed.

These performance skills are not viewed in isolation, but rather are seen as Karen engages in the occupation of clothes shopping. The required body functions and structures refer to the basic client factors necessary to perform the activity of shopping. The act of shopping requires a level of cognition or judgment because inherent in the activity of shopping is having the opportunity to make a choice between available items. Karen's ability to engage in the activity demand of making a choice of purchases indicates that she has an adequate level of cognition for shopping.

Using his skills of clinical reasoning, therapeutic use of self, and expert knowledge of activity analysis and activity demands, Kent continually assesses the interplay of Karen's strengths and abilities and her occupational goals to select the interventions that will most effectively achieve these goals. These interventions are described next.

Types of Occupational Therapy Intervention

Table 1.1 shows the types of OT intervention typically used in physical disability practice and their relationship to the domain of occupational therapy. Five general categories of intervention are presented in the OTPF-3: Occupations and Activities, Preparatory Methods and Tasks, Education and Training, Advocacy, and Group Intervention.[3]

TABLE 1.1

Types of OT Intervention Typically Used in Physical Disability Practices

Intervention	Description
Occupations and Activities	Selected interventions for specific clients, designed to meet therapeutic goals; address underlying needs of the mind, body, and spirit of the client.
Occupations	Client-directed daily life activities that match and support identified participation goals.
Activities	Selected to enhance ultimate engagement in occupational goal—client learns and practices portions of desired occupations.
Preparatory Methods and Tasks	Prepare client for occupational performance.
Preparatory methods	Modalities, devices, and techniques to prepare the client for occupational performance—often done to the client without the client's active participation. Includes splints, assistive technology and environmental modification, wheeled mobility,
Preparatory tasks	Actions to target specific client factors or performance skills
Education and Training	
Education	Occupational therapy (OT) imparts knowledge and information about occupation, health, well-being, and participation that enables the client to acquire helpful behaviors, habits, and routines that may or may not require application at the time of the intervention session.
Training	Facilitation of acquisition of concrete skills for meeting specific goals in a real-life, applied situation. Differentiated from education by its goal of enhanced performance as opposed to enhanced understanding.
Advocacy	Efforts directed toward promoting occupational justice and empowering clients to seek and obtain resources to fully participate in their daily life occupations. Can be advocacy efforts by the practitioner on behalf of the client or self-advocacy efforts undertaken by the client.
Group Intervention	Use of distinct knowledge and leadership techniques to facilitate learning and skill acquisition across the life span through the dynamics of group and social interaction. Groups may also be used as a method of service delivery.

Because occupation is the primary focus of the OTPF-3, it is wrong to think of the types of intervention as following in a linear or stepwise order. Instead, the occupational therapist reflects on the client's goal of engagement in his or her preferred, self-selected occupations and then collaborates with the client in selecting the type or types of intervention that the therapist believes would best help the client achieve each occupational goal.

Since the inception of the OTPF (continued in the OTPF-2 and OTPF-3), the traditional concept of “intervention levels” has been dismissed in favor of viewing interventions as types, with no one type considered more important than another; rather, each type has a potential contribution to make in facilitating the ultimate goal of achieving health, well-being, and participation in life through engagement in occupation.

OT Practice Notes

Throughout the OT process, the therapist should make sure the client understands that they will select the outcomes together, based on the client's choice, and they will collaborate in planning the intervention. This lays the foundation for a relationship based on caring and trust.

Threaded Case Study

Kent and Karen, Part 4

Kent did not previously regard therapeutic use of self as an integral, identified component of the OT process. However, through his study of the OTPF-3, he has come to value it highly and use it in his practice. Clients respond well to Kent's caring and gentle approach. He enjoys the personal and interactive aspects of the therapeutic relationship, shows genuine interest in his clients' histories, and actively listens to their responses. He makes it a practice to introduce himself and explain his role to his clients as the first step in the OT process. This practice allows Kent to assert the primacy of the client and to associate and integrate the information he is learning about the client with the image of the person he has just met.

Kent practiced therapeutic use of self throughout the OT process with Karen. He brought to the process his 25 years of experience, continued education, and knowledge of SCI, in addition to his well-developed clinical reasoning skills and his experiences in providing successful—and not-so-successful—OT intervention for numerous clients. Kent's college roommate and subsequent best friend has a physical disability, and this has served to increase Kent's understanding of, and inform his attitudes and beliefs about, the experience of having a disability. His close and loving relationships with his sisters, wife, and teenage daughters have provided him with an increased awareness of women's concerns and issues and have caused him to consider how disability might be experienced differently by his women clients than by his men clients. All of these aspects of Kent's personal and professional repertoire supported his ability to use therapeutic use of self, activity analysis, and clinical reasoning as effective therapeutic skills that continually informed his actions throughout Karen's OT process.

Occupations and Activities

In the first version of the OTPF (2002), the occupations and activities category of OT intervention was adapted from the section "Treatment Continuum in the Context of Occupational Performance" (Chapter 1) in the fifth edition of this book. In the OTPF-3, the category is defined as "selected interventions for specific clients, designed to meet therapeutic goals and address the underlying needs of the mind, body and spirit of the client. To use occupations/activities therapeutically, the practitioner considers activity demands and client factors in relation to the client's therapeutic goals, contexts, and environments"[3] (OTPF-3, p. S29). Specific activities considered to be representative of the occupations and activities category are further separated into two types including occupation and activity that will each be discussed here.

The OTPF-3 describes occupations (as interventions) as "client-directed daily life activities that match and support or address identified participation goals"[3] (OTPF-3, p. S29). An example in Table 6 of the OTPF-3 is: purchases groceries and prepares a meal. For Karen, an example might entail a clothes shopping trip using public transportation or completing a typical morning of office skills independently.

Activities (as interventions) are described as "actions designed and selected to support the development of performance skills and performance patterns to enhance occupational engagement. Activities often are components of occupations and always hold meaning, relevance and perceived utility for clients at their level of interest and motivation"[3] (OTPF-3, p. S29). Examples from Table 6 of the OTPF-3 include practicing safe ways of getting into and out of the bathtub and writing answers on an application form.

After reading the descriptions of occupations and activities as interventions, Kent now believes that occupation-based intervention would promote engagement in all areas of occupation, including ADLs, IADLs, rest and sleep, education, work, play, leisure, and social participation. Most of the OT intervention for Karen was occupation based. To reach her targeted goal of resuming her favorite leisure occupation of clothes shopping, Kent and Karen took a trip to a nearby department store, where Karen looked for a blouse with three-quarter sleeves that buttoned up the front. Karen perused the racks, inspecting the blouses on display; asked for help from a salesperson; tried on blouses in the dressing room; made her selection; and paid for her purchase—all parts of a typical shopping excursion in a customary shopping environment. When necessary, Kent demonstrated or suggested ways Karen could perform some of the more difficult shopping activities, such as accessing the crowded racks, negotiating her wheelchair into the dressing room from a narrow hallway, and transporting the hangers with blouses on her lap without having them slide to the ground.

The description of the purpose of activity as intervention in the OPTF-3 and the examples provided caused Kent to reframe or slightly reconfigure his view of what activity entails in relation to occupation. Given the OTPF-3 categorization, he considered that he was providing activity intervention when he had Karen practice activities that she would encounter as part of the occupation of clothes shopping. In the OT clinic, before the shopping trip, Karen and Kent collaborated on developing her ability to perform the activities of tearing checks out of her checkbook, accessing her credit card from her wallet, using a button hook to button her sweater, and lifting clothes on hangers out of a closet. Some of the shopping activities she performed while buying her blouse were learned as part of other occupation-based interventions, such as wheelchair mobility, writing, and dressing. When using activity as intervention, the OT practitioner is concerned primarily with assessing and remediating deficits in performance skills and performance patterns.

Preparatory Methods and Preparatory Tasks

When using intervention that is preparatory in nature, the practitioner selects directed "methods and techniques that prepare the client for occupational performance, used as part of a treatment session, in preparation for or concurrently with occupations and activities or provided to a client as a home-based engagement to support daily occupational performance"[3] (OTPF-3, p. S29).

Preparatory methods used in occupational therapy may include exercise, facilitation and inhibition techniques, positioning, sensory stimulation, selected physical agent modalities, and provision of orthotic devices, such as braces and splints. **Preparatory tasks** are described as "actions selected and provided to the client to target specific client factors or performance skills. Tasks involve active participation of the client and sometimes comprise engagements that use various materials to simulate activities or components of occupations. Preparatory tasks themselves may not hold inherent meaning, relevance, or perceived utility as stand alone entities"[3] (OTPF-3, p. S30).

OT services for persons with physical disabilities often introduce these preparatory methods, devices, and tasks during the acute stages of illness or injury. When using these methods, the occupational therapist is likely to be most concerned with assessing and remediating problems with client factors such as body structures and body functions. It is important for the therapist to plan the progression of this type of intervention so that the selected methods are used as preparation for occupation or activity and are directed toward the overarching goal of achieving health, well-being, and participation in life through engagement in occupation.

Kent reflected that in preparing for Karen's occupation intervention of clothes shopping, he used several other interventions that would be considered preparatory methods. For example, he and Karen looked at her options for grasping items and decided on a tenodesis hand splint, using orthotics as an intervention. To use the splint more effectively, she had to have stronger wrist extensors, and to push her wheelchair or to reach for and lift hangers with clothes, she needed stronger shoulder muscles; therefore, the preparatory intervention of exercise was chosen to facilitate Karen's ultimate engagement in purposeful occupations and activities.

Education and Training

The OTPF-3 describes **education** as a "type of intervention process that involves imparting knowledge and information about occupation, health, well-being and participation that enables the client to acquire helpful behaviors, habits and routines that may or may not require application at the time of the intervention session"[3] (OTPF-3, p. S30).

Kent considered this definition, thinking of instances when he provided education as intervention. Most recently, with Karen, he responded to her concerns about returning to her job as an administrative assistant. She was having misgivings about the amount of physical work and energy involved; the modest salary she received, which barely covered her preinjury expenses; and the additional expenses she would have for personal and household assistance. Using his years of knowledge and experience, Kent provided intervention in the form of educating Karen about her options. He informed her of the services offered by vocational rehabilitation and educated her about the possibilities and opportunities for further education to support her work goal of becoming an attorney—a job position, he pointed out, that held the potential for higher pay and one that could be less physically demanding than her administrative assistant position. Kent also educated Karen about her rights to employment accommodations under the Americans with Disabilities Act (ADA) (see Chapter 15). He informed her about the similar circumstances of some of his former clients, describing the various scenarios and outcomes of each (being mindful to preserve the former clients' anonymity and privacy). He also drew on his wealth of experience to discuss the many resources available to facilitate such options. Karen was already preparing to resume her job (an occupational goal she prioritized) and was actively participating in OT by engaging in occupations and activities that involved her actual work occupations and supporting activities. The education intervention made her aware of her options but did not involve any actual performance of an activity. Kent could use the same intervention process to educate Karen's vocational counselor and the law firm for which Karen works.

In the OTPF-3, **training** is distinguished from education; it is described as "facilitation of the acquisition of concrete skills for meeting specific goals in a real-life, applied situation. In this case skills refers to measurable components of function that enable mastery. Training is further differentiated from education by its goal of enhanced performance as opposed to enhanced understanding, although these goals often go hand in hand"[3] (OTPF-3, p. S30). Examples of training include interventions such as teaching a personal care attendant ways to help a client with ADLs.

Kent considered that he provided training when he taught Karen how to complete her administrative assistant duties by showing her how to access files, operate her environmental controls system, and dictate notes using voice recognition software. Kent anticipates training Karen in how to manage her bladder (empty her leg bag), perform regular weight shifts, and access the cafeteria at work—all skills that are part of Karen's personal care in the work setting that she wants to master before returning to full-time employment.

Advocacy

The intervention type identified as advocacy is provided when efforts are directed toward promoting occupational justice (access to occupation) and empowering clients to seek and obtain resources to fully participate in their daily life occupations[3] (OTPF-3, p. S41). Kent worked with Karen and her work supervisor to advocate to the law firm partners for reasonable accommodations to support Karen's continued employment. After a year of Karen's successful job performance and her newly learned abilities to continually self-advocate, Kent and Karen were invited to the state bar association conference to advocate for similar collaborations on behalf of other employees with disabilities.

Group Intervention

The intervention type labeled group intervention is described as functional groups, activity groups, task groups, social groups, and other groups used in inpatient units, in the community, or in schools. These group interventions allow clients to explore and develop skills for participation, including basic social interaction skills and tools for self-regulation, goal setting, and positive choice making[3] (OTPF-3, p. S31).

In reflecting on Karen's OT process, Kent concluded that perhaps one of the most important interventions for Karen was the Home and Community Skills classes offered by the OT department during her rehabilitation stay. This eight-session experiential group class, taught by Kent and several of his OT colleagues, introduced topics such as managing friendships, negotiating occupations in the environment (eg, going to movie theaters, hair salons, grocery stores, and so on), asking for assistance, dating, childrearing, and using public transportation, to name but a few. Former clients who had achieved their goal of health, well-being, and participation in life through engagement in occupation were invited as peer experts to provide the lived experience for the discussions facilitated by the therapists. In addition to talking about issues (as an OT intervention), Kent made sure that each client had follow-up opportunities for “doing” the occupations and activities.

A year or so after her discharge, Karen was invited to share her experiences of returning to work, seeking accessible housing, and beginning a relationship with her new boyfriend. Kent facilitated the discussion. He used his clinical reasoning skills and knowledge of these topics, along with activity analysis and activity demands, to ask Karen strategic questions, to make sure the discussion included specific details, and to point out alternative solutions that others in the class might have found more applicable.

Kent has carefully studied the OTPF-3 domain, process, and types of interventions, and he has reinforced his learning by applying this knowledge to his own circumstances and those of his client, Karen. However, Kent still feels the need for additional suggestions or strategies for learning the Framework more thoroughly. The next section explores these strategies.

Strategies for Learning the OTPF-3

The most effective first step in learning the OTPF-3 may be to obtain and thoroughly read the original document, making notations as points arise, drawing diagrams for increased understanding, writing questions or observations in the margins, and consulting tables, figures, and the glossary, when directed to do so, to reinforce or clarify information. The OTPF-3 is a comprehensive conceptualization of the profession, and it requires a substantial investment of time and commitment to study and integrate it into practice before a therapist will feel comfortable using it. Box 1.1 provides an abbreviated list of the core terminology and concepts of the OTPF-3; this can serve as a quick reference or can be used to jog the reader's memory as he or she learns to use the Framework.

Box 1.1

Quick Guide to the Occupational Therapy Practice Framework

Achieving Health, Well-being and Participation in Life through Engagement in Occupation: OT's unique contribution, the overarching theme of the domain, and the overarching outcome of the process

Occupational therapists (OTs) use their knowledge and expertise in the therapeutic use of self and in activity analysis and activity demands (space demands, social demands, sequencing and timing), in addition to critical thinking skills, to guide their actions throughout each step of the OT process. Clients contribute their life experiences, knowledge, and expertise to the process in collaboration with the OT.[10]

The practice framework is composed of two primary interrelated parts: domain and process. These major elements are enhanced and supported by additional parts of the framework.

Domain: What (OTs) do—no single aspect is considered more critical than another.

- *Performance of occupations* (activities of daily living [ADLs], instrumental activities of daily living [IADLs], rest and sleep, education, work, play, leisure, and social participation)
- *Client factors* (values, beliefs and spirituality, body functions, and body structures)
- *Performance skills* (motor skills, process skills, and social interaction skills)
- *Performance patterns* (habits, routines, roles, and rituals)
- *Context and environment* (cultural, personal, temporal, and virtual)

Process: How OTs provide their services—collaborative process between client and OT

- *Evaluation* (occupational profile and analysis of occupational performance)
- *Intervention* (preferred term rather than *treatment*—includes

intervention plan, intervention implementation, and intervention review)

- *Targeted outcomes* (all goals aimed at the overarching goal of achieving health, well-being, and participation in life through engagement in occupation)

Client: Recipient of OT services (*client* is the preferred term, but the term used varies by practice setting—could be *patient, student, consumer, employee, employer,* and so on)

- *Individual* (broad view of client—could be the actual person with a disability or an individual providing support for the client, such as a family member, caregiver, teacher, or employer, who also may help or be served indirectly)

- *Organizations* (eg, businesses, industries, and agencies)

- *Populations* (within a community)

- *Client-centered approach*—an approach to the evaluation of the need for and provision of an intervention with emphasis on the client and his or her goals

- *Occupation versus activity*—*Activities* are characterized as meaningful and goal directed but not of central importance to the life of the individual. *Occupations* are viewed as activities that give meaning to the person's life and contribute to his or her identity; they are also the activities the individual looks forward to engaging in. In the *Occupational Therapy Practice Framework: Domain and Process,* Third Edition (OTPF-3), the term *occupation* encompasses *activities.*

Engagement: Includes both the subjective (emotional or psychological) and objective (physically observable) aspects of performance

Types of Intervention

Occupations and Activities

- *Occupations*—client-directed daily life activities that match and support or address identified participation goals

- *Activities*—actions that support the development of performance skills and patterns to enhance occupational engagement; client learns and practices parts or portions of occupations

Preparatory Methods and Tasks

- *Preparatory methods*—modalities, devices, and techniques to prepare client for occupational performance; includes splints, assistive technology and environmental modifications, and wheelchair mobility

- *Preparatory tasks*—actions to target specific client factors or performance skills

Education and Training

- *Education*—OT imparts knowledge and information about occupation, health, well-being, and participation that enable the client to acquire helpful behaviors, habits, and routines, which may or may not require application at the time of the intervention session.

- *Training*—facilitation of acquisition of concrete skills for meeting specific goals in a real-life, applied situation. Differentiated from education by its goal of enhanced performance as opposed to enhanced understanding.

- *Advocacy*—promotes occupational justice and empowers clients to obtain resources for full participation in occupation. Can be advocacy efforts by the practitioner on behalf of the client or self-advocacy efforts undertaken by the client

- *Group interventions*—use of distinct knowledge and leadership techniques to facilitate learning and skill acquisition across the lifespan through the dynamics of group and social-interaction. Groups may also be used as a method of service delivery.

More experienced occupational therapists, who are accustomed to using the OTPF (2002) and OTPF-2, will find it helpful to consult the Preface in the OTPF-3 (pp. S1–S2), where changes and major revisions to the Framework are listed and discussed.[3]

Several pioneering authors have written helpful articles demonstrating application of the Framework for the AJOT's various Special Interest Section (SIS) quarterlies. Writing for the *Home and Community Health SIS Quarterly,* Siebert encouraged practitioners to realize that it is "not as important to learn the OTPF as to use it as a tool to communicate practice, to support practice patterns that facilitate engagement in occupation, and to reflect on and refine our practice."[24] She also pointed out the dominant role that context plays in home and community practice by providing continuity to the client, noting how firmly the Framework supports this concept. She expressed her belief that the Framework's focus on occupation, in addition to beginning the process with the client's occupational profile, ensures that the results of OT intervention will matter to the client.[24]

Coppola, writing for the *Gerontology SIS Quarterly,* described how the framework can be applied to geriatric practice and explained that the evaluation is one of occupational therapy's most powerful means of informing others (including clients and colleagues) what OT is and what OT does. She provided a working draft of an Occupational Therapy Evaluation Summary form, which was developed to be incorporated into the Framework and to highlight occupation in a visual way into her practice in a geriatric clinic. This summary form is unconstrained by the more traditional documentation forms that seem to bury occupation under diagnostic and clinical terminology.[9]

Similarly, Boss offered readers of the *Technology SIS Quarterly* his reflections on how the Framework can be operationalized in an assistive technology setting. Addressing each of the categories of the domain, he offered examples of how assistive technology supports engagement in occupation (allowing completion of an activity or occupation) and how the use of assistive technology (personal device care and device use) can be an occupation in and of itself. He concluded his article by pointing out that "assistive technologies are all about supporting the client's participation in the contexts of their choice and are therefore part of the core of occupational therapy."[6]

Although the previously cited articles refer to use of the original OTPF, they thoroughly demonstrate how creatively the Framework can be applied to the array of OT practice settings. Another strategy for facilitating the reader's education in the Framework is the format of the chapters in this book, as described next.

The OTPF-3: Its Use in This Book

In keeping with the OTPF-3's central focus on the client and the importance of contexts and participation in occupation, each chapter begins with a case study and then integrates the information presented into the consideration of that client and those circumstances, similar to Kent's and Karen's experiences as described and threaded throughout this chapter. As the particular content information is presented, the reader frequently is asked to refer back to the case study and consider how the information applies to the specifics of the client portrayed. The probative questions asked at the conclusion of Part 1 of the case study are answered throughout the text or addressed at the end of the chapter.

Summary

“Occupational Therapy Practice Framework: Domain and Process,” the first article on this model, was published in 2002 by the AOTA. The subsequent edition, OTPF-2, and the current version, OPTF-3, were developed by the OT profession for two purposes: (1) to reassert occupational therapy's focus on occupation, and (2) to clearly articulate and enhance understanding of the domain of occupational therapy (what OT practitioners do) and the process of occupational therapy (how they do it) for both internal audiences (members of the profession) and external audiences (clients, healthcare professionals, and interested others). The overarching goal of OTPF-3 is “achieving health, well-being, and participation in life through engagement in occupation”[3]—this emphasizes the primacy of occupation, regarding it as both the theme of the domain and the outcome of the process.

The domain comprises five categories that constitute the scope of occupational therapy: occupations, client factors, performance skills, performance patterns, and contexts and environments. The OT process involves three interactive phases of OT services—evaluation, intervention, and outcomes—that develop in a collaborative and nonlinear manner. The types of OT intervention included in the OTPF-3 and typically used in physical disabilities practice settings include therapeutic use of occupations and activities (including occupation-based activity and purposeful activity); preparatory methods and tasks (including techniques to prepare the client for occupational performance; splints and orthotics; assistive technology and environmental modifications; and wheeled mobility); education and training; advocacy (by the practitioner and also by the client as self-advocacy); and group intervention.[3]

In addition to studying the chapter, readers are encouraged to explore the OTPF-3 in its entirety and to reinforce their learning by applying it to their own life experiences and those of their clients, meaning both the clients in the case studies presented throughout this book and those they encounter in real life in the clinic.

Review Questions

1. Briefly describe the evolution of the Occupational Therapy Practice Framework, including the OTPF-3.
2. Describe the need for the OTPF-3 in the practice of OT for persons with physical disabilities.
3. Describe the fit between the OTPF-3 and the ICF and explain how they inform and enhance the occupational therapist's understanding of physical disability.
4. List and describe the components that make up the OT domain, and give examples of each.
5. List and describe the components that make up the OT process, and give examples of each.
6. Briefly describe the OT intervention levels, and give an example of each as it might be used in a physical disability practice setting.

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History and Practice Trends in Physical Dysfunction Intervention

Kathleen Barker Schwartz

CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Trace the ideas, values, and beliefs that have influenced the development of occupational therapy as a profession.
2. Analyze the development of occupational therapy within the larger context of cultural, social, political, and legislative forces.
3. Explain how some of the opportunities and challenges that physical disabilities practitioners face today are a result of the way the history of occupational therapy evolved.

KEY TERMS

Arts and crafts movement
Disability rights movement
Independent living movement
Medical model

Moral treatment movement
Rehabilitation model
Social model

Roots of Occupational Therapy

Even into the early 20th century, individuals with physical disabilities "were kept at home, out of sight, in back bedrooms, by families who felt a mixture of embarrassment and shame about their presence."[19] This detrimental and pervasive reaction to physical disability began to change with the introduction of the medical model. From a medical perspective, disability was seen as a biological deficit that could be ameliorated with professional treatment. In fact, in the early 20th century, "progressive reformers" were looking to medical professionals to assist individuals with disability to reclaim their place in the community and the workplace.[53] It was against this backdrop that the profession of occupational therapy was founded in 1917.

The founders of occupational therapy believed that they could help rehabilitate individuals with disability through engagement in occupation. They chose the term *occupational therapy* to reflect this goal because in 1917 *occupation* was commonly used to mean "being occupied or employed with, or engaged in something."[37] The founders were aware that such broad terminology could be confusing.[15] However, they valued the breadth of the term for the freedom it would give occupational therapists to use a wide range of modalities and approaches, individually tailored to meet each person's desires and needs.

The founders of occupational therapy included William Rush Dunton, a psychiatrist; Herbert J. Hall, a physician; Eleanor Clarke Slagle, a social welfare worker; Susan Johnson, a former arts and crafts teacher; Thomas Kidner and George Barton, both former architects; and Susan Tracey, who was a nurse. They were influenced in their views of occupational therapy by ideas and beliefs prevalent during the latter part of the 19th century and the early years of the 20th century. The ideas that seemed to have most shaped the profession's early development were reflected in three movements: moral treatment, arts and crafts, and scientific management.

Moral Treatment Movement

The **moral treatment movement** grew out of a humanistic philosophy that originated in 19th century Europe and was promoted by physicians such as Philippe Pinel of France and Samuel Tuke of England. It represented a shift in thinking from a pessimistic viewpoint that labeled the mentally ill as subhuman and incurable to an optimistic one that viewed the mentally ill as capable of reason and able to respond to humane treatment. The main features of moral treatment included a respect for human individuality, an acceptance of the unity of mind and body, and a belief that a humane approach using daily routine and occupation could lead to recovery.[9] Occupations included music, physical exercise, and art,[41] in addition to agriculture, carpentry, painting, and manual crafts.[14]

Building on these ideas half a century later, the famous neuropsychiatrist Adolf Meyer proposed that many illnesses were "problems of adaptation" that could be remedied through involvement in curative occupations.[33] Dunton and Slagle enthusiastically supported this view, and Meyer's philosophy of "occupation therapy" was published in the first issue of the profession's journal. Slagle, who worked with Meyer at Phipps Clinics, developed habit training programs in mental hospitals to reestablish healthy habits of self-care and social behavior.[45]

Arts and Crafts Movement

The rise of the **arts and crafts movement** in the 1890s occurred in reaction to the perceived social ills created by the Industrial Revolution.[11] The economy was changing from an agrarian to a manufacturing society, so that what had previously been made by hand was now produced in factories. Proponents of the arts and crafts movement asserted that this resulted in a society of dissatisfied workers who were bored by monotonous and repetitive working conditions.

The use of arts and crafts as a therapeutic medium in occupational therapy (OT) arose from this trend. The arts and crafts approach was based on the belief that craftwork improved physical and mental health through exercise and the satisfaction gained from creating a useful or decorative article with one's own hands. According to Johnson, the therapeutic value of handicrafts lay in their ability to provide occupation that stimulated "mental activity and muscular exercise at the same time."[26] Different handicrafts could also be graded for the desired physical and mental effects. During World War I, OT reconstruction aides successfully used crafts for the physical and mental restoration of disabled servicemen.[43] For treating tuberculosis, Kidner advocated a graduated approach that began with bedside crafts and habit training and proceeded to occupations related to shop work and ultimately actual work within the institution.[28]

Thus, the ideas from the moral treatment and arts and crafts movements became intertwined as a definition of OT evolved to include treatment of individuals with physical and mental disabilities. In the early years of the profession, occupational therapists worked with patients throughout three stages of recovery.[28] During convalescence, patients would engage in bedside occupations that primarily consisted of handicrafts, such as embroidery and basket weaving. Once patients were able to get out of bed, they would engage in occupations designed to strengthen both body and mind, such as weaving or gardening, and occupations designed to reestablish basic habits of self-care and communication. When they were almost ready to return to the community, patients would engage in occupations that would prepare them for vocational success, such as carpentry, painting, or manual crafts.

Scientific Management

Frederick Taylor, a prominent engineer, introduced his theory of scientific management in 1911.[48] He proposed that rationality, efficiency, and systematic observation could be applied to industrial management and to all other areas of life, including teaching, preaching, and medicine. Progressive reformers of the period advocated that the ideology of scientific management address societal problems such as poverty and illness. These reformers criticized the noisy, dirty asylum of the 19th century and urged that the image of medical care be transformed into the clean, efficient hospital.[25] The idea that knowledge could be developed through research and observation and applied to patient care became an underlying tenet of the science of medicine and ultimately resulted in the development of reliable protocols for surgical and medical interventions.[53]

The founders of OT were attracted to the idea of a scientific approach to treatment. Barton was particularly taken with Taylor's time and motion studies and thought they might provide a model for OT research.[8] Dunton advocated that those who entered the profession be capable of engaging in systematic inquiry in order to further the profession's goals.[16] Similarly, Slagle urged research in OT to validate its efficacy.[45] By 1920 the profession was promoting the notion of the “science” of occupation by calling for “the advancement of occupation as a therapeutic measure, the study of the effects of occupation upon the human being, and the dissemination of scientific knowledge on this subject.”[12]

However, there is little in the OT literature of the early 20th century to suggest that OT practice was informed by systematic observation. One exception was the Department of Occupational Therapy at Walter Reed Hospital in Washington, D.C., under the direction of psychologist Bird T. Baldwin.[7] OT reconstruction aides were assigned to the orthopedic ward, where methods of systematically recording range of motion and muscle strength were established. Activities were selected based on an analysis of the motions involved, including joint position, muscle action, and muscle strengthening. Methods of adapting tools were suggested, and splints were fabricated to provide support during the recovery process. Treatment with this systematic approach was more narrowly focused at times but was applied within the context of what Baldwin called “functional restoration,” in which OT's purpose was to “help each patient find himself and function again as a complete man [sic] physically, socially, educationally, and economically.”[6]

Besides advocating a scientific approach to practice, the scientific management ideology emphasized efficiency and a mechanistic approach to medical care. Using the factory analogy, patients were the product, and nurses and therapists were the factory workers. It was assumed that doctors had the most scientific knowledge and therefore should be positioned at the top of the medical hierarchy. Dunton, a physician himself, seemed to support this arrangement, saying, “The occupational therapist, therefore, has the same relation to the physician as the nurse, that is, she is a technical assistant.”[13] As the profession evolved, the emphasis on efficiency and deference to medical authority became problematic for the profession. The focus on science and the resulting growth of the medical model were both beneficial and detrimental to OT practice.

Expansion and Specialization

The Rehabilitation Model

The growth of the **rehabilitation model** began after World War II and peaked with the healthcare industry boom in the 1970s, following the passage of bills establishing Medicare and Medicaid.

World War II revived the need for the United States to provide medical care for its wounded soldiers. Many more soldiers survived than in World War I because of recent scientific discoveries such as sulfa and penicillin. World War II also highlighted the value of OT services: "Although occupational therapy started during the last World War, it developed slowly [until] now when doctors are finding this aid to the sick and wounded invaluable."[35] A major effort was launched to reorganize and revitalize the Veterans Administration (VA) hospital system. Departments of physical medicine and rehabilitation were created to bring together all the services needed to care for the large number of war injured:

The theory that handicapped persons can be aided by persons who understand their special needs originated during World War II. The armed services established … hospitals for disabled veterans [that] helped the morale and physical condition of the patients so much that others were built for civilians.[35]

The interdisciplinary approach to care was emulated in the private sector. Demand for medical services increased in the civilian population as the treatment of chronic disability became a priority. Howard Rusk, a prominent voice in the development of rehabilitation medicine, asserted that the critical shortage of trained personnel would impede the country's ability to deliver services to the "5,300,000 persons in the nation who suffer from chronic disability."[27] He cited OT as one of the essential rehabilitation services. In response to the growing demand for rehabilitation services, Congress passed the Hill-Burton Act in 1946 to provide federal aid for the construction of rehabilitation centers. A proviso of the legislation was that rehabilitation centers must "offer integrated services in four areas: medical, including occupational and physical therapy, psychological, social, and vocational."[54] The passage of legislation establishing Medicare and Medicaid in 1965 put further demands on rehabilitation services to serve the chronically ill and elderly in healthcare institutions and also in the community.

Physical Dysfunction as a Specialty

The creation of a specialty in physical dysfunction within occupational therapy came about as a response to the changing demands of the marketplace and its requirement that specialists possess particular kinds of medical knowledge and technologic skills.[22] This new specialty began with an increasing focus on occupations that would promote physical strength and endurance:

The Army is death on the old-time invalid occupations of basket weaving, chair caning, pottery and weaving. These are "not believed to be interesting occupation for the present condition of men in military service," says an officer from the Surgeon General's office. The stress now is on carpentry, repair work at the hospital, war-related jobs like knitting camouflage nets, and printing.[51]

The scientific approach of joint measurement and muscle strengthening that Baldwin pioneered at the end of World War I was adopted and improved upon. Claire Spackman, who along with Helen Willard wrote the profession's first textbook on occupational therapy, argued that therapists must become skilled in carrying out new treatments based on improved techniques. According to Spackman, the occupational therapists serving people with physical disability needed to be skilled in teaching activities of daily living (ADLs), work simplification, and training in the use of upper extremity prostheses. But first and foremost, she asserted, "Occupational therapy treats the patient by the use of constructive activity in a simulated, normal living and/or working situation. Constructive activity is the keynote of occupational therapy."[46]

As the rehabilitation movement helped to establish the importance of OT, it further positioned the profession within the **medical model**. OT was urged to specialize and separate into two distinct fields, physical dysfunction and mental illness. The head orthopedist at Rancho Los Amigos Hospital in Downey, California, argued that the separation would result in “strengthened treatment techniques” and thus more credibility within the medical profession, which “does not recognize your field as an established necessary specialty.”[24] The American Occupational Therapy Association (AOTA) sought closer ties with the American Medical Association in order to increase occupational therapy's visibility and reputation as a profession dedicated to rehabilitation of the individual through engagement in occupation.

The closer relationship with medicine probably helped the profession gain credibility, at least within the medical model. The positive aspect of the medical model is that it emphasized the importance of the rehabilitation of those with disabilities, and it helped stimulate the development of new scientific techniques. The negative aspect of the medical model is that it presumed that the individual is a passive participant in the process. In response to this view, a new social model was proposed that placed the individual at the center of the rehabilitation process.

A New Paradigm of Disability: the Disability Rights and Independent Living Movements

The advocacy for disability rights that took hold in the 1970s had its roots in the social and political activism of the 1960s. During the 1960s, disabled people were profoundly influenced by the social and political upheaval they witnessed. They identified with the struggles of other disenfranchised groups to achieve integration and meaningful equality of opportunity. They learned the tactics of litigation and the art of civil disobedience from other civil rights activists. They absorbed reform ideas from many sources: consumerism, demedicalization, and deinstitutionalization.[18]

Like the civil rights and women's movements, the **disability rights movement** was rooted in self-advocacy. That is, individuals with disability were themselves promoting their own cause. Their activism took many forms, including lawsuits, demonstrations, founding of a plethora of organizations dedicated to achieving disability rights, and political lobbying for legislation to address inequality and protect rights.

The ideas underlying the disability rights movement were based on a social rather than a medical model. The medical model had provided the predominant view of individuals with disability for much of the 20th century. It placed the medical professional at the center of the rehabilitation process and the patient on the periphery as the person who was being helped by the experts. It categorized individuals according to their medical disability (eg, the paraplegic or the quadriplegic), and it saw the remediation of that medical condition as the way to eradicate disability. Disability rights advocates rejected this view as too paternalistic, passive, and reductionistic. Instead, they advocated a paradigm that put the individual with disability at the center of the model as the expert in knowing what it was like to have a disability.

The **social model** proposed that disability was created because of environmental factors that prevented individuals from being fully functioning members of society. Physical boundaries prevented individuals from having access to schools, the workplace, and the home. Social views of individuals as pathetic cripples blocked full participation in life activities. Political and legal interpretations advocated "separate but equal" participation rather than inclusion. The social model argued that disability must be viewed from a cultural, political, and social lens rather than a biomedical one:

This [biomedical] model makes us aware that a complex system of mutually supporting beliefs and practices can impact those with disability by: stigmatizing them as less than full humans, isolating them by policies of confinement or the built environment, making them overly dependent on professionals rather than helping them develop responsible behaviors, robbing them of independent decision making that others enjoy, undermining their self-confidence in their many capabilities, over-generalizing the significance of some impairment, and defining them as tax-eaters rather than tax-contributors.[47]

Aligning itself with the social model, the **independent living movement** got its start when Edward Roberts was admitted to the University of California, Berkeley, in the fall of 1963.[47] The polio that Roberts had contracted at the age of 14 left him paralyzed from the neck down and in need of a respirator during the day and an iron lung at night. It was arranged that Roberts would stay in Cowell Hospital on the Berkeley campus with his brother Ron providing him personal assistance. Although Roberts was the first, in the following years Berkeley admitted other students with severe disabilities. They formed the "Rolling Quads" and were dedicated to making the campus and environs physically accessible.

Having completed his master's degree, Roberts, and his fellow Rolling Quads, were invited in 1969 to Washington to help develop a program aimed at retention of students with disability on college campuses. They created the Physically Disabled Students' Program (PDSP), which included provision for personal assistants, wheelchair repair, and financial aid. In 1972 Roberts became the first executive director of the first Center for Independent Living (CIL), located in Berkeley. Roberts based the CIL on the principles underlying the PDSP,[1] "that the experts on disability are the people with the disabilities[4]; that the needs of the people with disabilities can best be met by a comprehensive, or holistic program, rather than by fragmented programs at different agencies and offices[4]; that people with disabilities should be integrated into the community."[39] Since the founding of the first CIL, hundreds of other centers have been developed throughout the country.

Providing Humanistic and Scientific Care: an Ongoing Discussion Within the Profession

Moral Treatment and the Medical Model

As previously discussed, occupational therapy was founded on two paradigms: a humanistic framework and a scientific framework. In the 1960s and 1970s, the tension between paradigms within occupational therapy was expressed in terms of moral treatment versus the medical model. A cry arose from some of the profession's leaders to return to its roots in moral treatment and to forego what Shannon referred to as the "technique philosophy."[44] In his article on what he called "the derailment of occupational therapy," Shannon described two philosophies at odds with each other. One, he asserted, viewed the individual "as a mechanistic creature susceptible to manipulation and control via the application of techniques"; the other, based on the profession's early philosophy of moral treatment, emphasized a holistic and humanistic view of the individual.

Kielhofner and Burke described the situation as a conflict between the humanistic and scientific paradigms.[29] Early OT practice, they asserted, was based on the model of occupation that had moral treatment as its foundation. This paradigm provided a "holistic orientation to Man [sic] and health in the context of the culture of daily living and its activities." Post–World War II practice, they asserted, was based on the scientific paradigm of reductionism, a mode of thinking characteristic of the medical model. This view emphasized the individual's "internal states" and represented a shift in focus to "internal muscular, intrapsychic balance and sensorimotor problems." The authors acknowledged that practice based on the scientific paradigm "would pave the way for the development of more exact technologies for the treatment of internal deficits"; however, they were concerned that it "necessitate[d] a narrowing of the conceptual scope of occupational therapy."[29]

The claims that early OT practice was based on the humanistic and holistic philosophy of moral treatment are accurate, but they do not tell the full story. As this chapter describes, the founders also valued the medical model and the important role that "science" could play in establishing the profession's credibility. For example, the Committee on Installations and Advice, directed by Dunton, was formed to scientifically analyze the most commonly used crafts and to match the therapeutic value of each craft to a particular disability.[42]

How could the founders have supported what came to be viewed in the 1970s as the two opposing views of moral treatment and the medical model? The answer may be that in 1917, when the profession was founded, the models were not considered to be incompatible because the scientific medical model had not fully taken hold. It appears that in the founding years, occupational therapists primarily *practiced* moral treatment and *talked about* how practice should also be medical and scientific. When early practitioners were asked to treat patients in order to "restore the functions of nerves and muscles" or to make use of "the affected arm or leg,"[46] they based their treatment on their belief in the importance of occupation, habit training, and their knowledge of crafts. Once knowledge and technologic advances were sufficient and occupational therapists could actually practice using a scientific, medical perspective, it became apparent that the values underlying these two paradigms might be in conflict.

The physical disabilities therapist was faced with the problem of how to give treatment that was, on the one hand, holistic and humanistic and, on the other, medical and scientific. Baldwin's answer in 1919 was to see activities such as muscle strengthening and splint fabrication as techniques that contributed to the larger goal of "functional restoration" of the individual's social, physical, and economic well-being.[7] Spackman's answer in 1968 was that the occupational therapist should use "constructive activity in a simulated, normal living and/or working situation. This is and always has been our function."[46] She emphasized the teaching of ADLs and work simplification and was critical of treatment that consisted of having patients sand or use a bicycle saw with no "constructive activity" involved.

Another answer to the question of differing paradigms was to move outside the medical model. Bockoven urged OT practitioners to set up services in the community based on moral treatment:

It is the occupational therapist's inborn respect for the realities of life, for the real tasks of living, and for the time it takes the individual to develop his modes of coping with his tasks, that leads me to *urge haste on the profession … to assert its leadership in fashioning the design of human service programs … Don't drop dead, take over instead!*[10]

Yerxa urged therapists not to rely solely on doctor's orders:

The written prescription is no longer seen by many of us as necessary, holy or healthy. … The pseudo-security of the prescription required that we pay a high price. That price was the reduction of our potential to help clients because we often stagnated at the level of applying technical skills.[56]

However, as practice moved into the 1980s, there was much concern that if occupational therapists did as their critics suggested, they would jeopardize reimbursement and referrals. They argued that they were being asked to exclude skills and knowledge they believed were valuable in patient treatment, such as exercise, splinting, and facilitation techniques. They further argued that many patients receiving OT services were initially not at the level of motor capability that would enable them to engage in satisfying occupations. It was proposed that adjunctive techniques, such as exercise and biofeedback, should be considered legitimate when used to prepare the patient for further engagement in occupation.[52] A study conducted in 1984 by Pasquinelli showed that although therapists valued occupation, they used a wide variety of treatment techniques and approaches, including facilitation and nonactivity-oriented techniques.[38] Both Ayres[5] and Trombly[52] argued that instead of attempting to redirect the focus of OT, the profession should include current clinical practices that had proved effective on an empirical and practical basis.

The Rehabilitation Model and the Social Model

By the latter decades of the 20th century, the debate was being expressed as a conflict between the rehabilitation model and the social model. Scholars such as Gill[20] brought the perspective of the social model of the disability rights advocates to the discussion of what constituted ideal occupational therapy practice. She argued that the rehabilitation model exempted society from taking any responsibility for its role in creating the climate that restricted the rights and opportunities of the disabled. She urged occupational therapists to examine their practice and make sure that their treatment did not focus solely on the individual's physical condition:

For rehabilitation to be helpful, it must address the reality of what life is like for disabled persons. If rehabilitation professionals fail to fit their services to the patient's needs, values, and interests, they fail both the patient and their own professional aspirations. … Without a proper balance of physical treatment and realistic social information, rehabilitation cannot enable patients. … What good are increased range of motion and finger dexterity when a patient's morale can be crushed by job discrimination or social rejection?[20]

A study conducted by Pendleton in 1990 supported Gill's concerns. Pendleton found that occupational therapists were much less likely to provide training in independent living skills than physical remediation.[40] She defined independent living skills as “those specific abilities broadly associated with home management and social/community problem solving.” She argued that “Mastering such skills could contribute to the achievement of control over one's life based on the choice of acceptable options that minimize reliance on others. … The result of achieving such control is that the person can actively participate in the day-to-day life of the community.”[40] She recommended that if occupational therapists were not able to provide sufficient independent living skills training in inpatient rehabilitation centers, they should shift their treatment to community-based programs. Pendleton saw independent living skills as the essence of occupational therapy and urged therapists to make it one of their priorities.

Longmore, a well-known historian and disability rights activist, emphasized the importance of the issues raised by Gill and Pendleton. He acknowledged that disability rights activism had been responsible for numerous pieces of legislation since the 1970s aimed at giving those with disability equal access to all parts of society, including schools, work, public places, and transportation. However, he warned that there was still much to be done. The most important legislation passed during this period included the Rehabilitation Act of 1973, the Individuals with Disabilities Education Act of 1973 (IDEA), and the Americans with Disabilities Act of 1990 (ADA). Longmore argued that, despite this legislation, people with disabilities continued to experience marginalization and financial deprivation. He wrote, “Depending on age and definition of disability, poverty rates among disabled people range anywhere from 50% to 300% higher than in the population at large.”[31] He worried that most people assumed that the ADA had eradicated the major problems for those with disabilities, when in fact “to a surprising extent U.S. society continues to restrict or exclude people with disabilities.”[31]

Contemporary Practice: Addressing the Unintended Consequences of the Rehabilitation Model

As previously discussed, disability scholars such as Longmore[32] and Gill[21] criticized the main premise of the rehabilitation model—that something is abnormal or lacking in the individual with disability. The main justification for rehabilitation services is that through the intervention of professionals (eg, occupational therapists), the client can become more independent and a more useful contributor to society. The problem with this premise is that it assumes that clients want to become more "independent" (as defined by the rehabilitation specialists) and that they cannot fully contribute to society in their current condition. Thus, the rehabilitation model has the unintended consequence of devaluing individuals with disabilities and placing the focus of intervention on remediating the disability rather than the social, political, and economic barriers that contribute to it. Kielhofner discussed this problem in the *Special Issue on Disability Studies* that appeared in the *American Journal of Occupational Therapy*: "As this paper and others in this special issue illustrate, disability studies raises issues and questions to which there are no easy answers."[30] He quoted the disability scholar Paul Abberley, who noted that "OT, despite what may be the best of intentions on the part of its practitioners, serves to perpetuate the process of disablement of impaired people."[30]

One answer is to create constructs that attempt to blend the rehabilitation and social models by redefining disability. The World Health Organization (WHO) sought to do this in 2001 with the *International Classification of Functioning, Disability, and Health* (ICF).[55] The ICF provides a classification system that considers physical and mental impairments in addition to environmental and personal factors, any or all of which may result in activity limitations and participation restrictions.

Basing its work on WHO's conceptual scheme, the AOTA created the Occupational Therapy Practice Framework (OTPF) in 2002, which was revised in 2008 and 2014.[1-3] The Framework provides a construct that promotes client-centered engagement in occupation as the central focus of practice. This construct addresses issues raised by the proponents of moral treatment, in addition to problems inherent in the social and medical models. It reclaims the values of moral treatment by its focus on occupation-based treatment that is both holistic and humanistic. It integrates aspects of the medical model by advocating the reduction of functional impairments caused by physical and psychological limitations. Finally, it supports the social model of the disability rights movement by emphasizing the need for client-centered treatment within the context of the social, cultural, and political environments.

Another answer is for occupational therapists to continue to emphasize the therapeutic use of self in all relationships with clients. A focus on the importance of the therapist's interaction with clients has been an underlying tenet of occupational therapy since its founding and continues today. Indeed, as Taylor et al. found in their survey of 568 occupational therapists, "Most therapists considered therapeutic use of self as the most important skill in occupational therapy practice and a critical element of clinical reasoning."[50] By focusing on the client-therapist relationship, the practitioner is more likely to understand the client's experience as an individual with a disability and thus to work jointly with him or her to formulate an intervention plan that centers on the client's goals. When a viable therapeutic relationship is formed, practice is much more likely to be client centered.

Scholarship that focuses on the disability experience can add to the profession's body of knowledge and can help increase our understanding of how occupational therapy can address disability studies concerns. For example, research by occupational therapy scholars such as Taylor,[49] Neville-Jan,[34] and Guidetti et al.[23] examines the experiences of those with disabilities through phenomenological and narrative accounts, thereby helping occupational therapists understand disability from the individual's perspective.

Finally, a knowledge of history can provide a context from which to understand the current challenge to physical disabilities practice. As this history has demonstrated, early treatment in occupational therapy was based on belief in the importance of occupation, habit training, and knowledge of crafts. As scientific knowledge and technology advanced, OT defined a role for itself within the rehabilitation model. This resulted in the emergence of physical disabilities as a specialty within OT. The closer relationship with medicine helped the profession gain credibility. However, the scientific reductionism of the medical model put professional practice at odds with the holistic humanism of moral treatment. Today we discuss this in terms of the tensions inherent in the rehabilitation model versus the social model advocated by disability scholars.

Our current challenge is to interweave the rehabilitation and social models wherever possible. Occupational therapy is uniquely qualified to do this because we were founded on two potentially conflicting paradigms, the humanistic and the scientific; therefore, tension between two paradigms is not new for our profession. There have been ongoing discussions since the 1960s on how to resolve the tension between these paradigms. These discussions have led the profession full circle, back to its most enduring belief—the benefits of engagement in occupation. As Dunton emphasized in 1919, "Occupation is as necessary to life as food and drink."[17] When occupational therapists keep occupation as the central focus, it is easier to find the common ground of the rehabilitation and social models.

As new approaches and techniques are developed, OT intervention that promotes engagement in desired occupations will remain consistent with the philosophical base of the profession and help further advance occupational therapy as a valued service in physical disabilities practice.

Using History to Understand Today's Practice

In lieu of a case study, we will demonstrate how we can use our knowledge about occupational therapy's history to answer a question that is prevalent among students and therapists today: Why do occupational therapists continually have to define occupational therapy to others?

First, we should acknowledge that more people than ever do understand occupational therapy. Most of these people are individuals who have received treatment or have had personal contact with someone who received occupational therapy. So each time an occupational therapist successfully engages a client in treatment, he or she is providing a positive definition of occupational therapy. That being said, it can feel as though occupational therapists spend quite a bit of time educating others as to what we do. We can look back to the founding years to understand why this is so. The answer is complex and includes several factors.

The first relates to the profession's purpose. As noted earlier in the chapter, in naming the profession, the founders were looking for a term that was broad enough to encompass all the things occupational therapists did. In 1923 the AOTA described occupational therapy as follows:

Occupational Therapy is a method for training the sick or injured by means of instruction and employment in productive occupation. The objects sought are to arouse interest, courage, and confidence: to exercise mind and body in healthy activity; to overcome disability; and to re-establish capacity for industrial and social usefulness.[4]

This definition reflects a holistic, humanistic, and all-encompassing view of the individual, the rehabilitative process, and the role of occupational therapy within it. It addresses the mind in addition to the body, and social as well as medical goals. The founders ultimately decided that *occupational therapy* was the term that best reflected the profession's goals. This is not to say that the founders did not consider the possible negative aspects of the term. It is clear from their writings that they were aware that such a broad term might cause some misunderstanding. However, in the end, they felt that this negative would be offset by the positive of providing occupational therapists with a wide range of freedom to treat each individual in the best way possible.

Second, we must consider that the name *occupational therapy* was chosen in 1917, and meanings of terms change over time. For example, children with disabilities were placed in "asylums for the crippled" in the early 1900s. We would never use that terminology today. Fortunately, *occupation* does not carry such a negative connotation in today's lexicon, but the term has shifted in meaning. In 1917, *occupation* was most commonly used to mean an important activity in which one engages. For example, in a novel, one might read about a woman who was searching for an occupation that would satisfy her free time. As the century progressed, the term *occupation* came to be more closely aligned with the kind of paid work a person does, as in "What is your occupation?" When the profession's name is considered in this light, it is easier to understand any confusion someone today may have about the term and the continual need for the occupational therapist to educate people about the term's meaning within today's context.

Third, we must also consider that the professions that exist today did not exist at the time of occupational therapy's founding. That is one reason the definition of OT was so broad. At the time of the founding of occupational therapy, society was looking for a profession that could help remediate the wounds and illnesses of returning soldiers and enable them to become productive members of society. Occupational therapy offered that promise. Professions such as social work and physical therapy were still in their fledgling stage, and it was unclear which profession would ultimately be involved in the soldiers' rehabilitation. In addition, art, music, recreation, and vocational therapy had yet to be introduced.

Finally, as has been discussed throughout this chapter, the ideas underlying occupational therapy do not fit neatly into just one theoretical paradigm. Occupational therapy uses an occupation-based, client-centered approach that bridges both the medical and social models, as is evidenced in the Occupational Therapy Practice Framework. Although this sounds good in theory, in practice it means that if occupational therapists are working with people who use a strict medical model (including third parties), there will be misunderstandings about OT's proper role. This is where occupational therapists must be proactive in describing what we do.

History tells us that occupational therapy has always viewed its clients and its role through a humanistic, holistic lens, and it cannot be neatly confined either to the medical or the social paradigm. The blending of these paradigms, in the ICF and OTPF, finally offers occupational therapy a suitable home. However, these are new ideas, and it will take time for them to be accepted. This is one more reason occupational therapists will not be finished defining what we do any time soon. But is it not a worthy challenge? History would suggest that it is. So the next time you have to define occupational therapy, think of yourself as the latest generation to carry on the proud tradition of defining your goals by what is good for the client rather than what “fits” into the prevailing theoretical model.

Review Questions

1. Name the seven founders of occupational therapy, and list the professional background of each.
2. What ideologies shaped the development of occupational therapy in the late 19th and early 20th centuries?
3. What were the main features of the philosophy of moral treatment?
4. Describe the ideas that were the foundations of occupation as a remedy for mental and physical illness.
5. What provoked the rise of the arts and crafts movement?
6. How did the arts and crafts movement influence occupational therapy?
7. Describe scientific management. How did it influence the development of occupational therapy?
8. When did the rehabilitation model evolve? How did the world wars influence the development of the rehabilitation model?
9. How did physical dysfunction become a specialty?
10. What factors influenced occupational therapy to adopt the medical model?
11. What was the apparent conflict between moral treatment and the medical model?
12. What impact have the disability rights and independent living movements had on occupational therapy?
13. How is the apparent conflict between the medical model and the social model being resolved in occupational therapy practice?

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PART II

Occupational Therapy Process and Practice

OUTLINE

Application of the Occupational Therapy Practice Framework to Physical Dysfunction

Winifred Schultz-Krohn, Heidi McHugh Pendleton

CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Identify and describe the major functions of the occupational therapy (OT) process.
2. Describe how clinical reasoning adjusts to consider various factors that may be present in the intervention context.
3. Identify how theories, models of practice, and frames of reference can inform and support OT intervention.
4. Identify appropriate delegation of responsibility among the various levels of OT practitioners.
5. Discuss ways in which OT practitioners may effectively collaborate with members of other professions involved in client care.
6. Recognize ethical dilemmas that may occur frequently in OT practice, and identify ways in which these may be addressed and managed.
7. Describe the various practice settings for OT practice in the arena of physical disabilities.
8. Discuss the types of services typically provided in the various practice settings.
9. Identify ways in which different practice settings affect the occupational performance of persons receiving occupational therapy services.
10. Identify the environmental attributes that afford the most realistic projections of how the client will perform in the absence of the therapist.
11. Identify environmental and temporal aspects of at least three practice settings.
12. Describe ways in which the therapist can alter environmental and temporal features to obtain more accurate measures of performance.

KEY TERMS

Acute care
Acute rehabilitation
Clinical reasoning
Community-based settings
Conditional reasoning
Ethical dilemmas
Ethics
Evaluation
Frame of reference (FOR)
Inpatient settings
Interactive reasoning
Intervention plan
Narrative reasoning

Occupational therapist (OT)
Occupational therapy aide
Occupational therapy assistant (OTA)
Occupational therapy practitioners
Practice setting
Pragmatic reasoning
Procedural reasoning
Referral
Screening
Skilled nursing facility (SNF)
Subacute rehabilitation

Threaded Case Study

Serena, Part 1

Serena is an occupational therapy student who began her first fieldwork internship 2 weeks ago. She felt fortunate to be assigned a site that provides a wide array of services. Serena's site is a community hospital that provides a continuum of care, from emergency services and critical care (intensive care unit [ICU]) to outpatient rehabilitation services. Her internship includes providing occupational therapy (OT) intervention in a variety of settings. Her clinical instructor (CI) requested that Serena review the process of developing an intervention plan and be prepared to differentiate the roles of occupational therapy in the various settings.

Critical Thinking Questions

1. What process should be used to develop an intervention plan?

2. How do theories, models of practice, and frames of reference guide an intervention plan?

3. What forms of clinical reasoning are used when providing OT services?

This chapter is divided into two sections. The first section introduces the OT process, summarizing the functions of evaluation, intervention, and outcomes described in the "Occupational Therapy Practice Framework," third edition (OTPF-3).[6,7] The chapter acquaints the reader with the complexity and creativity of clinical reasoning within the context of the contemporary clinical environment. The complementary roles of different OT practitioners are described, as are the relationships between the occupational therapist and other healthcare professionals involved in the care of the client with physical dysfunction. Common ethical dilemmas are introduced, and ways to analyze these are presented.

The second section describes various practice settings in which OT services are provided for individuals who have physical disabilities. In addition, the typical services provided in each setting are discussed.

Section 1 The Occupational Therapy Process

Winifred Schultz-Krohn, Heidi McHugh Pendleton

The Steps of the Occupational Therapy Process

The OTPF-3 discusses both the domain and the process of the occupational therapy profession.[6,94] The domain is described in Chapter 1, and the reader should be familiar with the domain before reading about the process of occupational therapy.

The OT process should be conceptualized as a circular progression initiated by a referral (Fig. 3.1). The referral may be generated by another professional or by the client seeking services. The profession of occupational therapy identifies the "client" as including "persons, groups, and populations" (OTPF-3, p. S2).[7] Following the referral, an evaluation is conducted to identify the client's occupational needs. The intervention is developed based on the evaluation results. The targeted outcome of intervention is "achieving health, well-being, and participation in life through engagement in occupation" (OTPF-3, p. S2).[5,7] The steps of evaluation, intervention, and outcome should not be viewed in a linear fashion, but instead should be seen as a circular or spiraling process in which the parts are mutually influential.

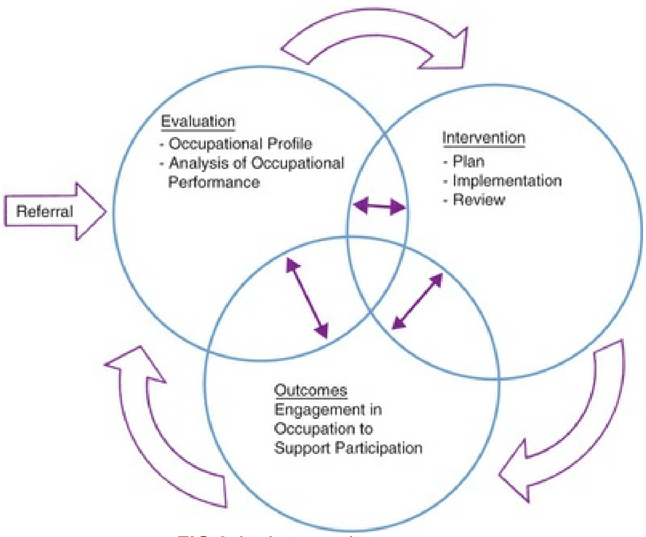

FIG 3.1 Intervention process.

Referral

The physician or another legally qualified professional often requests occupational therapy services for the client. The **referral** may be oral, but a written record is often a necessity. Individuals, groups, and/or populations may also seek occupational therapy services without a formal referral from another party. Guidelines for referral vary, and in some situations OT services may require a physician's referral before the initiation of services. The occupational therapist (OT) is responsible for responding to the referral. Although clients may seek OT services without first obtaining a referral, the occupational therapist may need a referral before the initiation of intervention services. State regulatory boards and licensing requirements should be reviewed before initiation of services to determine whether a referral for service is necessary.

Screening

The OT determines whether further evaluation is warranted and if OT services would be helpful to this client. The therapist may perform a **screening** independently or as a member of the healthcare team. Screening procedures are generally brief and do not cover all areas of occupation. A formal screening is not always conducted with the client; however, during the review of the client's record before the evaluation, the OT considers the client's diagnosis and physical condition, the referral, and information from other professionals. The therapist synthesizes this information before initiating an evaluation. In some settings, the screening process flows directly into the evaluation of the client in a seamless manner. This requires the OT to assess and view multiple influential factors through the lens of how the client would like to engage in occupations.

Evaluation

Evaluation refers to "the process of obtaining and interpreting data necessary for intervention. This includes planning for and documenting the evaluation process and its results."[1] Assessment refers to "specific tools or instruments that are used during the evaluation process."[1] Two parts of the evaluation process have been identified: the generation of an occupational profile and the analysis of occupational performance (OTPF-3, p. S10).[7] The assessments chosen, if necessary, help further develop the occupational profile. The OT then analyzes the client's occupational performance through synthesis of data collected using a variety of means.

The evaluation portion begins with the OT and client developing an occupational profile that reviews the client's occupational history and describes the client's current needs and priorities (OTPF-3, p. S10).[6,7,16] This portion of the evaluation process includes the client's previous roles and the contexts for occupational performance. For example, Serena has been assigned to develop an occupational profile for a 56-year-old man who recently had a tumor removed from his right cerebral hemisphere, resulting in dense left hemiplegia. He has been married to his wife for 27 years and reports that he never cooks. On further exploration during the development of the occupational profile, the man reports that one of his most treasured occupations is being able to grill, and he discusses the importance of grilling over charcoal versus using a gas grill. Although Serena may have initially ignored the need to work on cooking skills with this man, she now understands the occupational significance of grilling and, from the client's perspective, the difference between grilling and cooking! The occupational profile allows the OT to understand the client's occupational history, current needs, and priorities, and it also identifies which occupations or activities are successfully completed and those that are problematic for the client.

The occupational profile is most often initiated with an interview with the client and significant others in the client's life, and by a thorough review of available records.[6] Interviews may be completed using a formal instrument or informal tools. Although the occupational profile is used to focus subsequent intervention, this profile is often revised throughout the course of intervention to meet a client's needs. The purpose of the occupational profile is to answer the following questions, as posed by the American Occupational Therapy Association (AOTA) framework (OTPF-3, p. S13).[6,7] These questions provide an example of how the occupational therapist, Serena, initiates the occupational profile of one of her clients, Nora.

1. *Who is the client?* This requires consideration not only of the individual, but also of the significant others in the client's life. In some settings the client may be identified as a group and not as an individual. Serena's client, Nora, is a 28-year-old woman who sustained a traumatic brain injury (TBI), resulting in memory deficits and slight difficulties with coordination. She is a wife and the mother to two young children. During the evaluation process, Serena considers not only Nora's occupational needs, but also the needs of her family and her roles as a family member.

2. *Why is the client seeking service, and what are the client's current concerns relative to engaging in occupations and daily life activities?* This relates to the occupational needs identified by the individual and significant others. The needs not only of Nora, but also those of her husband and children, should be considered in answering this question.

3. *What occupations and activities are successful or are problematic for the client?* This requires an understanding of which occupations are successfully completed by the client. Nora has the physical ability to drive, yet she also has severe memory problems and difficulty remembering the routes for driving her children to school and various activities.

4. *What aspects of the client's environments and contexts influence engagement in occupations and desired outcomes?* Some contexts may be supportive, whereas others present challenges or prohibit occupational performance. Nora's parents expect her to be the primary caregiver for her children and when her husband attempts to support Nora, her parents interfere.

5. *What is the client's occupational history? What are the client's values and interests?* This includes the level of engagement in various occupations and activities, along with the value attributed to those occupations by the client. Although prior to her traumatic brain injury Nora was responsible for most of the housecleaning tasks, she did not highly value these duties. She was also responsible for meal preparation, and she says that she enjoys cooking. She places a much higher value on being able to drive her children to school and various after-school activities.

6. *What are the client's patterns of engagement in occupations, and how have these changed over time?* During the evaluation session, Nora explains that she has always been very active in the community and with her family. If anyone was sick, Nora was the person to provide support. Nora reveals to Serena that she has concerns about others needing to care for her; Nora has never been the one to receive care and support. Serena considers this marked change in a sense of self that Nora is experiencing after her TBI.

7. *What are the client's priorities and targeted outcomes?* These may be identified as occupational performance, role competence, adaptation to the circumstance, health and wellness, prevention, or quality-of-life issues. For Nora, the need to drive safely so as to resume responsibility for fostering community participation for her children was a primary outcome. This reflects her interest in occupational performance. She was not interested in having her parents or her husband assume these roles.

After the occupational profile has been developed, the OT identifies the necessary additional information to be collected, including areas to be evaluated and what assessment instruments should be used prior to the analysis of occupational performance. The OT may delegate some parts of the evaluation, such as the administration of selected assessment tools, to the occupational therapy assistant (OTA). The interpretation of data is the responsibility of the OT. This requires the OT to direct the evaluation by completing an occupational profile, interpreting the data collected from the profile, and then analyzing the client's occupational performance prior to proceeding to assessment of client factors. The selection of additional information beyond the occupational profile should answer the following questions:

1. What additional data are needed to understand the client's occupational needs, including contextual supports and challenges?

2. What is the best (most efficient and accurate) way to collect these data?

3. How will this information support the intervention plan?

4. How will this information influence potential outcomes?

The ability of the client to successfully plan, initiate, and complete various occupations is then evaluated. The occupations chosen are based on the occupational profile. The OT then analyzes the data to determine the client's specific strengths and weaknesses that impact occupational performance. The impact of contextual factors on occupational performance is included in the analysis of data. This can easily be seen when a client who is dependent on a wheelchair for all mobility is faced with several stairs to enter an office building to conduct business. The client has functional mobility skills but is prohibited from participating because of an environmental factor that restricts access. The analysis includes integrating data regarding the activity demands, the client's previous and current occupational patterns, and the client factors that support or prohibit occupational performance. Data about specific client factors may be helpful in developing an intervention plan but should be performed after the occupational profile is completed and an analysis of occupational performance has been initiated. The information generated from the profile and analysis will allow more careful selection of necessary assessment tools to collect further data. The OT also considers if the client would benefit from a referral to other professionals.

Threaded Case Study

Serena, Part 2

Although Serena is able to competently perform a manual muscle test and range-of-motion assessment, these assessments would not be necessary for all clients. Serena must first develop the client's occupational profile as a guide and then select the most appropriate assessment instruments to complete her evaluation of the client's occupational performance. After she has completed these steps, Serena will be able to identify more clearly what additional information is needed to plan and implement intervention services.

Intervention Planning

In collaboration with the client, the **occupational therapy practitioners** (OT and OTA) develop an **intervention plan**, using the approaches or strategies in the following list, to enhance the client's ability to participate in occupational performance.[6,7,16] Although the OT is responsible for the plan, the OTA contributes to the plan and must be "knowledgeable about the evaluation results."[3] The strategies selected should be linked to the intended outcomes of service.[6] These approaches or strategies answer the question, "What type (approach/strategy) of intervention will be provided to meet the client's goals?" Examples of each form of intervention approach or strategy are provided. with selected literature to support this form of occupational therapy intervention.[7]

1. *Create or promote healthy occupational engagement*. A disabling condition is not assumed; rather, OT services are provided to enhance and enrich occupational pursuits. This approach may be used to help clients who are transitioning in roles or to foster occupational performance across contexts. An example would be using narratives to promote a healthy transition from the role of a worker to retirement. As workers described what they anticipated in retirement, they linked "past, present, and future." This process of anticipating changes and making choices was considered to be an important factor in "understanding how people adapt to life changes."

2. *Establish or restore a skill or ability.* This strategy is aimed at improving a client's skills or abilities, thus allowing greater participation in occupations. Evidence of the effectiveness of OT services provides this form of intervention, as demonstrated by several investigators. Walker et al.[91] investigated the effectiveness of OT services in restoring skills for activities of daily living (ADLs) and instrumental activities of daily living (IADLs) in clients who had sustained a cerebrovascular accident (CVA) but who had not received inpatient rehabilitation services. Using a randomized controlled trial, these researchers demonstrated that clients who received OT services had significantly better ADL and IADL performances compared to clients who had not received these services. Rogers et al.[77] demonstrated that performance of ADLs can be significantly improved when clients are provided with systematic training by OT practitioners.

3. *Maintain current functional abilities.* This approach recognizes that many clients are faced with degenerative disorders, and OT services should actively address the need to maintain occupational engagement.[24,36] Intervention may focus on the activity demands, performance patterns, or context for occupational performance. For example, an individual in the early stage of Parkinson disease is still able to complete many self-care activities but should develop the habits that will maintain these skills as motor function continues to deteriorate. Maintenance also includes clients who have a chronic, nonprogressive disorder; these individuals need to maintain physical conditioning to meet activity and environmental demands.

4. *Modify, adapt, or compensate.* This approach focuses on modifying the environment, the activity demands, or the client's performance patterns to support health and participation in occupations. Instruction and use of energy conservation techniques for clients who have dyspnea (shortness of breath or difficulty breathing) as a result of chronic obstructive pulmonary disease (COPD) is an example of this approach.[63] The use of electronic aids to daily living (EADLs) is another example of how the activity can be modified to promote participation. In a study by Erikson et al.,[34] when clients who had acquired brain damage were provided with training in the use of EADLs, they reported a sense of mastery. Even if a client's previous abilities cannot be restored, using this adaptive or compensatory approach can promote participation in occupations.

5. *Prevention.* A prevention approach can be used for clients who have no identified disabling condition or circumstance. This approach focuses on developing the performance skills and patterns that support continued occupational performance, and it provides intervention that

anticipates potential hazards or challenges to occupational performance. Contextual issues are also addressed using this approach, and environmental barriers would be similarly considered. An example of services representing a preventive approach would be instructing a client who has compromised standing balance in fall prevention techniques and asking the family to remove loose throw rugs from the home to prevent falls.[29] Clark et al.[26] demonstrated the beneficial effects of preventive OT services in the investigation of well, elderly adults. Adults who received preventive OT displayed far fewer health and functional problems compared to adults who did not receive these services.

Through collaboration with the client and significant others, the OT can develop an intervention plan that identifies not only the specific focus of the goal, but also the explicit content of the goal. For example, Serena's client, Nora, who sustained a TBI, indicated that she wanted to be able to return to driving her children to various community-based activities. Services for Nora would focus on two approaches: restoring the skills needed to engage in this occupation of driving her children to community activities, and adapting the performance by avoiding community activities that necessitate driving during heavy traffic periods in the morning and late afternoon.

Specific driving skills would be improved using strategies to enhance reaction time, problem solving, and attention to potential safety risks. Because of Nora's diminished memory and difficulty with processing complex information, the occupation of driving her children to community activities should be modified. Nora could select community activities that are close to her children's school and home, thereby decreasing the length of time she is driving her children. Through the use of a programmable guidance system in her car, such as a global positioning system (GPS), she is able to follow the specific directions to the various community activities. If these intervention approaches are unsuccessful, the OT may explore alternatives to driving with Nora, such as bicycling or walking with her children to nearby community activities or carpooling with another parent, who assumes the actual driving role, while Nora contributes by providing snacks or gas money. Such alternatives could provide a safer solution and still meet the need for Nora to be involved in the occupation of driving or transporting her children to their community activities.

The OT is responsible for the plan and for any parts delegated to the OTA. The plan includes client-centered goals and methods for reaching them using the previously mentioned approaches or strategies. The values and goals of the client are primary; those of the therapist are secondary.[6] Cultural, social, and environmental factors are incorporated into the plan, which must identify the scope and frequency of the intervention and the anticipated date of completion. The outcomes of the intervention must be written at the time the intervention plan is developed. Discharge planning is initiated during the intervention planning process. This is accomplished by developing clear outcomes and targeted time frames for the completion of goals.

The generation of clear and measurable goals is a very important step in the planning process. Long-term goals or terminal behaviors must reflect a change in occupational performance. For a client to receive authentic OT services, the program must focus on "supporting health and participation in life through engagement in occupation."[6] This outcome may be achieved by several means, such as improved occupational performance, role competence, adaptation, prevention, and quality of life, or by fostering health and wellness.[7] Outcomes may also focus on occupational justice to afford individuals, groups, and populations the opportunity for occupational engagement. Short-term goals or behavioral objectives reflect the incremental steps that must be taken to achieve this outcome. An example would be Nora returning to driving. Several short-term steps would be necessary prior to meeting this terminal behavior or long-term goal. An intervention plan may address bilateral coordination and speed of reaction prior to having Nora return to driving. Several authors have provided detailed descriptions of the critical parts of a well-written goal.[48] Table 3.1 serves as a brief guide for the development of goals and objectives. (See Chapter 8 for additional details about goals and documentation.)

TABLE 3.1

ABCDE Format for Writing Goals

A – Actor	Begin the goal with a statement such as, "Nora will…" Name the client as the performer of the action for the goal.
B – Behavior	The occupation, activity, task, or skill to be performed by the client. If this is an outcome or terminal goal, the behavior must reflect occupational performance. Short-term goals or behavioral objectives are often steps to reaching a long-term goal or outcome. A short-term goal or objective may identify a client factor or performance skill as the targeted behavior. An outcome behavior for Nora, the client in the case study, would be the ability to drive a car, whereas a short-term behavior would be to enter the car and fasten a seat belt.
C – Condition	The situations for the performance of the stated behavior include social and physical environmental situations for the behavior. Examples of conditions included in a goal are the equipment used, social setting, and training necessary for the stated behavior. For Nora, driving a car with an automatic transmission is a far different condition than

	driving a car with a manual transmission.
D – Degree	The measure applied to the behavior and the criteria for how well the behavior is performed. These may include repetitions, duration, or the amount of the activity completed. A client may only be expected to complete a small portion of an activity as a short-term goal, but the long-term goal would address the targeted occupation. The amount of support provided serves as a measure of degree of behavioral performance. This would include whether the client required minimal assistance, verbal prompts, or performed the task independently. The criteria must be appropriate for the behavior. Safely driving 50% of the time is an inappropriate criterion; using a percentage to indicate that Nora will independently fasten her seat belt 100% of the time provides an appropriate criterion for the behavior
E – Expected Time Frame	When is the goal to be met, the time period that is anticipated to meet the goal as stated.

Adapted from Kettenbach G: *Writing SOAP notes*, ed 3, Philadelphia, 2004, FA Davis.

Intervention Implementation

The intervention plan is implemented by the OT practitioners. The OT may assign to the OTA specific responsibilities in the delivery of the intervention plan. Nonetheless, the OT retains the responsibility to direct, monitor, and supervise the intervention, and he or she must ensure that relevant and necessary interventions are provided in an appropriate and safe manner, and that documentation is accurate and complete.[3] The method used to provide interventions could include therapeutic use of self, therapeutic use of occupations and activities, preparatory methods and tasks, group interventions, education and training, or advocacy.[6,7] (See Chapter 1 for a more detailed description of these methods of providing intervention.) These methods answer the question, "How will intervention strategies be provided?" The intervention plan would identify which approach or strategy would be used in combination with the method of intervention. During the actual implementation of intervention services, a clinician may seamlessly shift between different methods, depending on the needs of the client.

OT Practice Notes

Implementation of the intervention plan does not occur in isolation; rather, it requires the OT to continuously review the effectiveness of the services delivered by monitoring the client's response to intervention. At the beginning of each intervention session, the OT should answer the following questions:

1. What is the primary focus of intervention for this session?

2. How will this service meet the client's goals and needs?

Implementation of services should also include helping the client anticipate needs and solutions. A method developed by Schultz-Krohn,[84] known as anticipatory problem solving, provides a structure for this process. This method was developed from client-centered models, such as the model of human occupation[44] and the person-environment-occupation model[55,58] (these are described later in the chapter). The method was designed to empower the client to anticipate potential challenges and develop solutions prior to encountering the challenges. The key elements of the anticipatory problem-solving process are:

1. The client and clinician identify the occupation or activity to be performed.

2. The specific features of the environment that are required for occupational/activity performance are identified. This includes contextual and environmental factors in addition to the necessary equipment to engage in the occupation/activity.

3. The OT and client identify potential safety risks or challenges to engagement in the occupation/activity that are located in the environment or with the objects required.

4. The OT and client develop a solution for these risks or challenges.

Remember that Nora would like to be able to drive her children to after-school activities. As she regains her abilities to drive, anticipatory problem-solving strategies are used to prepare her for potential environmental challenges. The process follows these steps:

1. Nora and the OT have identified the occupation of Nora driving her children to after-school music lessons as the focus for intervention.

2. Nora's car has an automatic transmission. The route she typically has taken to drive her children from school to the music lessons includes a busy street with four lanes, but no highway driving is required. She needs to make one left-hand turn on this street, but there is a left-turn light. The travel time typically is 10 minutes.

3. Nora reports that traveling on the one busy street can be a challenge because many drivers exceed the speed limit on this road and drive erratically. This is the quickest route to the music lessons, and because she is very familiar with it, it provides less challenge to her memory. Nora's husband also reports that this road often has construction, presenting an additional challenge.

4. Instead of changing her route, Nora develops a solution by allocating an additional 5 minutes to transport her children to lessons; this allows her to feel less pressure when drivers are exceeding the speed limit. Strategies to address the erratic drivers encountered on this road include frequent checks of her side mirrors and moving to the left lane two intersections before the left-hand turn light. In addition, an alternate route has been mapped out for Nora to use when road construction presents a challenge.

This process provides a brief illustration of how anticipatory problem-solving methods can be used during intervention implementation. The method can be equally applied to other activities. For example, for bathing, a client may anticipate the potential hazard of a slippery surface and make appropriate plans before getting in the bathtub. The foundation of this process is to engage the client in developing solutions for everyday challenges encountered as he or she engages in occupations/activities. The client is actively involved in identifying not only the occupation/activity, but also potential challenges or risks encountered, and in generating solutions for those challenges or risks.

Included in the intervention implementation process is ongoing monitoring of the client's response to the services provided. As services are initiated, the OT monitors the client's progression on a continuous basis and modifies the intervention methods used as needed to support the client's health and participation in life.

Intervention Review

The OT practitioner evaluates the intervention plan on a regular basis to determine whether the client's goals are being met.[6] The OT is "responsible for determining the need for continuing, modifying, or discontinuing occupational therapy services," but the OTA contributes to this process.[3] The review may include a reevaluation of the client's status to determine what changes have occurred since the previous evaluation. This measurement of the outcomes of intervention is critical in showing the effectiveness of the intervention. The intervention plan may be changed, continued, or discontinued based on the results of the re-evaluation. This re-evaluation also offers an opportunity to determine whether the intervention provided is focused on the outcomes articulated in the plan.

Outcomes

Working in collaboration with the client, the client's family, and the intervention team, the OT and OTA identify the intended outcome of the intervention. The OTPF-3 clearly states that the outcome of OT services focuses on several factors, including occupational performance, the "client's subjective impressions regarding goal attainment" (OTPF-3, p. S16),[7] and the well-being of caregivers, to name only a few potential outcomes. These outcomes can be measured in several ways. Outcomes may be written to reflect a client's improved occupational performance; a change in the client's response to an occupational challenge; effective role performance; habits and routines that foster health, wellness, or the prevention or lessening of further disability; and client satisfaction in the services provided. Client satisfaction can include overall quality of life outcomes that often incorporate several of the previously mentioned outcomes. Caregiver confidence may serve as an outcome measure, along with prevention of loss of occupational engagement for caregivers. For groups or populations, outcomes are often designed to address gains in "health promotion, occupational justice and self-advocacy" (OTPF-3, p. S16).[7]

Although the overarching outcome of OT intervention is "supporting health and participation in life through engagement in occupation,"[6] this goal can be achieved through several types of outcomes. The decision on whether the selected outcomes have been successfully met is made collaboratively with the members of the intervention team, including the client. The outcomes may require periodic revisions because of changes in the client's status. When the client has reached the established goals or achieved the maximum benefit from OT services, the OT formally discontinues service and creates a discontinuation plan that documents follow-up recommendations and arrangements. Final documentation includes a record of any change in the client's status from first evaluation through the end of services.

Fig. 3.1 shows the interrelationship of the various parts of the intervention process. This process is not completed in a linear fashion, but instead requires constant monitoring, and each section informs the other parts of the process. The outcome generated during the planning step should direct an OT to select intervention methods best suited to reach the desired client goals. During the intervention process, it may become apparent that the desired outcome is not realistic, necessitating revision of the client's goals and outcome of services.

Clinical Reasoning in the Intervention Process

Since 1986 the American Occupational Therapy Association (AOTA) has funded a series of investigations to examine how occupational therapists think and reason in their work with clients.[40] **Clinical reasoning** can be defined informally as the process used by OT practitioners to understand the client's occupational needs and make decisions about intervention services, and also as a means to think about the interactions of multiple factors that influence occupational engagement. There are several forms of clinical reasoning, and authors do not consistently use the same term for specific forms of clinical reasoning. The term “professional reasoning” has also been used by authors to capture the broad practice settings of occupational therapy because clinical reasoning is often associated with medical settings.[82] The AOTA's Standards for Continuing Competence uses the term “critical reasoning” to refer to the approach used by OT practitioners to make judgments and decisions.[5] This chapter uses the term clinical reasoning to focus on the relationship between the OT practitioner and the client.

The chapter includes information from authors discussing both professional and critical reasoning skills. Fleming[38] identified three “tracks” of clinical reasoning used by the expert clinician to organize and process data: procedural, interactive, and conditional. Yet another dimension of clinical reasoning, identified as narrative reasoning, has been discussed in the literature by Mattingly.[61] The fifth form of clinical reasoning, pragmatic reasoning, describes the practical issues and contextual factors that must be addressed.[65,81] This section describes how the five basic forms of clinical reasoning, discussed in the current literature, can be applied to practice.

Procedural reasoning is concerned with getting things done, with what “has to happen next.” This reasoning process is closely related to the medical form of problem solving. The emphasis is often placed on client factors and body functions and structures when this form of reasoning is used. A connection between the problems identified and the interventions provided is sought using this form of reasoning, and this can be seen in the “critical pathways” developed in some hospitals. A critical pathway is a form of decision-making tree that is based on a series of yes/no questions that can direct client intervention. For example, a client who had total hip replacement surgery would receive intervention that follows a predicted or anticipated trajectory of recovery.

Critical pathways are often developed to support best practice when there is substantial information about a client's course of recovery from a surgical procedure or medical treatment. Procedural reasoning would be used to develop critical pathways and is driven by the client's diagnosis and the potential outcomes anticipated for individuals with this diagnosis. This form of clinical reasoning is influenced by the current evidence regarding the client's condition and the selected intervention.[59] An OT should review the literature on an ongoing basis to provide effective and appropriate intervention services.[62] Using this knowledge to develop and implement intervention reflects procedural reasoning in practice.

This form of clinical reasoning supports evidence-based practice. Schaaf[80] describes the process of engaging in data-driven decision making, in which OT practitioners not only effectively use the current evidence to make decisions about selecting interventions, but also use the current evidence to determine appropriate outcome data. This approach connects the process of developing the occupational profile, selecting intervention methods, and determining not only the appropriate outcomes but also the data that best represent the outcomes of OT services.

Interactive reasoning is concerned with the interchanges between the client and therapist. The therapist uses this form of reasoning to engage with, to understand, and to motivate the client. Understanding the disability from the client's point of view is fundamental to this type of reasoning. This form of reasoning is used during the evaluation to detect the important information provided by the client and to further explore the client's occupational needs. During intervention, this form of reasoning is used to understand how the client is responding to the intervention selected and whether the intervention is effective in meeting the client's goals. The therapeutic use of self fits well with this form of clinical reasoning as the therapist uses personal skills and attributes to engage the client in the intervention process.

Conditional reasoning is concerned with the contexts in which interventions occur, the contexts in which the client performs occupations, and the ways in which various factors might affect the outcomes and direction of therapy. Using a "what if?" or conditional approach, the therapist imagines possible scenarios for the client. The therapist engages in conditional reasoning to integrate the client's current status with the hoped-for future. Intervention is often revised on a moment-to-moment basis to proceed to an outcome that will allow the client to participate in various contexts. Although an intervention is designed and implemented to foster occupational pursuits, conditional reasoning is not singularly focused on reaching the outcome. Conditional reasoning recognizes that the process of intervention often necessitates a reappraisal of outcomes. This reappraisal should be encouraged to help the client refine goals and outcomes.

Narrative reasoning uses story making or storytelling as a way to understand the client's experience. The client's explanation or description of life and the disability experience reveals themes that permeate the client's understanding and that will affect the enactment and outcomes of therapeutic intervention. In this sense, narrative reasoning is phenomenological. Therapists also use narrative reasoning to plan the intervention session, to create a story line of what will happen for the client as a result of therapy. Here the therapist draws on both interactive and conditional reasoning, using the client's words and metaphors to project possible futures for him or her.

The therapeutic use of self is critical when using this form of clinical reasoning. Providing an opportunity for the client to share the meaning of the disability experience helps the OT practitioners formulate plans and project future occupational performance. This is where the context and occupational performance intersect. A person may be able to engage in an activity with modifications, but those modifications may be unacceptable within the client's cultural and social context. For example, an individual who was an avid motorcyclist before a stroke now has impaired balance and is unable to operate the clutch and hand controls necessary to drive a motorcycle safely. Although automatic motorcycles are now available with three wheels, this client refuses the option, considering this to be not part of the motorcycle culture.

Pragmatic reasoning extends beyond the interaction of the client and therapist. This form of reasoning integrates several variables, including the demands of the intervention setting, the therapist's competence, the client's social and financial resources, and the client's potential discharge environment. Pragmatic reasoning recognizes the constraints faced by the therapist from forces beyond the client-therapist relationship. For example, a hospital that provides inpatient services may not have the resources for a therapist to make a home visit prior to a client's discharge. A therapist working solely through a home health agency will not have full access to clinic equipment when working in the client's home. These challenges to providing intervention would be considered when an intervention plan is developed using pragmatic reasoning.

Experienced master clinicians engage in all forms of reasoning to develop and modify their plans and actions during all phases of the OT process. Some of the questions a therapist might consider with each form of clinical reasoning are listed in Box 3.1.

Box 3.1

Questions to Engage in Clinical Reasoning

Procedural Questions

What is the diagnosis?

What prognosis, complications, and other factors are associated with this diagnosis?

What is the general protocol for assessment and intervention with this diagnosis?

What interventions (adjunctive methods, enabling activities, purposeful activities) might be employed?

What evidence supports the use of specific interventions to foster occupational performance?

Interactive Questions

Who is the client?

What are the client's goals, concerns, interests, and values?

How does the client view his or her occupational performance status?

How does the illness or disability fit into the client's performance patterns?

How might I engage this client?

How can we communicate?

Conditional Questions

What contexts has the client identified as important in his or her life?

What future(s) can be imagined for the client?

What events could or would shape the future?

How can I engage the client to imagine, believe in, and work toward a future?

Narrative Reasoning

What does the change in occupational performance mean to this client?

How is this change positioned within the client's life history?

How does the client experience the disabling condition?

What vision do I, as the client's therapist, hold for him or her in the future?

What “unfolding story” will bring this vision to fruition?

Pragmatic Reasoning

What organizational supports and constraints must be incorporated into the provision of services?

What physical environmental factors must be considered when designing an intervention plan?

What are my knowledge and skill levels as a therapist?

Clinical Reasoning in Context

Pressures for cost containment and reduction of unnecessary services require therapists to balance the needs of the client and the practical realities of healthcare reimbursement and documentation. Thus, on first meeting the client, the therapist will want to know the anticipated or required date of discharge, in addition to the scope of services that will be reimbursed and those that are likely to be denied. Simultaneously, the therapist is formulating an occupational profile with the client, evaluating the client's occupational performance, engaging the client in identifying outcomes and goals, and determining which interventions would best meet the desired outcomes. The OT also considers the contextual factors that will influence occupational performance. Further, the therapist is alert to requirements for documentation and the particular Current Procedural Terminology (CPT) codes that may apply. The OT must document services accurately and effectively so that reimbursement will not be challenged and the client's needs may be adequately addressed. (See Chapter 8 for a more detailed discussion of documentation.)

From the first meeting with the client, the therapist is guided by the client's goals and preferences. Client-centered service delivery requires client (or family) involvement and collaboration at all stages of the intervention process.[6] Effectively engaging the client and family demands cultural sensitivity and an ability to communicate with people of diverse backgrounds.[21,86,90,92] In some cultures the idea of participating equally in decision making with a health professional may be unknown. Being asked by a therapist to make decisions may feel quite unfamiliar and uncomfortable to the client. Thus, the therapist must support the client's ability to collaborate, adjust to the client's point of view, and find other ways to ensure that the intervention plan, including intended outcomes, is acceptable to the client and significant others in the client's life. Understanding the influence of culture on the client's occupational performance and performance patterns is fundamental to the provision of services.[21] The OT should ask himself or herself the following questions to foster cultural competence in the provision of services:

1. *What do I know about the client's culture and beliefs about health?* This represents the basic knowledge of cultural health practices and beliefs. Conclusions or judgments should not be formed about why these practices are present.

2. *Does the client agree with these beliefs?* Although a client may affiliate with a specific cultural group, the OT must investigate to determine whether the cultural beliefs about health and the client's beliefs about health are similar.

3. *How will these beliefs influence the intervention and outcomes of services provided?* The OT must acknowledge and respond to the influences of cultural beliefs and practices within the intervention plan. To design a plan that conflicts with cultural beliefs would not only be counterproductive to client-centered services, but also would be disrespectful of the client's belief system. If a client, in deference to the authority of the OT, follows an intervention that conflicts with cultural practices, the client may risk losing the support of and affiliation with that cultural group.

4. *How can the intervention plan support culturally endorsed occupations, roles, and responsibilities to promote the client's engagement in occupation?* The OT must consider the important occupations from a cultural perspective. Evening meals may include specific behaviors that have strong cultural symbols for one client, but another client may view an evening meal as merely taking in food with no prescribed rituals.

Client-Centered Practice

Involving clients in identifying their own goals and in making decisions about their own care and intervention is highly valued by leaders in the OT profession[37,71,83] and is endorsed by the AOTA in its policy and practice guidelines.[9] Client-centered practice begins when the therapist first meets the client. Therapists using an occupation-based assessment tool, such as the Canadian Occupational Performance Measure (COPM),[53] initiate assessment by asking clients to identify and choose goals early in the evaluation process. This process can be fostered when the therapist is aware of potential biases that could influence the development of goals.[79] Regardless of the individual's disability status or perceived limitations in cognitive functioning, every client should be invited to participate in evaluation and intervention decisions. Client-centered practice is guided by these concepts[11]:

- The language used reflects the client as a person first and the condition second.
- The client is offered choices and is supported in directing the OT process. This requires the occupational therapist to provide information about the client's condition and the evidence available about the various types of intervention.
- Intervention is provided in a flexible and accessible manner to meet the client's needs.
- Intervention is contextually appropriate and relevant.
- There is clear respect for differences and diversity in the OT process.

Although client-centered practice is most often conceptualized as the OT practitioner working with a person and those significant in that person's life, the OTPF-3 describes “clients” as persons, groups, and/or populations.[7] However, even when providing OT services to organizations or populations, the OT practitioner is expected to apply the same values of client-centered practice and enlist the client, whether an organization or population, in identifying goals and selecting outcomes.

Theories, Models of Practice, and Frames of Reference

The profession of occupational therapy acknowledges the need for theories, models of practice, and frames of reference to advance the profession, demonstrate evidence-based intervention, and more clearly view occupation.[49] Theories, models of practice, and frames of reference offer the OT practitioner a means to understand and interpret information so as to develop an effective intervention plan. These terms require definition and understanding prior to application to practice.

Theory

The term *theory* refers to the process of understanding phenomena, including articulating concepts that describe and define phenomena and the relationships between observed events across situations or settings. A theory is tested across settings for confirmation of concepts and relationships. Although a theory may be generated by one profession, it is often applied across professions if it becomes an accepted method of understanding phenomena. According to Reed,[74] theory attempts to:

- define and explain relationships between concepts or ideas related to the phenomenon of interest (eg, occupational performance and occupation).
- explain how these relationships can predict behavior or events.
- suggest ways that the phenomenon can be changed or controlled.

A clear example of a theory that meets these expectations and is well known is germ theory.[19] Widely accepted and tested, germ theory states that microorganisms produce infections. Before the relationship between these microorganisms and infections was understood, physicians would perform an autopsy and then go to an adjacent room to deliver a baby—without washing their hands between the two events. The number and severity of infections after childbirth declined dramatically when germ theory became accepted and then functionally applied to practice (a frame of reference) through the use of proper hand-washing procedures. From an OT perspective, theories provide the profession with a means to examine occupation and occupational performance and to understand the relationship between engagement in occupations and participation in context.[44] The main purpose of a theory is to understand the specific phenomenon. Mary Reilly's theory of occupational behavior was designed to explain the importance of occupation and the relationship between occupation and health.[75,76] Her theory served as a foundation for several models of practice within the profession of occupational therapy.

Model of Practice

Model of practice refers to the application of a theory to OT practice. This process is achieved through several means, such as the development of specific assessments and articulation of principles to guide intervention. Models of practice are not intervention protocols, but instead serve as a means to view occupation through the lens of theory, with the focus on the client's occupational performance. Models of practice often serve as a mechanism to engage in further testing of the theory.[44] Some authors refer to models of practice as conceptual models,[22] whereas other authors include models of practice in the discussion of professional theories.[28] In the profession of occupational therapy, several models of practice exist, but the commonality of all of them is the focus on occupation. The main purpose of a model of practice is to facilitate the analysis of the occupational profile and to consider potential outcomes with selected interventions. Models should be applicable across settings and client groups, rather than designed primarily for a specific diagnostic group. Using a very colloquial expression, a model of practice requires the practitioner to "put on the OT eyeglasses" to bring into focus the client's needs and abilities, various contextual issues, and engagement in occupation. Three of these models of practice are briefly described here. The reader is encouraged to seek additional information from the materials used in this brief description.

Model of Human Occupation

In the model of human occupation (MOHO),[49] the engagement in occupation is understood as the product of three interrelated subsystems: volitional, habituation, and performance capacity. These subsystems cannot be reduced to a linear process; they are linked to produce occupational performance.

- The *volitional subsystem* refers to the client's values, interests, and personal causation. A client may clearly identify values and interests to an OT practitioner, but then express a sense of incompetence to engage in a desired occupation. Volition is the client's thoughts and feelings, including occupational choices.
- The *habituation subsystem* refers to the habits and roles that are often critical to a sense of self. Colloquial phrases expressed by a client, such as, "I don't feel like myself," often speak of a distortion of habit or role experienced in life. A client faced with a disabling condition often experiences a severe disruption in roles and habits. The sense of self can deteriorate when roles such as driving to work, driving to go shopping, or driving friends to enjoy a picnic are eliminated because of a disabling condition.
- The *performance capacity subsystem* reflects the client's lived experience of the body. This does not refer to the muscle strength or range of motion available, but rather to the client's previous experience, changes, and expectations of performance capacity. The colloquial phrase "Once you've ridden a bicycle, you never forget" captures a portion of this concept and requires the therapist to consider the client's experience of successes or failures in using the body to engage in occupations.

Ecology of Human Performance

The ecology of human performance (EHP)[32] was not designed to be used exclusively within the profession of occupational therapy; rather, it was intended to serve as a mechanism for understanding human performance across professions. An important concept expressed in EHP is the interaction of the person, the task (activity demands), and the context. Occupational performance is intertwined with, and the product of, the interaction of these three variables. EHP is a client-centered model in which each person is viewed as unique and complex, having his or her own past experiences, skills, needs, and attributes. The task is understood as the objective and observable behaviors to accomplish a goal. The context includes the person's age, stage of life, and health status from a perspective of the cultural and societal meanings of each. Context also addresses the physical, social, and cultural factors that influence performance. EHP recognizes that these three factors influence each other and that the person and task are inextricably linked with the context. Performance is the product of the person engaged in a task within a context.

A significant contribution of this model is the equal importance placed on each variable in producing occupational performance. Instead of focusing only on improving the client's skills, intervention using this model can assume several forms. Five intervention strategies are described, reflecting a close similarity to the OTPF-3.[33]

1. *Establish/restore.* Although focused on improving the person's abilities and skills, the intervention includes the context for performance.

2. *Alter.* Intervention is designed to alter the contextual factors to foster occupational performance; an example would be home modifications to allow wheelchair access.

3. *Adapt/modify.* The task or context is adapted or modified to support performance, such as using a reacher to obtain objects or elastic shoelaces to eliminate the need to tie shoelaces.

4. *Prevent.* Intervention may address the person, the context, or the task to prevent potential problems. Examples would be teaching the client back safety techniques to prevent back injuries; removing rugs in an environment to reduce the risk of falls as a contextual prevention method; and turning down the water temperature for a client with sensory problems to reduce the risk of burns when bathing.

5. *Create.* Intervention addresses all three variables of the person, task, and context and is designed to develop or create opportunities for occupational performance.

Person-Environment-Occupation Model

The person-environment-occupation (PEO) model[54,55] shares characteristics of the EHP model; occupational performance is seen as the intersection of the person, environment, and occupation. This is a client-centered approach, but equal emphasis is placed on the environment and the occupation when the intervention is designed. PEO defines the person as a dynamic and changing being with skills and abilities to meet roles over the course of time. The environment includes the physical, social, cultural, and institutional factors that influence occupational performance. Occupations include self-care and productive and leisure pursuits. PEO further differentiates the progression from an activity, a small portion of a task, a task that is a clear step toward an occupation, and the occupation itself, which often evolves over time. An example would be the activity of safely handling a knife. This is a small portion of the task of making a peanut butter and jelly sandwich, and the task of making a sandwich is seen as a part of the occupation of meal preparation. Occupational performance is the result of the person, environment, and occupation interacting in a dynamic manner.

Frame of Reference

The purpose of a **frame of reference** (FOR) is to help the OT practitioner link theory to intervention strategies and to apply clinical reasoning to the chosen intervention methods.[51,64] An FOR tends to have a more narrow view of how to approach occupational performance compared to models of practice. The intervention strategies described within various FORs are not meant to be used as a protocol, but rather offer the practitioner a way to structure intervention and think about intervention progressions. The practitioner must always engage in the various forms of clinical reasoning to question the efficacy of the intervention in meeting the client's goals and outcomes.

A frame of reference should be well fitted to meeting the client's goals and hoped-for outcomes. The concept of "one size fits all" definitely does not apply to the use of an FOR to guide intervention; that is why there is a need for multiple FORs to meet varied client goals and outcomes. A practitioner may blend intervention strategies from several FORs to meet the client's needs effectively. As an example, a client may be able to recover precise coordination and control of both arms after a TBI if the OT practitioner combines a biomechanical FOR and a sensorimotor FOR, but the client may have persistent memory deficits, requiring the use of strategies from a rehabilitative FOR. The following brief descriptions are not meant to be an exhaustive review of all possible FORs that can be used in occupational therapy. Examples are provided to illustrate how a FOR can be used to guide the intervention process.

Biomechanical Frame of Reference

The understanding of kinematics and kinesiology serves as the foundation for the biomechanical FOR.[74] The practitioner views the limitations in occupational performance from a biomechanical perspective, analyzing the movement required to engage in the occupation. Based on principles of physics, the force, leverage, and torque required to perform a task or activity are assessed. These also serve as the basis for intervention. A client may be unable to open a jar of peanut butter or jelly because of limitations in grip strength or the range of motion available for the hands to hold the jar. A biomechanical approach would focus intervention on addressing these basic client factors to improve occupational performance. Although intervention may take the form of exercises, splinting, or other orthopedic approaches, the outcome must reflect engagement in occupation.[46]

Rehabilitation Frame of Reference

The rehabilitation FOR focuses on the client's ability to return to the fullest possible physical, mental, social, vocational, and economic functioning. The emphasis is placed on the client's abilities and using the current abilities, coupled with technology or equipment, to accomplish occupational performance. Compensatory intervention strategies are often used. An example would be teaching one-handed dressing techniques to an individual who no longer has functional use of one hand because of a CVA. The focus of intervention is often engagement in occupation through alternative means. (For additional examples of intervention strategies supported by the rehabilitation FOR, see Chapters 10, 11, and 17.) Returning to the example of making a peanut butter and jelly sandwich, instead of having the client work on strengthening the hands to finally open the jar, the OT practitioner would suggest using a device to stabilize the jar and a gripper to help accomplish the task using the client's current abilities. Regardless of the technology or equipment available, the practitioner must always link the intervention to the client's occupational performance.

Sensorimotor Frame of Reference

Several FORs are included in the sensorimotor category, such as proprioceptive neuromuscular facilitation (PNF) and neurodevelopmental treatment (NDT) (see Chapter 31 for additional information). These approaches have a common foundation: they view a client who has sustained a central nervous system (CNS) insult to the upper motor neurons as having poorly regulated control of the lower motor neurons. To recapture control of the lower motor neurons, various techniques are used to promote reorganization of the sensory and motor cortices of the brain. The specific techniques vary, but the basic premise is that when the client receives systematic sensory information, his or her brain will reorganize and motor function will return.

Meeting the Client's Needs

As mentioned previously, the occupational therapist relies on theories, models of practice, and FORs to interpret and integrate evaluation data to meet the client's identified outcomes. These elements are used in conjunction with clinical reasoning to develop an intervention plan and critically review the success of the plan. For example, the therapist would use procedural reasoning to select a theory, model, or FOR that has proven successful with clients who have a similar diagnosis. Interactive reasoning is used to assess whether the chosen model or FOR is meeting the client's needs. As a therapist applies theories, models, or FORs to meet the client's needs, a series of professional questions should be posed:

1. Does the theory, model of practice, or FOR help me understand and interpret the evaluation data as I consider the client's expressed needs?

2. Does the theory, model of practice, or FOR provide a good fit for the type of intervention that will meet the client's needs?

3. What evidence is available that the theory, model of practice, or FOR can efficiently produce the results requested by the client?

These questions should be posed throughout the intervention process as a review of the effectiveness of services provided. Although the OT is responsible for interpreting and integrating evaluation data, collaborating with the client to develop the intervention plan, and engaging in ongoing review of the effectiveness of intervention, the OTA contributes to the evaluation and intervention process.

Teamwork Within the Occupational Therapy Profession

The OT profession recognizes and certifies two levels of practitioners: the **occupational therapist (OT)** and the **occupational therapy assistant (OTA)**.[3,4] The AOTA has provided many documents to guide practice and to clarify the relationship between the two levels of practitioner.[3,9] The OT operates as an autonomous practitioner with the ability to provide OT services independently, whereas the OTA "must receive supervision from an occupational therapist to deliver occupational therapy services."[3] Even though OTs are considered able to independently provide OT services, they should seek supervision and mentoring to foster professional growth. The OT who is managing a case or providing services to clients should use the following points as a guide:

- Services are to be provided by personnel who have demonstrated service competency. Some states require advanced training and proficiency in specified arenas of practice. For example, advanced certification in dysphagia (difficulty swallowing) and physical agent modalities is required in California for an OT to provide those services.
- In the interest of rendering the best care at the least cost, the OT may delegate tasks to OTAs and, in some specific instances, to aides or other personnel, provided these individuals have the competencies to render such services. This requires the OT to establish the level of competence required and assess the ability of the OTA, aides, or other personnel to perform those duties.
- The OT retains final responsibility for all aspects of care, including documentation.

OT-OTA Relationship

To work effectively with OTAs, the OT must understand the role of the practitioner trained at the technical level.[3] It is common for OTs to alternately overestimate and underestimate the capabilities of OTAs. In overestimating the training and abilities of OTAs, OTs might assume that the OTA is trained to provide services identical to those of the OT but perhaps at a lesser pace and level and with a smaller caseload. In underestimating the OTA, the OT might assume that the OTA is capable of performing only concrete and repetitive tasks under the strictest supervision.[3]

The appropriate role of the OTA is complementary to that of the OT. Employed effectively, the OTA can provide occupational therapy services under supervision that ranges from close to general. The AOTA has identified critical factors that must be considered in the delegation of delivery of OT services.[3] These factors include the severity and complexity of the client's condition and needs, the competency of the person to whom the services would be delegated, the type of intervention selected to meet the identified outcomes, and the requirements of the practice setting. Working together with several OTAs, the OT will be able to manage a larger caseload and will have the option of introducing more advanced and specialized services because the role of the OTA is often to provide routine services. Many variations in the use of OTAs exist across settings. Some services the supervising OT may delegate to the service-competent OTA include:

1. Administering selected screening instruments or assessments, such as range-of-motion (ROM) tests, interviews, and questionnaires, ADL evaluations, and other assessments that follow a defined protocol.[9]

2. Collaborating with the OT and client to develop portions of the intervention plan (eg, planning for dressing training or for kitchen safety training).[9]

3. Implementing interventions supervised by the OT in the areas of ADLs, work, leisure, and play. With appropriate training and supervision, the OTA can implement interventions related to other areas of occupational performance.[9] As determined by the OT, an OTA can also implement interventions for which he or she has demonstrated competence. An example would be intervention related to the client factors of strength or ROM.

4. As assigned by the OT, assisting with the transition to the next service setting; for example, by making arrangements with or educating family members or contacting community providers to address the client's needs.

5. Contributing to documentation, record keeping, resource management, quality assurance, selection and procurement of supplies and equipment, and other aspects of service management.

6. Under the supervision of the OT, educating the client, family, or community about OT services.

Occupational Therapy Aides

The OT may also extend the reach of services by employing aides.[8] Under AOTA guidelines, the **occupational therapy aide** may work only under the direction and close supervision of an OT practitioner (OT or OTA) and may provide only supportive services: "Aides do not provide skilled occupational therapy services."[3] Aides may perform only specific, selected, delegated tasks. Although the OTA may direct and supervise the aide, the OT is ultimately responsible for the actions of the aide. Tasks that might be delegated to an aide include transporting clients, setting up equipment, preparing supplies, and performing simple and routine client services for which the aide has been trained. Individual jurisdictions and healthcare regulatory bodies may restrict aides from providing client care services; reimbursement may also be denied for some services provided by aides. Where permitted, the OT may delegate routine tasks to aides to increase productivity.[9]

Teamwork With Other Professionals

Many healthcare workers collaborate in the care of individuals with physical disabilities. Depending on the setting, the OT may work with physical therapists (PTs), speech and language pathologists (SLPs), activity therapists, recreational therapists, nurses, vocational counselors, psychologists, social workers, pastoral care specialists, orthotists, prosthetists, rehabilitation engineers, vendors of durable medical equipment, and physicians from many different specialties.

Relationships among and expectations of various healthcare providers are often determined by the context of care or the setting. For example, in some situations home care services are coordinated by a nurse. In a hospital or rehabilitation setting using a medical model, the physician most often directs the client care program. Some rehabilitation facilities use a team approach to assessment and intervention, which reduces duplication of services and increases communication and collaboration. Several individuals from different professions may together perform a single evaluation. For example, the OT may be the lead member of the team in some settings or may be the director of rehabilitation services. In a team, members adjust scheduling and expectations to collaborate with one another to promote effective client care.

Many factors affect relationships among professionals across disciplines: the intervention setting, reimbursement restrictions, licensure laws and other jurisdictional elements, and the training and experience of the individuals involved. Relationships develop over time, based on experience and interaction and sometimes on personality. Even when formal jurisdictional boundaries may appear to limit roles for OT, informal patterns often develop at variance with the prescribed rules. For example, although in some states a physician's referral may be required to initiate OT service, the physicians may expect the OT to initiate the referral and actually perform a cursory screening before the physician becomes involved. Some physicians rely on OT staff to identify clients who are most likely to benefit from OT service, and they generate referrals upon the recommendation of the OT.

Another example in which interdisciplinary boundaries may be at variance with actual practice is in the relationships among the rehabilitation specialists of OT, PT, and SLP. By formal definition, each discipline has a designated scope of practice, with some areas of overlap and occasional dispute. The scope of OT practice is described in the domain section of the OTPF-3 and in the AOTA document "Scope of Practice."[10] Nonetheless, it is common for practitioners to share skills and caseloads across disciplines and to train each other to provide less complex aspects of each discipline's care. Two terms used to describe this are *cross training* and *multiskilling*.

Cross training is the training of a single rehabilitation worker to provide services that would ordinarily be rendered by several different professions. Multiskilling is sometimes used synonymously with cross training but may also mean the acquisition by a single healthcare worker of many different skills.

Arguments have been made for and against cross training and multiskilling.[27,39,70,93] The consumer may benefit by having fewer healthcare providers and better integration of services, and involving fewer providers may reduce costs. Disadvantages cited include the prospect of erosion of professional identity, possible risk to consumers of harm at the hands of less skilled providers, and ceding the control of individual professions to outside parties, such as insurers and advocates of competing professions.

Ethics

Although the study of **ethics** in an OT curriculum may be addressed as a separate course or topic, practitioners encounter **ethical dilemmas** with surprising frequency. In an ethics survey conducted by Kyler for the AOTA in 1997 and 1998,[51] practitioner respondents ranked the following as the five most frequently occurring ethics issues they confront in practice:

1. Cost-containment policies that jeopardize client care
2. Inaccurate or inappropriate documentation
3. Improper or inadequate supervision
4. Provision of treatment to individuals who do not need it
5. Violation of client confidentiality by colleagues

Additional concerns were related to conflict with colleagues, lack of access to OT for some consumers, and discriminatory practice. In another finding, 21% of practitioners reported that they faced ethical dilemmas daily, 31% weekly, and 32% at least monthly.[51]

The AOTA has provided several documents to assist OT practitioners in analyzing and resolving ethical questions, including the “Occupational Therapy Code of Ethics and Ethics Standards”[4]; the “Core Values and Attitudes of Occupational Therapy Practice”[2]; the “Standards for Continuing Competence”[12]; and the “Scope of Practice.”[10] These documents provide a basis for resolving ethical issues; practitioners may find additional resources and support if they approach institutional ethics committees and review boards for guidance. Kyler[51] also suggests that OT practitioners act to formalize resolutions for recurring questions by engaging with peers and others to analyze and consider courses of action.

Ethical Considerations

One process of ethical decision making in clinical practice follows these steps:

1. Gather sufficient data about the problem.

2. Clearly articulate the problem, including the action and consequences.

3. Analyze the problem using theoretical constructs and principles.

4. Explore practical options.

5. Select and implement an action plan to address the problem.

6. Evaluate the effectiveness of the process and outcome.

Adapted from Doherty RF, Purtilo RB: *Ethical dimensions in the health professions*, ed 6, St Louis, 2016, Elsevier.

Lohman et al.[58] expanded the discussion of ethical practice to include the public policy arena. Instead of OT practitioners considering ethical practice only from the perspective of service delivery to an individual, these researchers recommended that the practitioner consider the need to influence public policy to better serve all clients.

OT practitioners should anticipate that in clinical practice, they will frequently encounter ethical distress (defined as the subjective experience of discomfort originating in a conflict between ethical principles). Many approaches for resolving this may be useful. For example, a plan of action for addressing ethical distress and resolving ethical dilemmas may involve the following:

1. Reviewing AOTA guidelines[2,4]

2. Seeking guidance from institutional ethics and review boards

3. Approaching and engaging colleagues, peers, and the community to identify and debate ethical questions and formalize resolutions

Summary: Section 1

The OT process begins with referral and ends with discontinuation of service. Although discrete stages can be named and described as evaluation, intervention, and outcomes, the process is more spiraling and circular than stepwise. The processes of evaluation, intervention, and outcomes influence and interact with one another. This may look confusing to the novice, but it is actually a hallmark of clinical reasoning.

Different types of clinical reasoning are simultaneously used to make decisions about the form and type of service provided. While logically analyzing how to proceed through the steps of therapy using procedural reasoning, the therapist also considers how best to interact with the client. Further, the therapist creates scenarios of possible future situations. The expert clinician seeks to uncover how the client understands the disability and uses a narrative or story-making approach to capture the client's imagination of how therapy will benefit him or her. This process is also influenced by the pragmatic reasoning that draws attention to the demands of the current healthcare arena.

The OT profession endorses client-centered practice, engaging the client in all stages of decision making, beginning with assessment. To achieve this ideal, clinical reality requires that the OT approach every client as a coparticipant, whom the OT assists in identifying and prioritizing goals and in considering and selecting intervention approaches.

The OT and OTA have specific responsibilities and areas of emphasis within the OT process. The OT is the manager and director of the process, who delegates specific tasks and steps to the qualified OTA. Aides may also be employed to extend the reach of OT services.

Effective practice typically involves interactions with members of other professions. This requires that the OT practitioner consider the intervention setting, the scope of practice of other professions, the applicable jurisdictions and healthcare regulations, and other factors that affect the individual situation (eg, culture, personality, and history).

Ethical questions arise with increasing frequency in modern healthcare. The AOTA provides guidelines and other resources to help resolve these. In addition, practitioners are urged to consider institutional and local resources and to take an active role in identifying and resolving ethical concerns.

Section 2 Practice Settings FOR Physical Disabilities

Winifred Schultz-Krohn

Individuals who have a physical disability receive OT services in a variety of settings. These may include acute care hospitals, acute inpatient rehabilitation, subacute rehabilitation, outpatient clinics, skilled nursing facilities, assisted living units, home health, day treatment, community care programs, and work sites. Regardless of the physical setting in which services are delivered, the OT should always focus on enhancing occupational performance to support participation across contexts. The OT practitioner needs to be mindful of the supports and constraints encountered in the various practice settings.

The term **practice setting** refers to the environment in which OT intervention occurs, an environment that includes the physical facility or structure, along with the social, economic, cultural, and political situations that encompass it. Several factors influence the delivery of OT service within a specific practice setting, including (1) government regulations, (2) the economic realities of reimbursement rules, (3) the workplace pressures of critical pathways and other clinical protocols, (4) the range of services considered customary and reasonable, and (5) the traditions and culture staff members have developed over time.

Physical aspects also play a role, such as the building itself, the temperature and humidity of the air, the colors and materials used, the layout of the space, and the furnishings and lighting. Practitioners must always be aware that context influences client performance in evaluation and intervention. The practice setting also influences the type of intervention available.[68] Limitations on the length of stay (LOS) and the number of visits require the OT practitioner to carefully examine intervention that can produce outcomes within the allotted time. Each practice setting has unique physical, social, and cultural circumstances that influence the individual's ability to engage in occupations or activities. These environmental features are important to consider when projecting how the client will perform in another setting. For example, individuals who are in control in their home environment may abdicate control for even simple decisions in an acute care hospital, giving the erroneous impression of being passive and indecisive.[20]

The following section describes the typical practice settings in which OT services are provided for individuals with physical disabilities. Table 3.2 provides a comparison of the approaches used in the various settings, the length of time services are provided, and the frequency of services. Notice that although the typical client conditions do not substantially change across settings, the approaches change to meet the client's needs. Suggestions are given for modifications of the therapeutic environment and clinical approach.

TABLE 3.2

Comparison of Practice Settings

Practice Setting	Length of Time Services Are Provided	Examples of Client Conditions Needing OT Services	Examples of Typical OT Approaches Used in the Setting	Frequency of Services
Acute care hospitalization	Days to 1 or 2 weeks	Acute injuries and illnesses, exacerbations of chronic conditions	Restore ability or skill, modify the activity or context, prevent further disability with an emphasis on discharge setting	Daily
Acute rehabilitation	Weeks	Neurological, orthopedic, cardiac, and general medical conditions	Restore ability or skill, modify the activity or context, prevent further disability with emphasis on occupational performance	Daily, 3 hours a day
Subacute rehabilitation	Weeks to months	Neurological, orthopedic, cardiac, and general medical conditions	Restore ability or skill, modify the activity or context, prevent further disability with emphasis on occupational performance	Daily to weekly
Skilled nursing facilities	Months to years	Neurological, orthopedic, cardiac, and general medical conditions	Restore ability or skill, modify the activity or context, prevent further disability, preserve current skills	Daily, weekly, monthly consultation
Home- and community-based settings	Weeks to months	Neurological, orthopedic, cardiac, and general medical conditions	Restore ability or skill, modify the activity or context, prevent further disability with emphasis on occupational performance	Daily to weekly
Residential care and assisted living units	Months to years	Neurological, orthopedic, cardiac, and general medical conditions	Restore ability or skill, modify the activity or context, prevent further disability, preserve current skills, promote health	Weekly, monthly consultation
Home healthcare	Weeks to months	Neurological, orthopedic, cardiac, and general medical conditions	Restore ability or skill, modify the activity or context, prevent further disability	Weekly
Outpatient	Weeks to months	Neurological, orthopedic, cardiac, and general medical conditions	Restore ability or skill, modify the activity or context, prevent further disability with emphasis on occupational performance	Weekly
Day treatment	Months to years	Neurological, orthopedic, cardiac, and general medical conditions	Restore ability or skill, modify the activity or context, prevent further disability, preserve current skills, promote health	Daily, weekly
Work site	Weeks to months	Neurological, orthopedic, cardiac, and general medical conditions	Restore ability or skill, modify the activity or context, prevent further disability with emphasis on occupational performance	Weekly, monthly consultation

Continuum of Healthcare

The variety of settings forms a continuum of care, albeit not always in a sequential fashion, for the client who has a physical disability. People with physical disabilities who are referred to OT services may enter the healthcare system at any point on the continuum and do not necessarily follow a direct progression through the various settings described here. A client in an acute care hospital might be referred for bed mobility, transfers, and self-care retraining. Depending on the severity of the condition and the potential to improve, the client may be seen in a rehabilitation or day treatment program. A home health or outpatient therapist may see the same individual to address unresolved problems and modify the home environment to maximize occupational performance.

Should the client return to the workforce, he or she may benefit from such OT services as an assessment and recommendations about modifications to the work environment or job tasks (see Chapter 14). Evidence has demonstrated the effectiveness of OT services in helping individuals return to work after they have experienced a disabling condition.[60] Some hospitals offer a range of healthcare services, from an emergency department and acute care or an intensive care unit (ICU) to inpatient and outpatient rehabilitation services. Other settings may offer only outpatient rehabilitation services.

Inpatient Settings

Settings in which the client receives nursing and other healthcare services while staying overnight are classified as **inpatient settings**.

Acute Care Inpatient Setting

Clients in an **acute care** inpatient setting typically have either a new medical condition (eg, heart attack, burn, cerebrovascular accident, or traumatic brain injury) that led to hospitalization or an exacerbation of a chronic condition (eg, multiple sclerosis). An acute decline in a chronically progressive condition abruptly confronts the client with a long-term prognosis of increasing disability. The client may require life support because of the severity of the condition. Terminally ill clients who have managed in their own home with support from a hospice program may require acute hospitalization for pain management, placement, or imminent death; in such cases, a client's hospice goals should be clearly stated and respected by the hospital staff. (For additional information on hospice care, see the section Skilled Nursing Facilities later in this chapter.)

Acute hospitalization, especially when unplanned, results in a sudden change in the client's environmental supports and context or contexts. Previous social roles may be abandoned when the person is hospitalized. External stressors (eg, financial issues or disruption of career and educational pursuits) must be considered when services are provided in an acute care setting. An individual who felt in control of his or her life becomes controlled by the circumstances requiring the hospitalization.

Threaded Case Study

Serena, Part 3

Nora, Serena's client in the case study, experienced a sudden change in her ability to control her environment and exercise her roles as wife and mother. When the TBI occurred, she was admitted through the emergency department and hospitalized in an ICU to stabilize her condition. Both a nasogastric (NG) tube and a catheter were inserted. On Nora's second day in the ICU, the OT evaluated her ability to manage oral secretions and swallow her own saliva. She would continue to receive most of her nutrition through the NG tube but was cleared to begin to eat thick liquids, such as nectar. When her vital signs stabilized on day 3, she was transferred to an acute rehabilitation setting for continued therapy services.

Three general roles have been identified for the occupational therapist working in the acute care setting: education, initiation of the rehabilitation process, and consultation.[18] Education may address safety precautions and activity analysis. Rehabilitation services may be initiated for clients who will be transferred to a rehabilitation facility. Consultation focuses on the discharge environment and the client's needs after leaving the acute care hospital. An experienced occupational therapist, equipped with a knowledge of available resources in the hospital and community, can offer a better coordinated and more efficient intervention plan to promote the client's progress toward anticipate outcomes. For example, a therapist who determines that a client living alone at discharge would be unable to prepare meals should contact the social worker, who would help arrange for the delivery of meals to the home. Another example is a therapist who evaluates a client scheduled for imminent discharge and finds that the client is impulsive, lacks insight into the consequences of his or her actions, and is confused when performing self-care tasks. In this instance, the therapist expresses these concerns to the discharge coordinator or the physician. The social worker might be consulted about available family support, or discharge may be delayed until it can be determined whether appropriate environmental supports are available for the client.

Acute hospitalization is frequently stressful and frustrating for clients. Away from home while ill and subjected to multiple tests and examinations, in addition to interrupted sleep, clients are in a socially compromised environment. They may experience sleep deprivation and overstimulation because of the frequency of procedures or interventions. Some clients, after 2 or 3 days in the ICU, may display marked difficulties with orientation, appearing confused, agitated, and disorganized.[70] This has been referred to as “ICU psychosis,” and clients may experience hallucinations in addition to anxiety and confusion. The client's history should be reviewed to determine whether he or she had had previous episodes of disorientation and confusion, or whether these conditions have been produced by the disorienting effects of hospitalization in an ICU. Concerns about whether the client will be able to return home after hospitalization, who will help with care, or who is helping care for dependent loved ones may add to a client's feelings of stress.

Acute hospitalization involves many physical environmental factors that present a challenge to clients. Often clients have several monitors in place or tubes inserted (eg, oxygen saturation monitors, cardiac monitors, arterial lines, and catheters) that may compromise engagement in occupations.[45] The arrangement of hospital room and extra equipment can further affect the client's occupational performance. The absence of carpeting and the presence of a slippery floor surface may prove challenging for clients during a transfer and when walking. The incidence of falls in the geriatric population is higher in acute care hospitals than in either the community or skilled nursing facilities.[25]

Providing OT intervention services in an acute care setting may be challenging for therapists because it is often necessary to perform assessments in a client's room rather than in more natural environments designed for ADLs. As mentioned, performance of various activities may be affected by catheters, feeding tubes, or monitors. Likewise, client performance in some self-care activities may be artificially enhanced by a lack of the extraneous stimuli found in the home and by the physical attributes of hospital equipment. For example, a client whose home includes three very active cats, several throw rugs on a slippery floor, a very soft bed several feet from the bathroom, and a tiny bathroom faces far more challenges in getting up in the middle of the night to use the toilet compared to the same activity performed in the hospital. The hospital has no throw rugs or active cats as obstacles, and often the bathroom is adapted to support safety and performance in toileting.

To partially replicate the home environment during the intervention session, the therapist might position the client's bed flat, eliminate the bed rails, and lower the bed. Most hospitals would not allow further challenges, such as bringing a cat into the room or scattering throw rugs on the floor as an obstacle for the client. Using clinical experience and judgment, along with information provided by the client about the home environment, the therapist must be able to anticipate the client's performance at home. However, referral to a home health therapist is also advisable to assess occupational performance and accessibility in the client's home.

The acute care hospital also presents the occupational therapist with unique economic, social, and physical challenges. Medical intervention is directed toward promoting medical stability and providing for safe, expedient discharge. It is not unusual for the individual in acute care to receive OT services for the first time on the day of discharge. During this single visit, the therapist must communicate the role of occupational therapy, establish an occupational profile, and assist the client in identifying problems and assets in the discharge environment. The client and the family frequently look to the therapist to identify what the client will need at home. The therapist, in collaboration with the client and family, must develop intervention priorities by identifying issues and concerns after discharge from the acute care setting. The intervention plan may include purchase of durable medical equipment and referral for further intervention to inpatient rehabilitation, a skilled nursing facility, an outpatient clinic, or home health therapy providers. By contacting other members of the healthcare team and communicating concerns, the therapist can facilitate implementation of the recommendations.

Inpatient Rehabilitation Setting

Clients may be admitted to an inpatient rehabilitation unit when they are able to tolerate several hours (usually 3) of therapy per day and are deemed capable of benefiting from rehabilitation. Rehabilitation settings may be classified as acute or subacute (discussed later). Clients are generally medically stable in this setting and require less acute medical care compared to services provided in an acute care hospital. Pain, which may be present and can affect the client's performance, should be addressed in this setting. The client's performance of ADLs will reflect his or her adaptation to pain, and the energy expended to perform self-care tasks should be considered. (See Chapter 28 for a further discussion of pain.)

During Nora's acute rehabilitation hospitalization, she received OT services twice a day, along with daily services from a speech and language pathologist and a physical therapist. These services were coordinated to support the outcomes she and her OT had selected. As is common during acute rehabilitation hospitalization, Nora was expected to dress in her typical street clothing and eat meals at a table in a dining area. This environmental feature of the acute rehabilitation setting provides a social element that is not present in the acute care hospital.

Acute Rehabilitation

When clients are medically stable and able to tolerate 3 hours of combined therapy services for 5 to 6 days a week, they may be transferred to an acute inpatient rehabilitation setting. Clients may still require some level of acute medical care in this setting. The LOS in **acute rehabilitation** settings generally ranges from 2 to 3 weeks, but it varies according to the client's needs. The usual discharge plan from acute rehabilitation is to a lesser level of care (eg, residential care or the client's home with assistance, such as a home health aide or personal care attendant).

The process of adjusting to disability has begun by the time the client enters acute rehabilitation. As the client begins to participate in areas of occupation, deficits and strengths become more defined. An improvement in the client's function from the onset of the disabling condition may have occurred. Within a rehabilitation center, many clients form new social relationships with individuals who have similar disabilities. The advantages of these relationships are emotional support and encouragement from the progress of others. In rehabilitation, interventions focus on resuming the roles and occupations deemed important to the client's life. For example, an adolescent will reestablish social roles with peers; a parent will resume childcare responsibilities.

Although bedrooms in acute inpatient rehabilitation settings are similar to those found in acute care hospitals, clients are often encouraged to personalize their room by having family and friends bring in pictures, comforters, and other items from home. In this setting, clients are expected to wear street clothes rather than pajamas. The clothing that clients most often select is easy-to-don leisure wear. However, the OT practitioner must consider the range of clothing the client will be expected to wear to resume his or her occupational roles upon discharge, and the practitioner must include training with appropriate clothing (eg, neckties, button-front shirts, and pantyhose).

Simulated living environments, family rooms, kitchens, bathrooms, and laundry facilities can be found at most rehabilitation centers. These environments may be inaccurate replicas of the client's home. For example, at home, laundry machines may be side-by-side and top-loading versions rather than coin-operated and front-loading machines. Kitchens may be wheelchair accessible in the facility but inaccessible in the home. Clutter, noise, and types of appliances encountered in the rehabilitation setting often vary from the client's natural environment.

Access to the community is not generally evaluated during the acute rehabilitation hospitalization. Some urban facilities are able to integrate community training more smoothly because stores, restaurants, and theaters are located near the hospital. Although the community surrounding the hospital may differ from the client's neighborhood, this offers an opportunity to experience a more natural environment.

The culture of rehabilitation facilities focuses on the client's performance and goal attainment. The client's own culture may be compromised in the process of rehabilitation unless the team is sensitive to and incorporates the client's perspective into the intervention plan.[21] For example, some cultures view hospital settings as a place for respite and passive client involvement. Engaging clients in ADLs can be in direct conflict with the client's and family's expectations. When cultural perspectives clash, unrealistic goals may result. As in any setting, achieving planned outcomes depends on clear communication and the identification of goals that are relevant and meaningful to the client.[79]

Upon completion of the acute inpatient rehabilitation program, some clients return home and receive home health services. Unfortunately, not all clients eligible to receive home health services are referred for these services.[66] The occupational therapist should actively participate in discharge planning for clients to ensure that they receive the necessary services when discharged from the acute rehabilitation setting. Upon discharge from the acute rehabilitation facility, some clients are referred to a subacute rehabilitation setting for continued services. There are several similarities between the acute and subacute rehabilitation settings. The primary differences found in subacute settings are discussed in the next section.

Subacute Rehabilitation

Subacute rehabilitation facilities are found in skilled nursing facilities and other facilities that do not provide acute medical care. This setting is also known as a short-term skilled nursing facility. The equipment available to the occupational therapist for intervention and evaluation in the subacute setting may be comparable to that found in the acute rehabilitation facility. The focus of intervention continues to be restoring functional abilities; however, because of the slower rate of change, the occupational therapist must also consider the need to adapt or modify the environment to promote occupational performance. LOS in the subacute setting varies; stays may last a week to several months. Clients are usually discharged to a lesser level of care when they leave a subacute rehabilitation setting.

The pace of intervention services varies, and engaging in 3 hours of therapy per day is not mandatory. The client's endurance influences the frequency and duration of therapy. A client may continue to make steady gains, but at a slower pace than was seen during the acute inpatient rehabilitation stay.

Because many subacute rehabilitation programs are located in skilled nursing facilities, the client may have roommates who are convalescing rather than actively participating in rehabilitation services. This presents as an additional variable to be considered in the intervention plan because the social context does not always support participation in the rehabilitation services provided at the setting. Staff members may be more oriented to the skilled nursing care services and may not allocate comparable effort to the rehabilitation goals of independence.

Skilled Nursing Facilities

A **skilled nursing facility (SNF)** is an institution that meets Medicare or Medicaid criteria for skilled nursing care, including rehabilitation services. Although subacute and short-term rehabilitation programs may be housed in SNFs, OT services are also provided to individuals who are not in a subacute rehabilitation program; these services are known as long-term skilled programs. Many residents (the preferred consumer label for people who live in long-term care settings) will stay in an SNF for the remainder of their lives; others will be discharged home.[17] Goals should be directed toward independence and meaningful occupational pursuits, and they may include fostering engagement in occupations through environmental modifications and adaptations. An example would be reading materials and playing cards with enlarged print to foster leisure pursuits for clients with macular degeneration.

Hospice services may be included in the SNF setting if appropriate.[90] Hospice care requires the physician to document that the client "probably has 6 months or fewer to live."[89] The services provided do not focus on rehabilitation, but instead address palliative care and environmental modifications. OT services for hospice clients should address access to the environment and participation in occupation through support and modifications. For example, OT services could address participation in leisure pursuits as a hospice client creates a memory book for significant others.

The physical and social environments in skilled nursing facilities may impede the natural performance of ADLs. Clients often receive assistance with self-care tasks to expedite task completion, but this assistance is not focused on fostering engagement in occupational performance.[78] An investigation in SNFs demonstrated that even clients who were severely cognitively impaired benefited from intervention that was focused on fostering the client's participation in ADLs. The study found that not only did clients increase participation in self-care tasks, but also that disruptive behavior declined.

Extreme variations in disability status are present in SNFs. Observing residents who are severely and permanently disabled may lead newly disabled individuals to form negative expectations of their own prognosis and performance. Younger adults placed in SNFs (where most residents are older adults) may feel isolated and abandoned, which can adversely affect performance. Friends are less likely to visit in this environment. Family and friends may expect less of the individual than they would in other settings. Maintaining connections with friends from the community may require the client to actively pursue these relationships. A therapist who facilitates identification of realistic and meaningful expectations and goals with the resident can promote a more positive outlook and outcome. A strong family commitment can support outside relationships by providing transportation to various community gatherings.

Community-Based Settings

Community-based settings often afford the therapist access to the client's natural physical, social, and cultural environments. Services provided in community settings can foster not only skill acquisition and habit formation, but also engagement in occupations in natural environments. Community-based settings may include a residential aspect, but the client is not hospitalized. Clients also reside in their homes when receiving community-based services.

Home- and Community-Based Settings

An alternative to an acute inpatient rehabilitation program for clients with traumatic injuries (eg, head or spinal cord injuries) is a home- and community-based therapy program. This type of program provides intensive rehabilitation in the client's own home and community. The client receives comprehensive rehabilitation services and acquires functional skills in daily activities in the normal environments of home, school, work site, and community. This enhances the likelihood of a successful and functional outcome. Nora, for example, may benefit more from working on tasks in her home and community than in a clinic or an acute rehabilitation setting.

In home- and community-based settings, the client is performing in her natural physical, social, and cultural environment. Scheduling is within the client's control, and intervention sessions vary in length and frequency, depending on the goals. An all-morning session to work with the client as she moves through her daily routine (eg, bathing and dressing her child, going grocery shopping, and performing various household chores) would be possible.

OT Practice Notes

The occupational therapist must be able to adapt the intervention to the natural social and cultural aspects present in the home. Attempts to alter the natural social and cultural order are ill advised because things are likely to return to their natural state after the session ends and the therapist has left.

When practice is necessary for goal attainment, a rehabilitation technician or therapy aide may be charged with carrying out specific and limited programs established by the therapist. The technician who spends many hours with the client can provide insight when the program is not succeeding because it interferes with the natural context of the client's lifestyle. Adjusting intervention strategies to adapt to these lifestyle differences will ensure better clinical outcomes.

Intermediate Care Facilities (Residential Care)

Generally, residential facilities more closely resemble home situations; clients may reside there on a permanent or transitional basis, depending on their prognosis.[63] Similarities in the age of residents, their disability status, and even diagnoses are common. Although clients do not require ongoing intensive medical care, the facilities are staffed with care providers 24 hours a day because of the clients' need for safety and supervision. OT services may not be available on a daily basis, and rehabilitation technicians may implement the unskilled portions of the intervention plans addressing ADLs, select IADLs, and leisure. Often clients require ongoing assistance for portions of these tasks, and personal care attendants or technicians complete portions of the activity or task. The therapist can identify key performance issues in this context. Difficulties with evening self-care, follow-through with safety guidelines, problem solving, schedules, and client performance are reviewed and discussed with the OT. Modifications in the intervention plan can be more easily tailored to promote independence under such close supervision.

Assisted Living Unit or Residence

An assisted living unit (ALU) provides health services in a cooperative living setting. A client may live in an apartment or a cottage where one or more meals are provided on a daily basis; medication management is provided as needed; and 24-hour support is available. These settings usually have age restrictions: commonly, residents must be over 55 years of age or, if a couple is involved, one person must be over age 55. The client generally does not plan or anticipate a move to another type of setting and is often expected to own or rent the living space in the ALU. Because of the age restriction in most ALUs, social and environmental support is present to enable a person to live in one's own space. For example, apartments or cottages may be equipped with safety railings in the bathroom and walk-in closets for ease of accessibility.

In this setting, OT services are provided to foster and enhance the habits and routines necessary to remain housed in this environment, which often includes personal care skills such as dressing, grooming, hygiene, and simple home care tasks. Some household tasks may be partially assumed by the services provided in the assisted living setting. For example, an ALU may provide a service of laundering towels and bed linen, but the individual is responsible for the care of his or her own clothing. Some ALU settings provide all meals, whereas others provide only one meal, and the individual will need simple meal preparation skills to live in that setting. It is important for the OT to determine what services are available at the ALU prior to designing an intervention plan with the client. An important occupational pursuit for those in this setting would be leisure activities. Environmental supports such as magnifiers for reading, enlarged print playing cards, and a universal remote to access the television may provide opportunities for leisure activities in this setting.

Home Health

Home healthcare provides services within the client's home and affords the most natural context for intervention.[87] The desired outcome for services provided within the home could include supported completion of ADLs or IADLs such as bathing, dressing, and meal preparation. The client, returning home from the hospital, begins to resume life roles at home. Stark et al.[87] provided guidelines to foster the decision-making process for providing home modifications; these guidelines cover both intrinsic and extrinsic factors. The intrinsic factors included the client's willingness to accept changes to the home and his or her ability to maintain any home modification, in addition to the esthetics of the proposed modifications. Extrinsic factors included financial resources, the type of home structure, and the typical weather conditions encountered. This approach allows the OT to focus intervention on supporting occupational participation in the home environment.[88]

A visiting therapist is a guest in the client's home and is subject to certain social rules associated with guests. For example, the family may practice the custom of removing street shoes within the home, and the therapist should respect and comply with this practice. The client and family establish daily schedules for meals, waking, and sleeping. Appointments should support the family's routines and not interfere with daily schedules. For example, if the client is accustomed to eating a larger meal during the middle of the day and a very small evening meal, an intervention to address meal preparation skills should be scheduled to support this routine.

Self-care, homemaking, and cooking tasks evaluated in the context of the home clearly identify the challenges that the client meets daily. The familiar clothing, furniture, appliances, and utensils used in everyday life are present and promote orientation and task performance. However, moving furniture to make things more accessible and safe for the client or modifying equipment to be used within the home may challenge the client's orientation skills and increase confusion. Caring for and feeding pets, answering the door safely, and determining a grocery list for the week are potential issues to be addressed within the home setting. Self-care tasks such as bathing can be addressed within the natural environment, and when appropriate modifications to the home are made, the client's dependence on others may decrease.[35]

Social and family support, or lack thereof, is readily evident to the home health therapist. Individuals who appeared alone and unsupported while hospitalized may have a network of friends and family members who lend support at home. Conversely, individuals who had frequent visitors in the hospital may be abandoned when the realities of disability reach the home setting.

The client who receives home health services typically requires assistance for some aspects of his or her ADLs. Nearly 20% of all family caregivers are employed full time outside the home.[15] These caregivers are available for only part of the client's day and will be concerned primarily with the safety of the client during their absence.

Stress is common among caregivers. Respite care, which temporarily places the client under the care and supervision of an alternative caregiver for a few hours and up to several days, can provide necessary relief for a caregiver.[15] Caring for a person with a disability in one's home is not an easy task. Box 3.2 identifies practical concerns that arise when a client is cared for in the home. A study by Dooley and Hinojosa[30] found that when individualized OT recommendations were provided for home modifications, caregiver approaches, and community-based resources for clients who had Alzheimer's disease, caregivers reported a decrease in a sense of burden and an improved quality of life.[30]

Box 3.2

Concerns in Caring for a Person With Disability in One's Home

Amount and Type of Care Needed

Long-term versus temporary care; intensive supervision or assistance versus minimal needs; help available to the caregiver; alternative solutions; and personal feelings about the client and the type of care required (intimate assistance versus household tasks).

Impact on the Household

Effect on spouses, children, and others living in the home; possible involvement of family in making decisions.

Environmental Concerns

Need for and possibility of adapting the home, expenses of adaptations.

Work and Finance

Options for family medical leave; ability and need to quit work; and benefits available.

Adapted from Visiting Nurses Association of America: *Caregiver's handbook: a complete guide to home medical care*, New York, 1997, DK Publishing.

When viewing the client's home environment, the therapist can make recommendations for environmental adaptations, see them implemented, and modify those changes as needed to best meet the client's needs.[44] Physical changes to the home, including moving furniture, dishes, or bathing supplies, should not be undertaken without the permission of the client and are best considered through a team approach to support the collaboration between professionals and client.[73] If the client is in the home of a family member or friend, the permission of the homeowner must also be sought.

The client and family are in control of the home environment. Clinicians who fail to ask permission before adapting the environment will rapidly alienate their clients. A throw rug, viewed by the therapist as a tripping hazard, may be a precious memoir from the client's childhood home. In seeking the permission of the client and family and providing options, the therapist opens communication. An adhesive mat placed beneath the throw rug will provide a safer surface on which to walk. Another possible solution is to hang the rug as a wall tapestry, where it will be more visually prominent and less prone to damage.

Healthcare workers in the home occasionally encounter ethical dilemmas, typically involving safety.[67] The therapist must determine the best method for resolving issues of safety hazards. Fire and health hazards must be discussed and corrected when the safety of the client or adjacent households is in jeopardy. By broaching the subject diplomatically and directly, the therapist can address most hazards and provide acceptable solutions. Inclusion of the client, family, and other team members in the process of problem identification and solution generation is strongly recommended.

When Nora returned home after her acute rehabilitation hospitalization, Serena arranged for her to receive OT services through a home health agency. Nora, Serena, and the home health OT identified concerns with meal preparation, laundry, and playing with the children as important occupations to be addressed. Serena was not able to make a home visit prior to Nora's discharge from the acute rehabilitation program, but she was able to coordinate continued services through the home health agency. The home health OT worked with Nora on strategies to improve her safety in meal preparation, helped her to simplify her laundry and cleaning routines, and provided suggestions for leisure activities in which Nora could engage with her children in the home.

Outpatient Settings

Outpatient OT service is provided in hospitals and freestanding clinics to clients who reside elsewhere. Clients receiving services in this setting are medically stable and able to tolerate a few hours of therapy and travel to an outpatient clinic. Although many clients are adjusting to a new disability, some individuals with long-standing disability may be referred for re-evaluations of functional status and equipment-related issues. The frequency of services provided in this setting varies substantially; some clients receive services several times a week, and other clients are seen once every few months. The frequency of service is determined by the client's needs and the services offered at the outpatient clinic.

Clients exert more control over outpatient therapy schedules compared to inpatient therapy schedules. Transportation issues and pressing family matters necessitate that clinics offer a variety of times from which a client may choose. Otherwise, the client may select a different clinic or choose to forgo therapy.

To evaluate a client's performance of ADLs or IADLs in an outpatient setting, the therapist must extrapolate how task performance would occur at home.[78] Engaging in self-care tasks in an outpatient clinic may be awkward for the client. Individuals who have been assisted with bathing and dressing before coming to the clinic may resist working on these same tasks during therapy. The more contrived and inappropriate a task and context seem to a client, the less likely he or she is to perform well and benefit from services addressing those needs.

The physical design and equipment in outpatient clinics vary to meet the intervention needs of specific disabilities. Clinics with hand therapy programs, for example, will have treatment tables for exercise and activities and areas for splint fabrication. A clinic designed to address industrial work is often equipped with special exercise equipment, such as Baltimore Therapeutic Equipment (BTE), which mimics work tasks. Less commonly found in the outpatient setting are complete kitchens with cooking equipment and therapeutic apartments with bathing facilities, living rooms, and bedrooms.

The social context found in outpatient programs is quite distinctive. The client has begun to resume life in the home and community and may be newly aware of problems not previously foreseen or acknowledged. If the therapist is viewed as an ally in resolving problems and promoting a smooth transition to the home, the client or family members may easily disclose concerns. However, if the client and family fear that the client will be removed from the home because of an inability to manage there, they may actively hide concerns from the therapist. In the former case, the client and family view themselves as being in control of the situation. In the latter, control and power are assumed to belong to the healthcare professional. An outpatient therapist must be skilled in empowering the client. Soliciting the client's opinion and listening for unspoken needs are two methods of increasing the client's sense of control.[44] Providing choices for intervention does much to motivate clients and improve performance in desired tasks.

Day Treatment

Day treatment programs are becoming more popular as a community-based intervention setting. Programs vary, but the underlying philosophy is to provide an intensive interdisciplinary intervention for clients who do not need to be hospitalized.[41] Clients receiving day treatment typically live at home but frequently require support and assistance for ADLs or IADLs. Most programs offer a team approach. Professionals from all disciplines are engaged cooperatively, sharing their expertise to meet the client's individual goals. Clients may seek services from a day treatment program to further recover functional skills after an acute injury or illness such as a TBI or CVA, or clients with a progressively deteriorating disorder, such as Parkinson's disease or Alzheimer's disease, may benefit from a day treatment program to foster continued participation in occupations through environmental modifications and adaptations.

Many day treatment programs are designed without the time constraints often seen in outpatient programs. Lengthy community outings and home and work site intervention sessions may be used as methods of attaining goals. In a day treatment setting, the occupational therapist may have the best opportunity to evaluate and provide intervention for clients in all their natural environments.

Work Site Therapy Settings

Industrial rehabilitation can be conducted in the context of the employee's place of work. Work site therapy programs are designed to address an employee's therapy needs related to a work injury. The injured worker receives intervention to foster the occupational performance necessary in the workplace, which may include work hardening, back safety, energy conservation, and work simplification techniques. This approach places the client back into the work role. Prevention of further injury occurs in a more natural context when employees are treated at the work site.

Providing OT services to individuals at their place of work helps them make the transition from the patient role to the role of worker. The therapist providing service at the work site must avoid compromising the worker's status.[43] The employer and peers view the employee as a worker rather than as a client. Maintaining confidentiality can be challenging because co-workers' curiosity is often aroused by the unfamiliar face of the therapist in the workplace. The therapist should remember never to answer queries that would compromise client-therapist confidentiality. Unsolicited requests from co-workers for medical advice and work site modifications are best referred to that employee's healthcare provider or manager.

In the work setting, the therapist interacts not only with the client, but also with the employer and often the insurance company. By encouraging the injured employee to communicate his or her needs for work modification and how productivity might be maintained, the therapist paves the way for a successful transition to work. The therapist strives to balance the needs of both the employee and employer while promoting resolution of work-related issues that would interfere with a smooth transition to productive work. Scheduling of therapy visits to the workplace should meet the needs of both the employee and employer. Work site visits should be scheduled in a manner that minimizes interference with the natural flow of work.

The financial impact of work modifications will concern the employer. Employers do not have unlimited resources for modifying work environments. Only reasonable and necessary work modifications should be considered. Suggestions for work modifications that have an associated cost should be discussed with the employer. The therapist can suggest work modifications but must also consider the impact of these modifications on co-workers using the same equipment. As a general rule, modifications that affect workers other than the employee must be discussed with management before they are presented to the employee as possible options.

In a traditional clinic setting, a secretary with a repetitive motion injury of her wrist may receive various modalities to control her symptoms of pain and edema and may be educated about techniques for protecting joints and tendons while performing various movements. When the secretary receives OT services in her work environment, additional benefits often occur. Joint and tendon protection techniques are applied at work while the client performs day-to-day work tasks. Because the client's injury occurred at work, this type of injury could be exacerbated or prevented at work. (See Chapters 14 and 15 for more information on the role of the OT in providing services to workers and in work settings.)

Emerging Practice: Telemedicine

Telemedicine is the use of "electronic information and communications technologies to provide and support healthcare when distance separates the participants."[42] This approach can be effectively used to meet the needs of clients who live in rural settings, where it can be difficult to receive the needed OT services.[31] The AOTA has published a document discussing the use of telemedicine for both evaluation and intervention. along with ethical considerations.[11]

Telemedicine has also been used as a method to monitor and modify a client's home exercise program.[52,57] Cason[23] clearly discussed the important role of occupational therapy in telehealth to promote access for populations. This focus allows far more individuals to receive OT services. Linder et al.[57] investigated the use of telemedicine to improve motor outcomes after a stroke, in addition to improving the quality of life and reducing depression for individuals who had had a stroke. They used a randomized controlled trial with 99 participants to compare two intervention approaches. One group received telemedicine focused on monitoring and modifying the home exercise program, and the other group received similar telemedicine coupled with robot-assisted rehabilitation to foster hand use. All participants significantly improved in motor skills, quality of life measures, and reduced depressive symptoms. This investigation demonstrated that significant improvements were made using telemedicine to modify and monitor home exercise, but it did not demonstrate any superiority of coupling robotics with telemedicine to produce better outcomes than telemedicine alone.

Asano et al.[14] investigated the use of teleconferencing to help individuals diagnosed with multiple sclerosis manage symptoms of fatigue. The occupational therapist used weekly conference calls with small groups of four to seven participants to address a variety of topics, including self-management strategies related to fatigue and energy conservation techniques. Of the 81 participants in the investigation, more than 75% indicated that they had made gains in their goals, and approximately 50% said they had achieved their goal of managing fatigue.

Summary: Section 2

Practice settings, the environment in which intervention occurs, have temporal, social, cultural, and physical contextual dimensions that affect both the therapist and the person receiving therapy services. Knowing the features of each practice setting and anticipating how the context will affect occupational performance prepares the therapist to best meet the client's needs. The continuum of care must be considered as the OT develops the intervention plan with the client in a specific intervention setting. A skilled therapist collaborates with the client to develop meaningful and attainable goals and then clearly communicates those goals from one setting to the next to foster meaningful outcomes. Evidence-based interventions and quality outcome measures should be used throughout the provision of OT services.[56] Sensitivity to the unique needs of each individual in each practice setting is critical.

Review Questions

1. What are the major functions of the OT process?
2. How are the various forms of clinical reasoning used to guide the OT process?
3. How do theories, models of practice, and frames of reference inform and support OT intervention?
4. What is the appropriate delegation of responsibility among the various levels of OT practitioners (OT and OTA)?
5. What services may be assigned to the OT aide? What are the limits, and why?
6. How should OT practitioners effectively collaborate with members of other professions involved in client care?
7. What are some of the ethical dilemmas that occur frequently in OT practice, and how can these be addressed and managed?
8. What are the various practice settings for OT services in the arena of physical disabilities?
9. What types of services are typically provided in the various practice settings?

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Suggested Readings

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Evidence-Based Practice for Occupational Therapy

Lynn Gitlow, Elizabeth DePoy

CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:
1. Distinguish among diverse models of evidence-based practice.
2. Define systematic occupational therapy practice (SOTP).
3. List, in sequence, the five steps of SOTP and detail the content and processes of each step.
4. Compare SOTP with the OT process as articulated in the Occupational Therapy Practice Framework.

KEY TERMS

Abductive reasoning
Action processes
Deductive reasoning
Evidence
Evidence-based practice (EBP)
Goals
Inductive reasoning
Need statement
Objectives
Outcome objectives
Problem mapping
Problem statement

Process objectives

Specificity

Systematic OT practice (SOTP)

Thinking processes

In this chapter we present, discuss, and apply **systematic occupational therapy practice (SOTP)**, a model that synthesizes and builds on evidence-based approaches to professional practice. The importance of systematically grounded practice has become established within occupational therapy (OT) and the broader healthcare arena. The need for empirical analysis of the problems and needs that OT practitioners address continues to be emphasized at local, national, and international levels, as reflected by numerous initiatives from the American Occupational Therapy Association (AOTA) and the American Occupational Therapy Foundation (AOTF). Box 4.1 lists some of the current initiatives.

Box 4.1

Examples of Empirically Focused Initiatives

- American Occupational Therapy Foundation (AOTF) Intervention Grant Program[9]
- (http://aotf.org/scholarshipsgrants/aotfinterventionresearchgrantprog
- EBP Resource Directory
- (http://www.aota.org/Practice/Researchers/EBP-Resource-Directory.aspx)
- Special issues of the *American Journal of Occupational Therapy*, which include systematic reviews of the literature focused on a certain area of practice; also the American Occupational Therapy Association (AOTA) Practice Guidelines, which are based on systematic reviews of the literature related to a given practice area.[8,23]
- (http://www.aota.org/Practice/Researchers/practice-guidelines.aspx).
- Evidence-based resources available on the AOTA website.
- (http://www.aota.org)[4]

Educators, scholars, and practitioners continue to discuss and encourage the use of theoretically grounded and supported OT interventions and the development of solid evidence of successful outcomes of interventions.[1,8,33] We assert that current and ongoing systematic OT practice is needed in all professional domains (persons, groups and populations) if OT is to remain a viable and valued field that will continue to flourish in the competitive environment of managed care and fiscal scarcity.

Systematic OT practice involves the integration of research-based techniques into all elements of OT practice. This chapter provides a framework that will help readers understand and learn the research-based systematic thinking and action processes necessary to conduct all or part of the sequence of SOTP. The chapter begins with a discussion and analysis of current models of **evidence-based practice (EBP)**. We then define systematic OT practice and proceed through the presentation and application of our model. As you will see, SOTP is valuable in all arenas of OT.

Threaded Case Study

Maria, Part 1

Maria, an occupational therapist, receives a referral to treat a client who has been diagnosed with carpal tunnel syndrome. The referral states, “Client needs to improve hand strength in order to increase independence in ADLs [activities of daily living].”

Critical Thinking Questions

Think about how to answer the following questions as you proceed through this chapter.

1. How do you clarify the OT problem, and what is needed to resolve it? What evidence do you need to support your decision?

2. What factors do you need to consider in examining your professional activity and interventions, and what evidence do you need?

3. How do you establish the extent to which you have determined the need and resolved the problem? What evidence do you need?

Models of Evidence-Based Practice

Many models of EBP have been presented in the literature. Practice models that integrate multiple methods of inquiry into all domains of professional practice have been called evidence-based medicine,[13,28,32] evidence-based practice,[11] evidence-based rehabilitation,[27]outcomes research,[14] and so on. Because of the expansive literature on EBP approaches, it is beyond the scope of a single chapter to review all the work in its entirety. Therefore, we have chosen to present important definitions that have been advanced in the literature and to discuss their variations. This discussion provides a rationale for systematic OT practice, our model for the critical application and use of evidence-based approaches relevant to and consistent with OT practice. At this point you may be asking, "Why create another model if there are so many?" Our approach is not entirely new. However, we developed it as a comprehensive organizational framework that sees systematic OT practice and inquiry as one and the same. In other words, following the steps of SOTP in all professional activity leads not only to sound practice, but also to the continuing creation of OT knowledge.

Table 4.1 presents diverse approaches to evidence- and inquiry-based practice. As you read these descriptions, you will notice that each approach identifies different sources as credible evidence in three categories: client generated, professionally generated, or scientifically grounded. By client generated we mean that information put forth by the client is considered as part of the evidence base for professional interaction. Professionally generated refers to the provider's education and experience as a valued source of knowledge for use. Scientifically grounded means that the evidence was developed by diverse rigorous methods of inquiry.[30,31] As Table 4.1 shows, not all models may value all three sources.

Ethical Considerations

Consistent with OT ethics, philosophy, values, and theory, we subscribe to the principle that it is our ethical obligation as professionals[6,7] to collaborate with clients regarding all aspects of their service need, provision, risk, and outcome. Therefore, we not only support the value of evidence generated by the client, the practitioner, and science, but we also encourage critical use of diverse sets of evidence as viable and purposive.

TABLE 4.1

Approaches to Evidence- and Inquiry-Based Practice

Author	Description	CREDIBLE EVIDENCE		
		Client Generated	Scientifically Grounded	Professionally Generated
Sackett et al.[31]	Evidence-based medicine is the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients. The practice of evidence-based medicine means integrating individual clinical expertise with the best available clinical evidence from systematic research.		X	X
Institute of Medicine[21]	Evidence-based practice (EBP) is the integration of best research evidence with clinical expertise and patient values.	X	X	X
Law[24]	Evidence-based rehabilitation is a subset of EBP that consists of four concepts: 1. *Awareness:* Being aware of the existence and strength of evidence in one's field 2. *Consultation:* Collaborating with the client and other healthcare professionals to determine the client's relevant problems and their clinical solutions 3. *Judgment:* Being able to apply best evidence to the individual with whom one is working 4. *Creativity:* Emphasizes that EBP is not a "cookie cutter" approach, but rather the combination of art and science	X	X	X
Lee and Miller[26]	The process of evidence-based clinical decision making encourages OT professionals to include the "values, knowledge, and experience" of the client and other healthcare professionals.	X	X	X
Kielhofner, Hammel, Helfrich, et al[23]	Investigation that provides evidence about the effects of services Identifying the client's need Creating the best possible services to address those needs Generating evidence about the nature of specific services and their impact Accumulating and evaluating a body of evidence about specific OT services	X	X	X

The Systematic Occupational Therapy Practice Model—SOTP

Building on and synthesizing the excellent work in EBP, we have defined systematic OT practice as the integration of critical, analytic, scientific thinking, and action processes throughout all phases and domains of OT practice. Let's look at this definition more closely.

Although thought and action are intertwined processes, for educational purposes we distinguish between them. In systematic inquiry, it is essential for the thinking sequence and its rationale to be presented clearly. Thinking processes comprise the reasoning sequence and logic that OT practitioners use to conceptualize intervention and specify desired outcomes. **Thinking processes** involve the selection of a theoretical framework on which the OT practitioner grounds and plans the steps necessary to assess problems, evaluate intervention, specify desired outcomes, and plan a strategy to determine and systematically demonstrate the degree to which client-centered outcomes were met for an individual receiving OT services. Sometimes we are not fully aware of our thought processes, but they are there nonetheless and are the foundation of systematic OT practice, as we will see later in this chapter.

Action processes are the specific behaviors involved in implementing thinking processes.[16] Action processes are behavioral steps. In systematic OT practice, these steps are founded on logical inquiry such that any claim is supported with empirically derived information from a variety of sources.

Although SOTP is not research in itself, it is the organized application of research to the conceptualization, enactment, and investigation of the process and outcome of intervention. Moreover, SOTP stimulates research and can be used as an organizing framework in which research questions are posed and answered. OT and healthcare researchers, educators, and practitioners have identified many arenas in which EBP is valuable. The AOTA's Centennial Vision statement asserts that OT will be an "evidence based profession."[2] Synonyms for evidence include terms such as data, documentation, indication, sign, proof, authentication, and confirmation. In some models of EBP, the highest evidence in the hierarchy of credibility is considered to be data generated by positivist, experimental-type inquiries, the methods most frequently used in clinical trials. This perspective is reflected in the AOTA's use of standards of evidence based on those described by Sackett et al.[32] However, other OTs and authors suggest that a broader range of methods can generate useful evidence.[20,27,36]

In this chapter and in SOTP, we define **evidence** as information used to support a claim. This expansive definition allows for the identification and acceptance of a broad scope of evidence as the basis for decision making in practice, as long as the evidence is identified and used within the systematic thinking and action processes that we discuss in detail here.

Ethical Considerations

Unsubstantiated beliefs or claims are insufficient in themselves to support professional activity in a healthcare environment that is increasingly demanding with regard to competitiveness, quality, safety, cost consciousness, and accountability. A standard established by the Accreditation Council of Occupational Therapy Education (ACOTE) attests to this professional obligation: "Be prepared to be an effective consumer of the latest research and knowledge bases that support practice and contribute to the growth and dissemination of research and knowledge."[2]

Within the OT profession, practitioners can use the information obtained from SOTP not only to improve the processes and outcomes of their practices, but also to engage in informed thinking when choosing among possible interventions, and to contribute to the overall knowledge base of our profession. Although the importance of using evidence to inform practice has been emphasized in the OT literature and scholarship, a study of practitioners' use of EBP for informing intervention revealed that only a minority of the practitioners surveyed used EBP when planning interventions.[12] SOTP systematically guides practitioners in determining which interventions will be effective at producing desired outcomes; which interventions must be improved; and what kinds of new knowledge need development. Additionally, having credible evidence to support the interventions OT practitioners use to produce desirable outcomes provides concrete feedback to the consumer.[34,35]

Furthermore, by systematically evaluating interventions, OT practitioners can develop evidence for advancing clinical practices in the profession.

Pressures and demands on health practitioners from external sources render SOTP even more critical, for three reasons:

- First, the location of service delivery and the time allowed for service delivery are in flux. Long-term hospital stays and treatments in acute care settings have been replaced by community-based treatment, and the length of time for delivery of treatment is decreasing as third-party payers demand more efficient and cost-effective healthcare. SOTP guides the practitioner in balancing the multiple factors involved in practicing within a quality-focused, fiscally driven healthcare environment.
- Second, by systematically examining the processes and outcomes of current practice, OT practitioners can provide an evidentiary basis for clinical thinking and action, which then can be presented to consumers, other professionals, insurers, and policy makers.
- Third, systematic inquiry transcends professional boundaries through shared language and theory. Within the context of physical rehabilitation, for example, the systematic foundation of the World Health Organization (WHO) *International Classification of Functioning, Disability and Health* (ICF)[36] is consistent with the current Occupational Therapy Practice Framework (OTPF-3)[7] and provides a common forum and language for cross-disciplinary communication.

As we proceed through SOTP, keep in mind that the skills and knowledge you already have are largely relevant to this conceptual approach. Let's now turn to the philosophical foundation and steps of the model.

OT Practice Note

It is no secret that OT practitioners have always had difficulty clearly describing what they do to those outside the profession. Moreover, OT practitioners have typically placed more emphasis on providing direct services than on publishing studies that document the results or that attribute successful outcomes to OT intervention. In today's increasingly complex and competitive healthcare environment, OT practitioners must clearly demonstrate their contribution to achieving clinical outcomes. It is particularly critical to do this if referral sources are to understand the benefits of OT to diverse client groups.

Theoretical and Logical Foundations of SOTP

SOTP is grounded in logic and the systematic thinking that undergirds all research thinking processes. Inductive, abductive, and deductive reasoning methods form the basis for these thinking processes. Moreover, the three major research design traditions—naturalistic, experimental, and mixed methods inquiry—are based on these logic structures.[16] Therefore, OT practitioners must understand them and use them to guide their thinking and action and to support claims about the process and outcomes of OT intervention.

Inductive reasoning is a thinking process in which a person begins with seemingly unrelated data and then links these data by discovering relationships and principles within the data set. In inductive systematic approaches, the data may take many forms. Inductive reasoning leads us to select naturalistic strategies, those in which theory is derived from gathered evidence rather than tested by scientific experimentation. Among the methods used in naturalistic design are interview, observation, and textual analysis.[16] Data are collected, and themes that emerge from repeated examination of the data are named, defined, and placed in a theoretical context.

Abduction, a term introduced by Charles Peirce[29] in 1957, currently is used by researchers and logicians to refer to an iterative process in naturalistic inquiry. This process involves the development of new theoretical propositions that can best account for a set of observations which cannot be accounted for or explained by a previous proposition or theoretical framework. The new theoretical proposition becomes validated and modified as part of the research process.

What distinguishes abduction from induction is that in inductive reasoning, an attempt is made to fit the data to a theoretical framework or to generate a set of identified and well-defined concepts that emerge from the data. In **abductive reasoning**, the data are analyzed for their own patterns and concepts, which in some cases may relate to available theories and in other cases may not.

Deductive reasoning begins with a theory and reduces the theory to its parts, which are then verified or discounted through examination. Deductive reasoning provides the foundation for experimental-type research, in which theories or parts are stated in measurable terms and standardized measurement forms the basis of all inquiry. Strategies used in deductive traditions include sampling, measurement, and statistical analysis. Because the rules of logic guide thinking, one can easily follow thinking processes and identify the basis on which guesses, claims, decisions, and pronouncements are made and verified.

Approaches that combine abduction and/or induction with deduction constitute mixed methods research, in which techniques and strategies from both the naturalistic and experimental-type traditions are used.

Complementarity With Contemporary Practice Models

Although it may seem difficult at first to engage in the formal, logical thinking processes that provide the foundation for research, we do it every day. Consider the ways the decision-making skills used in OT practice mirror the logical thinking processes that form the foundation of SOTP. Box 4.2 presents the steps of SOTP, and Table 4.2 illustrates the relationship between the OT process/clinical decision making and systematic thinking processes.

Box 4.2

Steps in SOTP

1. Identification and clarification of the problem to be addressed by the intervention

2. Understanding of need—what is needed to resolve all or part of the problem?

3. Setting of goals and objectives to address the need

4. Reflexive intervention to achieve the goals and objectives

5. Outcome assessment

TABLE 4.2

Relationship Between SOTP and the OT Process

SOTP	OT Process/Clinical Decision Making
Initial problem statement	Referral to OT
Need statement	Systematic assessment of client/occupational profile and analysis of occupational performance
Goals and objectives	Intervention goals and objectives
Reflexive intervention	Regular progress monitoring and revision of intervention in response
Outcome assessment	Final assessment of client's progress

Sequence of SOTP

Our model of SOTP has five steps (see Box 4.2). The process begins with a conceptualization of the problem to be addressed. But what exactly is a problem?

Statement of the Problem

Although we often see problems as entities existing outside ourselves, problems are contextually embedded in personal and cultural values. A problem is a value judgment about what is undesirable or in need of modification. Therefore, a **problem statement** is defined as a specific claim of what is not desired or of what should be changed. Although it seems simple to specify a problem, we often see problems stated in terms of a preferred solution; this error limits our options in analyzing problem components and solutions. Moreover, in systematic OT practice, problem statements must be derived from credible, systematically generated knowledge, including scholarly literature and inquiry, client reports and data, and other sources discussed later in the chapter.

Threaded Case Study

Maria, Part 2

Remember that the referral Maria received specified the client's problem as “needs to improve hand strength in order to increase independence in ADLs.” This problem, stated as a preferred need, suggests only one solution: to increase hand strength. However, through systematic analysis and problem solving, together with the client, Maria expands her analysis of the problem to “limited hand strength does not allow the client to participate in work or self-care occupations”; this allows Maria to generate additional potential solutions. For example, the client may take the following measures: look for alternative work, increase hand strength, work with adaptive equipment, adapt the environment, and so forth. By expanding a problem statement, the OT practitioner moves beyond the obvious primary difficulty or impairment and a singular solution and can capture the breadth of the problem, as revealed by systematically derived evidence from the literature, the client, or others.

If the OT practitioner proceeds merely from the problem statement in the referral, he or she may miss the essence of the client's problem and thus may select inappropriate interventions and outcomes. The OTPF-3 provides a guide for defining problems in OT by using a client-centered approach. Therefore, in SOTP it is critical to include the client and other diverse sources of knowledge, beyond the practitioner's guesses, to formulate the problem statement.

There are many ways to identify problems. Problem mapping is a method in which the OT practitioner expands a problem statement beyond its initial conceptualization by asking two questions repeatedly: “What caused the problem?” and “What are the consequences of the problem?”[3] As with other professionals, OTs do not address all aspects of the problem statement. **Problem mapping** helps us operationalize the OTPF in that it provides a thinking process to locate impairment and individual function (1) within several broad contexts (cultural, personal, temporal, and virtual); (2) within diverse environments; and (3) as influenced by social and physical factors.[7] As we see in the example that follows, the problem areas for OT intervention are defined by the scope of our professional activity.

In the following clinical example, we apply the problem mapping method to the statement, “Jane has impaired short-term memory resulting from a traumatic brain injury sustained in an automobile accident caused by a drunk driver.” To conduct problem mapping, we first need to conceptualize the problem as a river. Articulating the original statement of the problem is analogous to stepping into the river and picking up one rock. As we look upstream, we see what shapes (and therefore causes) the problem; as we look downstream, we see the problem's ripples, or consequences. How does this mapping technique work?

Look at the problem map in Fig. 4.1. Each box above the initial problem contains a possible answer to the question of what caused the problem. Once we have determined the first-level causes of the problem, we ask, “What caused the cause of the problem?” and so on, until we reach cultural and social value statements, both of which are specified as contexts for OT practice in the OTPF-3. Keep in mind that the evidence used to identify causes and consequences must be generated from credible, identifiable sources, including client, professional, and scientific sources.

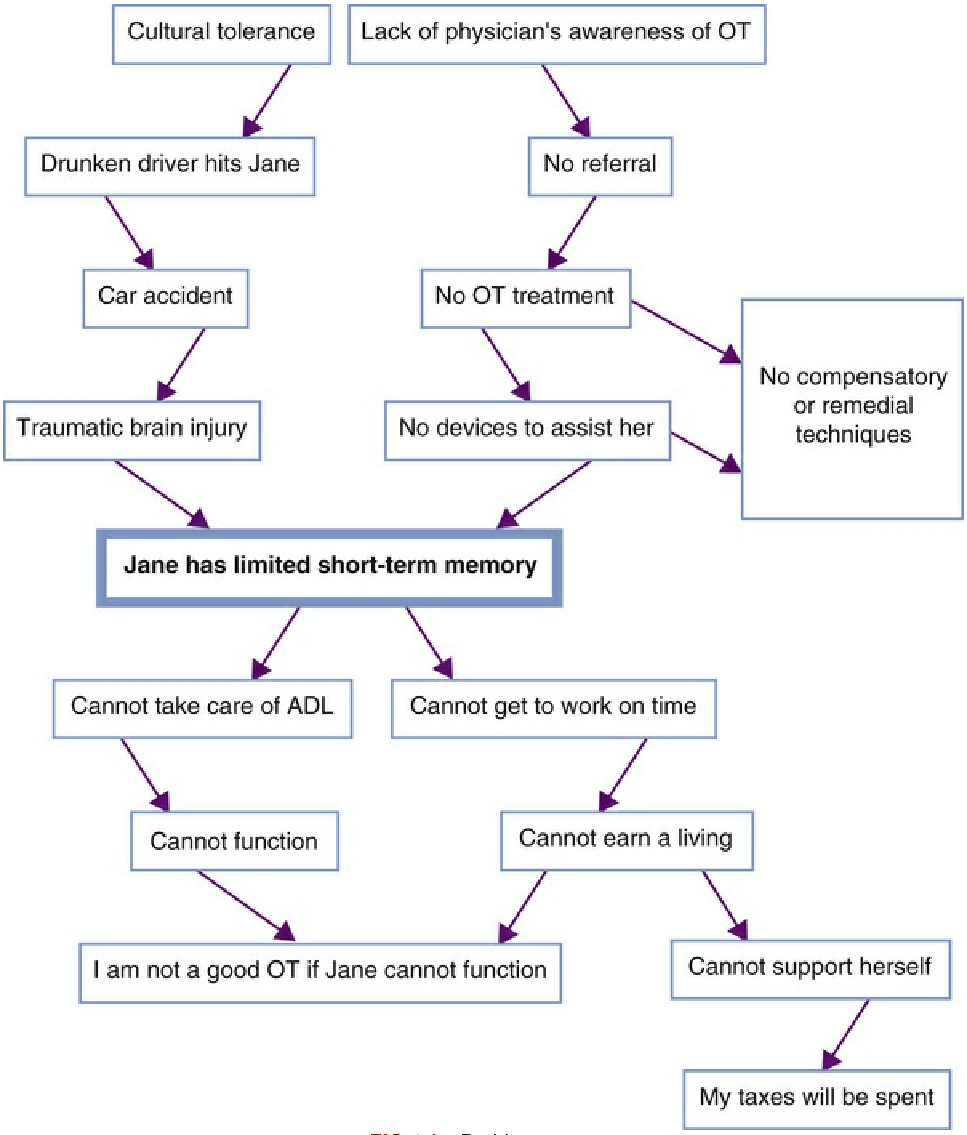

FIG 4.1 Problem map.

Below the initial problem statement, we repeatedly ask the question, "What is the consequence of the problem?" As with the upstream map, this question about the consequences of consequences is repeated until we reach the effect of the problem on ourselves. At this point, you may be asking "Why?" The reason is, problems are values and thus are in the eye of the beholder. The problem map expands the problem statement from documented cultural, social, and environmental causes to personal effect, and it suggests many different sites or targets for intervention.

As you might imagine from the clinical example of Jane's situation, many causes and consequences of problems are not within the scope of OT practice and thus cannot be resolved by OT intervention. Many OT practitioners will likely expand their efforts into political action or other areas at some point in their careers; however, others will continue primarily to look for clinical interventions that can improve the occupational performance of individuals. Given the focus of this text, the emphasis in this chapter is on clinical interventions rather than other roles OTs might assume.

Jane's problem map suggests numerous points of intervention for clinical OT; for example, in cognitive remediation, compensatory training, and provision of assistive devices and services, such as assistive technology (AT). Because our focus is on clinical practice, in Jane's case, an area of occupational performance is considered—developing vocationally related strategies that will enable Jane to return to work. The OT practitioner could also make a referral to a social service agency for Jane, who might be eligible for Social Security disability income; in this way, the OT practitioner would indirectly intervene (through referral to another professional on the team) at the level of

Jane's inability to support herself financially. In addition, as we look at the expanded problem, the OT practitioner may want to intervene on the macro level by advocating for stricter legislation and cultural "zero tolerance" of drunk driving, perhaps by educating adolescents and young adults. These areas of practice are beyond the scope of this chapter, but they allow us to see the expansiveness of problems and how mapping can assist OTs to identify diverse areas for OT to target or address through collaboration.

Consider the initial problem statement focusing on Jane's impaired short-term memory. This is not a problem that can be resolved by an OT practitioner as it is stated. Therefore, the OT, in collaboration with the client, must reconceptualize and restate the problem so that the OT can intervene using meaningful and systematic methods within the OT professional scope of practice.[5] Problem mapping or other logical, evidence-based problem identification techniques help the OT practitioner to examine and analyze problems beyond their initial presentation and to identify the strength of the evidence by which problems are analyzed. In SOTP, problem analysis and a careful statement of the part of the problem to be addressed are critical if the rest of the steps are to be implemented. Including in the process evidence from the client's perspective is essential in our model. Clarifying the problem will help the therapist ascertain what is needed to resolve the part of the problem that will be addressed. Now let's move to the next step of SOTP, ascertaining need.

Ascertaining Need

After problem mapping, the next step is ascertaining need. In this step, the practitioner must clarify exactly what is needed to resolve the part of the problem that has been targeted for change.

A distinction must be made between *problem* and *need.* As discussed earlier, a problem is a value statement about what is not desired. For a problem to be relevant to OT practitioners, it must concern improvement or maintenance of occupational performance. Thus, the problem area on the map that the OT practitioner would target for resolution would be delimited and guided by the professional and theoretical domains of OT concern. A **need statement** is a systematic, evidence-based claim, linked to all or part of a problem, that specifies what conditions and actions are necessary to resolve the part of the problem to be addressed. The identification of need involves collecting and analyzing diverse sets of information (eg, assessment data and the information from the client interview) to form an occupational profile to ascertain what is necessary to resolve a problem.

At this needs assessment stage of the SOTP sequence, the OT may already have information on which to formulate need, or he or she may collect data in a systematic fashion to clearly delimit and identify need. A need statement should include four specifics: (1) who is the target of the problem (this defines the client or recipient of OT service); (2) what changes are desired; (3) what degree of change is desired; and (4) how it will be recognized that the change has occurred. The need statement must be based on systematically derived data already contained in credible resources (eg, the relevant practice and research literature or documentation, and professional education, knowledge, and experience) or as revealed by the client in a needs assessment inquiry. Can you see that the need statement uses systematic, research-based processes to define the next steps: specifying goals and objectives, determining the intervention, and specifying the evaluative criteria to determine whether the desired outcomes of an intervention have been met?

Let's return to the example from our problem statement. As already mentioned, the problem as stated (impaired short-term memory) is not a problem an OT practitioner can resolve. Yet it is common for referrals for OT intervention to identify problems such as this one. Thus the use of a problem map or similar problem analysis strategy is not only a reasonable thinking tool, it is also essential if we are to define the nature of our interventions more clearly and thereby document the unique contributions and outcomes of OT both within and outside of our field. In Jane's case, therefore, the OT practitioner chose to reason about the causes and consequences of the problem to identify whether an area existed in which Jane would require OT intervention. By mapping the problem, the therapist found that OT did indeed have a critical role to play in Jane's treatment. The OT's problem statement then became: Jane's ability to engage in meaningful occupational performance is impaired because she is unable to manage her time and arrive at work on time as a result of her impaired short-term memory.

Given this problem statement, the therapist decided to conduct a research-based needs assessment to determine what was necessary to resolve the targeted part of the problem; to set goals and objectives to guide the selection of an intervention; and to determine what processes and outcome should be expected.

Using a systematic approach to data collection, the OT practitioner used mixed method techniques, including an interview and systematic observation of Jane, to ascertain Jane's desires and skills. The OT practitioner also administered a standardized cognitive assessment and an occupational performance assessment. In this instance the OT practitioner is integrating qualitative and quantitative inquiry strategies to document a complete understanding of need and to provide the empirical basis for clinical decisions, in addition to expected outcomes.

One of the tools the OT practitioner can use to collect data is the Canadian Occupational Performance Measure (COPM). This criterion-referenced measure is used to identify client-perceived problems in daily functioning in the areas of self-care, productivity, and leisure. By means of a semistructured interview format, the COPM may be used to assess the performance skills and patterns the client identifies as interfering with his or her ability to function in a particular area. The data from the COPM are credible, outcome based, and accepted as evidence in the research world.[25]

Systematic assessment revealed that Jane identified returning to her job as a saleswoman in a boutique as her most important goal. Additionally, the results of the COPM interview revealed that Jane was not satisfied with her ability to manage her time or her ability to be punctual and that she perceived these two issues as the greatest barriers to achieving her desired goal of returning to work. She recognized that her difficulties with short-term memory would affect her ability to do other work-related tasks, but she reported being most concerned about time management and promptness.

Standardized testing indicated that Jane's short-term memory was impaired but that her capacity to respond well to external cues remained intact. Additionally, Jane's performance on the Wisconsin Card Sorting Test (WCST) revealed that she was able to solve problems and that she demonstrated abstract reasoning. (The WCST is a standardized cognitive assessment of executive function that was developed to assess problem solving, abstract reasoning, and the ability to shift cognitive strategies.[19]) The results of standardized testing also suggested that Jane was able to learn new behaviors with specific, well-structured practice in the environment in which she would function. The WCST also provided an assessment of cognitive flexibility, and those data could be extrapolated to imply that Jane would be able to learn new skills in a structured environment, but that the number of variables and complexity of her work setting should also be considered.

With this empirically generated information, the therapist and Jane had a sound and credible basis for deciding that the OT intervention would be directed to the need to find and teach Jane compensatory strategies for time management and promptness.

In addition, Jane had indicated in her occupational profile that she was married and that her husband would be supportive in helping her get to work. Based on this information, generated from the naturalistic part of the needs assessment, the therapist and Jane decided to include Jane's husband in the intervention, and to work first in Jane's home environment and then transfer her treatment to the work environment.

Can you see from this example how SOTP both provides the guidance and the documentation for clinical decisions and suggests future steps in the intervention and outcome assessment processes? Anyone who observes the intervention process can easily see the rationale for decisions and actions. Credible, evidence-based knowledge is structured in a manner that provides a clear reasoning trail.

The desired outcomes are implicit in the need statement, which provides a basis for formulating measurable outcomes of an intervention. According to the literature on closed head injury and professional wisdom,[22] what is needed in Jane's situation is contextually based OT intervention in the home and in the workplace to assist her with time management and promptness, as a skill to facilitate her return to work. The evidence for targeting this intervention and for the goals and objectives to follow is clear and specified, as is the desired outcome.

The following case example features George, another OT practitioner, and considers a different type of need statement that illustrates why OT practice requires systematic inquiry.

Case Study

George

George, an OT practitioner, is asked by an employer to address a problem involving several computer *operators whose ability to perform their jobs has been impaired or lost as a result of neck pain. After constructing a problem map based on literature about causes and consequences of neck pain, George formulates a need statement based on two areas that he believes will address the problem: instruction in proper body mechanics and instruction in a regularly scheduled upper body stretching routine. A literature review provided him with empirical evidence on which to base his intervention. He begins his intervention by teaching proper body mechanics and upper body stretching techniques to the computer operators, but the problem is not resolved. The computer operators continue to be unable to do their jobs, and their complaints of neck pain continue. George's intervention has not successfully resolved the problem for which he was hired.*

What was missing from George's reasoning? He based his problem map on empirical literature and educated but preconceived guesses without fully assessing the situation. Had he conducted a systematic needs assessment that included interviewing, testing, and observing the workers, he might have found that the monitors were too high for the operators and the chair heights were not adjustable. Thus, the intervention of body mechanics instruction and upper body stretching that may have been viable in another situation did not address the specific needs that George failed to identify. Had he used systematic thinking and action to ascertain need, rather than guessing and then jumping from the problem to the intervention, George would quickly have identified the appropriate target areas.

In needs assessment, many systematic approaches can be useful in identifying and documenting needs, including but not limited to formal research strategies, well-conducted a priori studies, and mixed methods of information gathering and analysis. For individual clinical problems, strategies such as single case design are extremely useful for guiding and testing the efficacy of intervention decisions with a client.[16] For program development, the therapist may want to use "group" (also called nomothetic) approaches, such as survey, interview, or standardized testing strategies, to obtain needed information on which to support a needs claim. Naturalistic inquiry or mixed method thinking and action strategies may be valuable to ascertain the perspectives of client groups about whose problems and needs the therapist knows little. Many excellent research texts are available from which to build research knowledge (see the Suggested Readings at the end of this chapter).

The next step in the process of systematic OT practice is translating the needs into goals and objectives.

Goals and Objectives

Goals and objectives are two words with which OT practitioners are familiar because these concepts are used to structure treatment. In SOTP, goals and objectives emerge from the need statement and are essential not only for structuring intervention, but also for specifying how the process and outcome of intervention will be examined and supported.

Definitions of the two terms are helpful. **Goals** are statements developed by clients and relevant others identifying the client's desired outcome of the service—what would the client like to be able to do or be.[10] In other words, a goal is a vision statement about future desires that is delimited by the need that it addresses. **Objectives** are statements about how to reach a goal and how to determine whether all or part of the goal has been reached. The objective sets up the systematic approach to attaining the goal and determining its empirical measurement or assessment.[17]

There are two basic types of objectives: process and outcome. **Process objectives** define concrete steps necessary to attain a goal. Process objectives are interventions or services that will be provided or structured by the OT practitioner.[15] **Outcome objectives** define the criteria that must be met to determine that all or part of the goal has been reached; outcome objectives further specify how these criteria will be demonstrated. Ultimately, assessing the attainment of outcome objectives focuses on ascertaining whether the desired change has taken place as a result of participation in the OT process.

To develop goal and objective statements in our model, the therapist examines the need carefully, including the evidence supporting the need statement. Then, the therapist and the client formulate conceptual goal and objective statements that guide and imply how the process and outcomes of intervention will be assessed. Goals are overall conceptual statements about what is desired; objectives are statements that are operationalized (ie, stated in terms of how they will be measured or known). Both are based on systematically generated knowledge from the needs assessment.[15]

Let's now return to Jane to illustrate goals and objectives. From the problem and need statements, the OT practitioner determined that an overall goal for Jane's intervention was to develop, teach, and have Jane learn compensatory strategies for promptness and time management so she could improve her performance in these areas and return to work. Based on the evidence given in the needs assessment, the OT intervention was to be carried out at first in Jane's home, with her husband participating; after this, a transition would be made to the workplace.

A critical element of goal setting in SOTP is **specificity**. The following example uses the treatment goal discussed previously as the basis for writing specific goal and objective statements.

Goal: Jane will improve her promptness so as to be able to get to work on time (performance), to her satisfaction.

The process (P) and outcome (O) objectives to be used to attain this goal are:

1. Jane will be presented with assistive technology supports and services and repositories of assistive devices from which she can select those she thinks will be most useful for her to achieve the goal. (P)

2. Given a choice of a variety of assistive devices (eg, smart watches, notification apps, and clocks), Jane will choose one or more devices to use as an external cue provider for promptness. (P)

3. Jane will select one daily activity at home for which she needs an external promptness cue. (P)

4. With assistance from the OT practitioner, Jane and her husband will configure the device to cue Jane to attend to this daily event. (P)

5. Jane's husband will monitor her promptness and provide feedback to Jane and the therapist regarding the effectiveness of the assistive device in meeting the goal. (P)

6. Once Jane has demonstrated that she can promptly attend to her schedule at home, she will begin to use the promptness cue to arrive at work. (O)

7. Once Jane has demonstrated that she can arrive at work on time, the therapist will work with Jane at the work site so that she can use the device to attend promptly to her work schedule, to her and her employer's satisfaction. (P)

8. Using the most effective strategy and devices, Jane will improve her promptness and satisfaction with her performance at work. (O)

As you can see by reading this goal and its related objectives, in SOTP, objectives are very directive conceptual statements designed to produce broad goal statements based on an empirical understanding of need. As we will see in the following sections, Reflexive Intervention and Outcome Assessment, stating the goals and objectives as demonstrated in this chapter determines what will be formatively monitored and examined to ascertain treatment success.

Reflexive Intervention

Extrapolating from naturalistic methods of inquiry, DePoy and Gilson[15] chose the term *reflexive intervention* to highlight the fact that systematic thinking does not stop during the implementation of interventions. Therefore, we have integrated this term into our model to remind the practitioner that as practice proceeds, the OT makes decisions based on feedback from the actual intervention itself, as well as on examination of the therapeutic use of self and other influences on the intervention process. We use the term reflexive intervention to refer to the thinking and action strategies that occur during the intervention phase of OT practice. In reflexive intervention, the OT systematically monitors the client, the collaboration, the professional practice, setting-based resources, the therapeutic use of self, and other internal and external influences that affect the practice process and outcome. That is not to say that practice wisdom and intuition do not occur or are not used as evidence. They do occur, and in SOTP the OT makes it a point to be well aware of the pluralistic evidentiary basis from which he or she is making decisions, to carefully look at all practice to obtain clarity about what was done, and to consider feedback from engaging in practice.

Process assessment, the systematic monitoring of process objectives (denoted in the objective list by "P") occurs throughout the reflexive intervention phase to provide the evidence on which to describe intervention and the context in which the intervention occurs; it also yields the evidence on which decisions are made about the need for intervention or programmatic change. Knowing what outcomes occurred without knowing what was done to cause them limits our knowledge base and our ability to communicate the benefits of OT practice to those outside of the profession. Thus, reflexive intervention is critical to the growth of OT knowledge, theory, and practice strategies. Let us return to Jane to illustrate.

As we mentioned previously, the COPM is an excellent measure for documenting performance that is meaningful to the client. In process assessment, the COPM can be used to document changes in occupational performance and to illustrate the benefits of OT to Jane and other diverse audiences. Using this tool to collect data at multiple points during intervention can support the intervention "as is," or it can help the therapist reconceptualize the intervention. The OT might also have tracked and documented Jane's promptness over the course of her treatment to determine whether revisions in the intervention were necessary. Moreover, documentation is an excellent way to show Jane and others that Jane has improved through OT. Similar strategies could be used to examine and document time management and other areas that Jane and the OT were addressing. The OTPF provides excellent guidance on reflexive intervention.

Outcome Assessment

Outcome assessment is a set of thinking and action processes conducted to ascertain and document what occurs as a result of the client being voluntarily or involuntarily exposed to a purposive intervention process and to assess the worth of an intervention. (In the objective list shown earlier, outcome objectives were identified with an "O.") These objectives can be assessed by using quantitative, naturalistic techniques and mixed methods, and by applying systematic inquiry to examine whether objectives have been attained. To brush up on inquiry, we suggest that you consult one of the many excellent research method texts, some of which we list at the end of this chapter.

To perform an outcome assessment of Jane's intervention, the OT selected a pre-post test design using the COPM and the other documentation noted in the discussion on reflexive intervention. Although Jane's performance was measured multiple times, only the change from beginning to end was used for outcome assessment. As you can see, all OTs already do outcome assessment. The trick is to realize that you do it and to purposefully select methods that are credible and useful. We suggest that you choose strategies that use mixed method approaches. Box 4.3 shows how each objective was assessed in Jane's case.

OT Practice Notes

SOTP in Professional Practice

An OT should deliberately perform each of the steps of SOTP and find a personal style for using evidence in professional practice. SOTP not only serves as a valuable approach in direct intervention, it also provides the foundation for knowledge building and intervention development in all professional domains.

Box 4.3

Putting It All Together

Goal, Objectives, Evidence, and Success Criteria

Goal: *Jane will improve her promptness so as to be able to get to work on time (performance), to her satisfaction.*

1. **(P)** Jane will be supplied with repositories and assistive devices from which to select those that she thinks will be most useful for her to achieve the goal.

Criterion for success: Completion of activity

Evidence: Notes of each session documenting progress toward goal

2. **(P)** Given a variety of assistive devices (eg, smart watches, notification apps, and clocks), Jane will choose a device to use as an external cue provider for promptness.

Criterion for success: Selection of device

Evidence: Notes of each session documenting progress toward goal

3. **(P)** Jane will select one activity at home for which she needs an external promptness cue.

Criterion for success: Selection of activity

Evidence: Notes of each session documenting progress toward goal

4. **(P)** With assistance from the OT, Jane and her husband will configure the device to cue Jane to attend to this daily event.

Criterion for success: demonstration that Jane and her husband have completed the objective

Evidence: progress notes indicating mastery of task

5. **(P)** Jane's husband will monitor her promptness and provide feedback to Jane and the therapist regarding the effectiveness of the assistive device in meeting the goal.

Criterion for success: Daily record of Jane's promptness, supplied to her each evening after dinner

Evidence: Husband's recorded time charts

6. **(O)** Jane will demonstrate that she can promptly attend to her schedule at home.

Criterion for success: Daily record of Jane's promptness at home

Evidence: Husband's recorded time charts

7. **(P)** Once Jane has demonstrated that she can promptly attend to her schedule at home, she will begin to use the promptness cue to arrive at work.

Criterion for success: Daily record of Jane's use of cues

Evidence: Client self-report

8. **(O)** Jane will regularly arrive at work on time.

Criterion for success: Daily record of Jane's promptness at work

Evidence: Client's documented arrival time

9. **(P)** Once Jane has demonstrated that she can arrive at work on time, the therapist will work with Jane at the work site so that she can use the device to attend promptly to her work schedule to her and her employer's satisfaction.

Criterion for success: OT will meet Jane at work daily for 1 week to support use of device

*Eviden*ce: OT notes

. **(O)** Using the most effective strategy and devices, Jane will improve her promptness sufficient to work and sufficient for her satisfaction.

Criterion for success: Significant improvement in Jane's promptness

Evidence: COPM score on this item, compared with COPM score on pretest on this item

COPM, Canadian Occupational Performance Measure; *O*, outcome objective; *P*, process objective.

Summary

In this chapter we presented SOTP, a practice approach in which systematic thinking and action are essential tools in OT practice. Our model begins with a clear problem statement that guides all the remaining steps. Naturalistic and experimental research traditions are applied to clinical decision making to guide the subsequent steps of identifying and documenting need, positing goals and objectives, reflexive intervention, and outcome assessment.

Reexamine Table 4.2 now in light of the need statement. The links among problem, needs, goals and objectives, process, and outcome have been clearly illustrated. Each step of SOTP emerges from and is anchored in the previous step. Moreover, systematic thinking and action provide the specificity and credible evidence supporting the extent to which the intervention resolved the part of the problem that was identified as falling within the OT domain.

Review Questions

1. List three reasons OT practitioners need to use SOTP to demonstrate the efficacy of OT to external audiences.
2. Name and describe each of the steps of SOTP.
3. Compare the steps of SOTP to the steps of the OT process.
4. Using a potential OT client as a case study, select a problem and develop a problem map.
5. Suggest strategies to ascertain the need based on your problem statement.
6. Identify the need for your client based on your problem statement.
7. What is the difference between a goal and an objective, and what is their relationship?
8. How do goals and objectives relate to need?
9. How do goals and objectives relate to a problem?
10. Identify goals for your client.
11. What are the two types of objectives described in this chapter, and what are the differences between them?
12. Based on your goals for your client, identify at least two process objectives and two outcome objectives.
13. Explain how you will know that your objectives have been met.
14. Choose at least two interventions to achieve the goals and objectives you established in question 12.
15. Identify what questions you will ask and how you will answer them in reflexive intervention.
16. Discuss how you will use reflexive intervention and outcome assessment data to contribute to OT knowledge.

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Health Promotion and Well-Being for People With Physical Disabilities

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CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Discuss historical influences on occupational therapy's role in health promotion and well-being.
2. Define key health promotion and disease prevention constructs and terminology.
3. Describe the impact of Healthy People 2020 on occupational therapy practice.
4. Identify strategies for integrating health promotion into physical disability practice.
5. Develop a holistic, client- and occupation-centered health promotion perspective for physical disability practice.

KEY TERMS

Client-centered care (client-centered practice)
Empowerment

Enablement
Expert-centered
Health promotion
Health protection strategies
Moral treatment
Occupational justice
PRECEDE-PROCEED model
Prevention
Primary prevention
Quality of life
Risk factors
Secondary conditions
Secondary prevention
Tertiary prevention
Transtheoretical model (TTM)
Well-being
Wellness

The American Occupational Therapy Association (AOTA) supports and promotes involvement of occupational therapists and occupational therapy assistants in the development and provision of programs and services that promote health, well-being, and social participation of all people.

American Occupational Therapy Association[59]

In its official statement on health promotion and well-being, the AOTA describes three important roles for the profession:

To promote healthy lifestyles; to emphasize occupation as an essential element of health promotion strategies; and to provide interventions, not only with individuals but also with populations. It is important that occupational therapy practitioners promote a healthy lifestyle for all individuals and their families, including people with physical, mental, or cognitive impairments.[59]

Threaded Case Study

Jean, Part 1

Jean is a 49-year-old wife and mother with three grown children, two of whom live away from home. The one living at home has a 2-year-old child. Jean has been married for 27 years. She developed gestational diabetes with her first-born child and has been insulin dependent for most of her married life. Jean is knowledgeable about diet, the need for exercise and activity, and insulin regulation. She is active in her community, works part-time as a cashier to supplement her husband's income, and enjoys bowling, playing cards with friends every Friday night, crocheting, and maintaining her home.

Jean developed symptoms that later were confirmed to indicate a minor stroke. She lost sensation in her fingertips and in both lower extremities. As a result, she developed altered dynamic balance and grasp in both hands. She has coped with beginning glaucoma and diabetic neuropathies for several years. She has a weakened cardiac status secondary to diabetes, even though she has been active much of her life. Jean is overweight and has smoked a pack of cigarettes per day since she was 18 years old. Her husband also smokes regularly.

Critical Thinking Questions

1. How would you evaluate this client from a health promotion perspective?

2. In addition to standard occupational therapy services, what health promotion interventions might you use with this client and/or her family?

The value a society places on the health and welfare of its people can be measured by its level of commitment to policies and funding for healthcare. The wisdom of a society also can be measured by its commitment to prevention and health promotion. This chapter describes the involvement of the occupational therapy (OT) profession in health promotion and prevention activities, in addition to policy development. A new direction, which may come to be identified as a historical shift back to occupational therapy's concern with societal-level problems, is also identified.

The historical overview is followed by a review of health promotion principles and a description of health promotion–focused evaluation and intervention for individuals with physical disabilities. A case study is presented to help readers integrate the principles and practice of health promotion and impairment prevention for people with physical disabilities and impairments.

Historical Influences and Considerations

Early History and Symbolism

Humans have long appreciated the health-promoting and healing qualities of engagement in occupation.[55,58] History and anthropology,[24] in addition to archeology,[90] provide rich examples of how people through time, from cultures around the world, have used occupations not only for survival, but also as a means of healing and expressing identity and spirituality.[12,25,90] In the United States, petroglyphs (ie, rock carvings) are as important to the living as they were to those who created them centuries ago. Herman Agoyoyo, chairman of the All-Indian Pueblo Council, pointed out:

To us, these petroglyphs are not the remnants of some long lost civilization that has been dead for many years … they are part of our living culture. What is stored in the petroglyphs is not written in any book or to be found in any library. We need to return to them to remind us of who we are and where we came from, and to teach our sons and daughters of it.[84]

This pictorial evidence often depicts the human engagement in hunting or other subsistence activities, the use of symbols, or representations of the human hand or animals.[25,83] When living conditions allowed time for occupations other than for subsistence (ie, activities of daily living and instrumental activities of daily living), humans turned their energy to identifying these very occupations and the animals they shared their world with through symbols and artwork. These symbols convey feelings, identity, beliefs, and knowledge of these important occupations.

Humans currently use symbols, often subconsciously, for these same purposes.[26] The production of petroglyphs is early evidence of the importance of symbols and their influence on health. Through these symbols, early humans could communicate their essence to future generations and, according to Reilly,[57] demonstrate that "through the use of his hands, as they are energized by mind and will, [man] can influence the state of his own health."

The meanings or relevance of specific symbols can change through time, in a society and in an individual. A handprint made on the wall of the Cave of Chauvet-Pont-d'Arc[29] during the Paleolithic period could have had a symbolism that was both similar to and different from the symbolism of a small child's handprint to a parent of today. For an individual with a disability, the familiar stick person in a wheelchair symbol used to denote accessibility might have held little or no meaning before the person sustained the disability. After an individual is diagnosed with or sustains a physical disability, however, this symbol (Fig. 5.1), the International Symbol of Access (ISA), may take on new meaning and relevance both for that person and for his or her family.

FIG 5.1 International Symbol of Access (ISA).

Development of a Profession

Many descriptions of the development of occupational therapy as a profession either start with or include a discussion of moral treatment.[39,55,56,61] **Moral treatment** was defined as a "humane approach to the insane" that included occupation-based intervention that emphasized self-discipline, hard work, and learning self-control while developing "good habits."[90] (Chapter 2 provides a rich description of this time period and those who influenced the practice of occupational therapy with people with disabilities in the United States.) The values and beliefs of the founders of occupational therapy in the United States were consistent with and influenced by the values and beliefs of the mental hygiene movement, the arts and crafts movement, the settlement house movement, and the actions of other social activists and reformers in the United States at that time.[13,40] These idealistic individuals and groups worked to correct the social injustices of their time, and they are viewed as helping to promote health, well-being, and social participation.[61]

The backgrounds and contributions of the founders of occupational therapy in the United States are well documented.[a] Therefore, the rest of this discussion focuses on (1) a summary of key events for involvement in health promotion and policy development in the United States and (2) recent international developments that may influence practice in the United States in the coming decades.

Milestones in Occupational Therapy Health Promotion Interventions

Leaders in the field of occupational therapy have been encouraging the profession to focus increased attention on health promotion for many decades. As early as the 1960s, leaders articulated their vision of the role of occupational therapy in prevention and health promotion.[15,85,86,88,89] Themes have included (1) concerns about an emphasis on cure or the saving of life versus the provision of services to maximize the quality of a saved life or the prevention of the illness or injury; (2) the matching of OT values and principles with those of public health; (3) the untapped potential and responsibility for occupational therapy to contribute to the well-being of society; (4) the need to build and redefine the knowledge base of the profession; and (5) the responsibility to conduct research to determine the effectiveness of community-based initiatives for health promotion and prevention. Finn[27,28] has continued to encourage this involvement through the Eleanor Clarke Slagle Lecture[26] and subsequent work.

Through the years the AOTA has developed a series of statements and used other means to focus attention on health promotion. In 1979 the organization published its first official document related to health promotion and prevention, "Role of the Occupational Therapist in the Promotion of Health and the Prevention of Disabilities."[1] This document has been revised and republished four times since then—in 1989,[2] 2001,[14] 2008,[68] and 2013.[59] In 1986 the AOTA supported this role by devoting an entire issue of its journal, the *American Journal of Occupational Therapy (AJOT),* to health promotion.[87] In 1992 an article on the history of occupational therapy's role in preventive health appeared in the special 75th anniversary issue of the *AJOT.*[58]

Besides encouraging occupational therapy's role in health promotion within the profession, the AOTA also promoted it to external audiences. The AOTA was a participant in the Healthy People 2000 Consortium.[4] The consortium worked cooperatively with 22 expert groups and numerous state and national governmental agencies and services to set the nation's health agenda for the next decade.[80] Both this document and its current version, Healthy People 2020,[77,81,82] include targeted health goals for individuals with disabilities. Healthy People 2020[77,81,82] was released in 2010 to identify health goals for the next decade. The overarching goals of Healthy People 2020 are:

- attaining high-quality, longer lives free of preventable disease, disability, injury, and premature death
- achieving health equity, eliminating disparities, and improving the health of all groups
- creating social and physical environments that promote good health for all
- promoting quality of life, healthy development, and healthy behaviors across all life stages[81,82]

A review of Healthy People 2020 (*http://healthypeople.gov*) can assist occupational therapists in the development of new intervention strategies to address the documented unmet health needs of U.S. residents, both with and without disabilities. In 2007 the AOTA selected six focus areas for the profession to emphasize in the decade leading to its centennial in 2017. Health and wellness is one of these six areas; the others are children and youth; productive aging; mental health; work and industry; and rehabilitation, disability, and participation.[5]

Another AOTA document, "The Role of Occupational Therapy in Disaster Preparedness, Response, and Recovery,"[6] provides a prevention and action tool to help OT practitioners meet the disaster preparedness needs of individuals with disabilities and to assist employers in preparing for mass casualties resulting from extreme weather, mass transportation accidents, or terrorist activities. As will be discussed later in this chapter, prevention is part of a comprehensive health promotion strategy.

Lifestyle Redesign Programs

A significant event in health promotion OT practice was the development of the Lifestyle Redesign programs, which were created by faculty members of the Mrs. T.H. Chan Division of Occupational Science and Occupational Therapy, University of Southern California (USC). The outcome of the first of these programs for well elderly was published in a landmark article in the *Journal of the American Medical Association.*[20] The intervention protocol that evolved for the Well Elderly Study was eventually named "Lifestyle Redesign."[44] The results of this Lifestyle Redesign program indicated that "preventive occupational therapy greatly enhances the health and quality of life of independent-living adults."[44] Other Lifestyle Redesign programs have since been developed for individuals both with and without disabilities.[79] These include programs addressing weight, pain, headache, diabetes management, and ergonomics, among others. The USC faculty practice also has designed an interdisciplinary program with physical therapy for individuals living with multiple sclerosis (Optimal Living with MS), in addition to programs for veterans and college students, life coaching, and lifestyle risk assessment.[79]

International Trends

An international discussion started by Wilcock[90,91] and Townsend[74] has shaped the future of occupational therapy's involvement in health promotion and prevention worldwide. These researchers called attention to the potential for OTs and OTAs to combat social and occupational injustice.

The idea of occupational justice first emerged in Australia and Canada. **Occupational justice** is "the promotion of social and economic change to increase individual, community, and political awareness, resources, and equitable opportunities for diverse occupational opportunities which enable people to meet their potential and experience well-being."[90]

The World Federation of Occupational Therapists (WFOT) has actively responded to the call for the profession to become involved in promoting occupational justice; it has encouraged occupational therapists to contribute to the eradication of occupational deprivation.[70] The discussion is slowly emerging in the United States.[8,60,65,78] The WFOT continues to advocate for occupational therapy to address broad societal concerns that impact health and well-being. In 2012 the federation approved the document, "Environmental Sustainability, Sustainable Practice within Occupational Therapy,"[92] which encourages the profession "to re-evaluate practice models and expand clinical reasoning about occupational performance to include sustainable practice."

Ethical Considerations

The profession of occupational therapy has the potential to be able to conduct an assessment of societal issues that impact the daily occupational rights and function of marginalized individuals, groups, and communities. Through education, political advocacy, and activism, occupational therapists can draw attention to the inequities that exist.

As occupational therapy practitioners further gain working knowledge of the political process, they can advocate for both the prevention of disability as well as the promotion of health and prevention of secondary conditions for individuals with disabilities who have been marginalized. In preparation for this advocacy, OT practitioners should familiarize themselves with the goals of Healthy People 2020,[8] especially the second overarching goal, "Achieve health equity, eliminate disparities, and improve the health of all groups." They also should study the other data available in Healthy People 2020 regarding reducing disparities and improving the quality of life for individuals with disabilities.

One step OT practitioners can take is increasing their awareness of current history-making efforts that can be joined and supported. The independent living movement, which is working to combat disparities and social injustice for individuals with disabilities, is an example of such an effort. However, if an OT practitioner singularly embraces the rehabilitation paradigm, he or she may not feel comfortable with either the principles of the independent living movement or its political agenda. Integrating a proactive approach to health that includes health promotion, wellness, and rehabilitation can significantly impact the quality of life of people with disabilities and their loved ones.[49,52]

The rehabilitation paradigm is clearly used by OT practitioners. Wellness and health promotion strategies can easily be introduced into any practice area. An example of this can be seen when the OT works with a client post-stroke who is obese. The OT practitioner would address healthy nutrition and activity levels, identifying positive environmental supports and helping to develop routines that promote health and well-being, in addition to supporting occupational performance through remediation of persistent symptoms after the stroke. When the OT works from a client-centered perspective, rather than an **expert-centered** one, the client is given more control for positive independent living. Arbesman et al. stated:

As new approaches are developed in Medicare and in private insurance, occupational therapy's role may move from being considered a rehabilitation service to being an essential component of any well-designed, effective, and efficient healthcare system. Areas in which occupational therapy practitioners may be involved with healthy as well as frail community-dwelling older adults include several fully supported by the evidence.[7]

An important milestone in international efforts to ensure independent living and other equal rights for individuals with disabilities was the adoption in 2006 of the United Nations Convention on the Rights of Persons with Disabilities. The United States did not sign this convention until 2009, at which time 142 other countries had already signed.[75,76]

OT practitioners need to look beyond the immediate rehabilitation goals to be truly client centered in their practice.[74] This includes advocacy for equal access and rights for all people, marginalized or not, with or without physical disabilities. In a sense, this discussion has brought the OT profession full circle, giving it the opportunity to emulate its founders by becoming social activists.

Health Promotion Principles and Practice

Health is a constant interplay of a variety of factors. Important determinants of health status include biology and genetics, individual behavior, social factors, policymaking, and health services (Fig. 5.2).[59,81] Public health professionals evaluate the health status of a population by examining birth and death rates, incidence and prevalence of disease, injury and disability, use of healthcare services, life expectancy, quality of life, and other factors. Leading health indicators for the U.S. population were established during the development of Healthy People 2020 in an effort to set priorities and focus the national health promotion agenda. The leading health indicators that served as the foundation for the strategic planning process are:

- Access to health services
- Clinical preventive services
- Environmental quality
- Injury and violence
- Maternal, infant, and child health
- Mental health
- Nutrition, physical activity, and obesity
- Oral health
- Reproductive and sexual health
- Social determinants
- Substance abuse
- Tobacco[81,82]

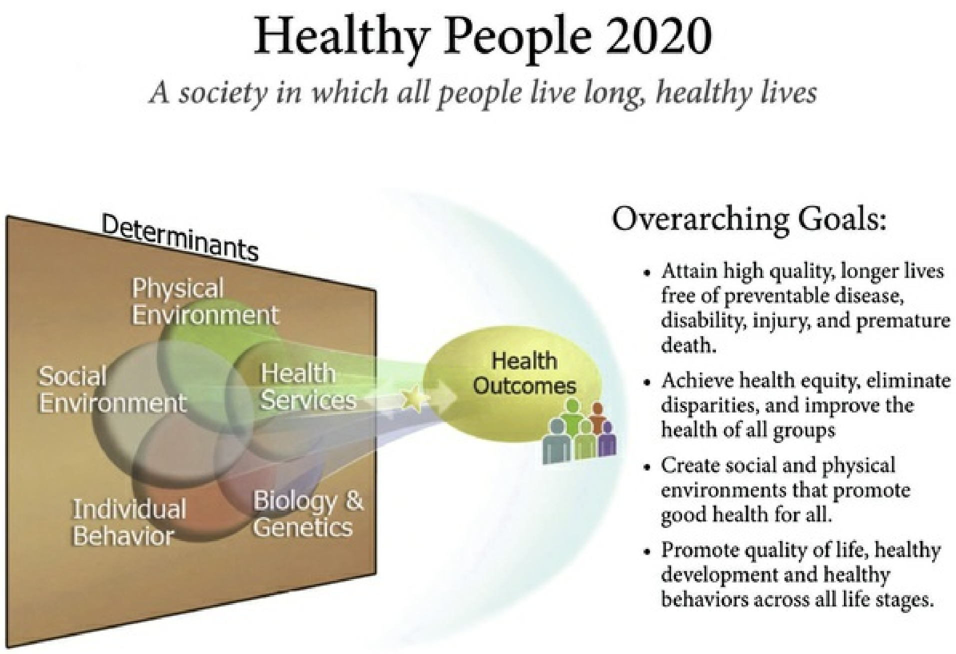

FIG 5.2 Determinants of health. (From Healthy People 2020. Washington, DC, U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion. http://www.healthypeople.gov/2020/about-healthy-people.)

The World Health Organization (WHO) has defined health promotion in this way:

[It is] the process of enabling people to increase control over, and to improve, their health. To reach a state of complete physical mental and social wellbeing, an individual or group must be able to identify and to realize aspirations, to satisfy needs, and to change or cope with the environment.

Health is, therefore, seen as a resource for everyday life, not the objective of living.[93]

Health promotion encompasses both health protection and prevention of disease. **Health protection strategies** are targeted at populations and include control of infectious diseases, immunizations, protection from occupational hazards, and government standards for the regulation of clean air and water, sanitation, and food and drug safety, among other things.[22] According to Pickett and Hanlon,[47] **prevention** refers to "anticipatory action taken to reduce the possibility of an event or condition from occurring or developing, or to minimize the damage that may result from the event or condition if it does occur."[47] Prevention strategies can be categorized into three levels: primary, secondary, and tertiary.

- **Primary prevention** focuses on healthy individuals to decrease vulnerability or susceptibility to disease or dysfunction. Primary prevention strategies include good nutrition, regular physical activity, adequate housing, recreation and working conditions, periodic physical examinations, and seatbelt laws.
- **Secondary prevention** focuses on people at risk or in the early stages of disease, with the goal of arresting the disease progression and preventing complications and disability. Secondary prevention strategies include early detection and intervention, in addition to screening for chronic diseases such as cancer, coronary artery disease, and diabetes.
- **Tertiary prevention** focuses on individuals with disease or disability and attempts to prevent further complications, minimize the effects of the condition, and promote social opportunity. Tertiary prevention strategies include rehabilitation services and the removal of architectural and attitudinal barriers to social participation.[23,33,66]

Health promotion and prevention approaches attempt to reduce risk factors and enhance protective or resiliency factors. **Risk factors** are human characteristics or behaviors, circumstances, or conditions that increase the likelihood or predispose an individual or community to manifest certain health problems. Risk factors include not only physical conditions, such as hypertension and behaviors such as smoking, but also social, economic, and environmental conditions, such as poverty, homelessness, exposure to radiation, and pollution.[23,66] Research indicates that "it is usually the accumulation of risk rather than the presence of any single risk factor that affects outcomes, and that multiple risks usually have multiplicative rather than merely additive effects."[22] Protective or resiliency factors are human characteristics or behaviors, circumstances, or conditions that decrease susceptibility or increase an individual's or community's resistance to illness, dysfunction, or injury. Protective factors include not only an individual's genetic profile, personality, and health behaviors, but also peer and family relationships, social norms, and social support.[22,66]

Models of Health Promotion Practice

In the health promotion field there are a number of individual, interpersonal, and community models and theories of health behavior change.[62,63] Two models are presented here briefly to help the OT practitioner better conceptualize health promotion interventions. The transtheoretical model (also known as the stages of change model) was designed to facilitate individual health behavior change and is therefore extremely relevant to OT practitioners. The PRECEDE-PROCEED model is an approach to planning that facilitates the design, implementation, and evaluation of health promotion interventions.[30]

Transtheoretical Model

The **transtheoretical model (TTM)** is based on the premise that change occurs in stages. The model consists of six stages: precontemplation, contemplation, preparation, action, maintenance, and termination. *Precontemplation* is the stage in which the person has no intention of taking action to modify health behaviors. This may be due to lack of knowledge, previous failed attempts at changing health behavior, or simply a lack of motivation. The *contemplation* stage is characterized by intention to modify behaviors within the next 6 months, but with some ambivalence about the costs and benefits of doing so. The *preparation* stage is an indication that the person is ready to take action in the very near future (30 days or less) and has demonstrated some initiative to plan the change strategies, such as reading a self-help book, joining a health club, or talking to a healthcare provider. *Action* refers to specific overt manifestations of lifestyle modification. The duration of this stage is a minimum of 6 months. After 6 months of sustained health behavior change, a person is considered to be in the *maintenance* stage. The goal of this stage is to prevent relapse into previous unhealthy behaviors. *Termination* is the stage at which a person is no longer tempted and has a sense of self-efficacy that permits him or her to maintain healthy behaviors even in stressful, high-risk situations. True termination may be unrealistic for most behavioral changes, and lifelong maintenance may be the appropriate goal for the majority of people.[54]

According to the TTM, change occurs through "covert and overt activities that people use to progress through the stages."[54] These activities or processes of change include consciousness raising, dramatic relief, self-reevaluation, environmental reevaluation, self-liberation, helping relationships, counterconditioning, contingency or reinforcement management, stimulus control, and social liberation. The developers of the TTM discovered that each of these processes is more or less effective during different stages of change. For example, consciousness raising is critical in the precontemplation stage for the person to progress to the contemplation stage. Contingency management and stimulus control strategies are most useful in the maintenance stage to prevent relapse.[54]

PRECEDE-PROCEED Model

As mentioned, the **PRECEDE-PROCEED model** is used for planning interventions. It consists of nine steps. The PRECEDE portion of the model is based on the assumption that health behaviors are the result of a complex interaction of multiple factors.[31,32] In the PRECEDE framework, these factors are identified and specific objectives are developed for a population. The PROCEED portion of the model consists of policy development, intervention implementation, and evaluation.

The first five steps represent a comprehensive needs assessment that evaluates a number of social, epidemiologic, behavioral, environmental, educational, ecologic, administrative, and policy issues that might affect the development, implementation, and ultimate success of a health promotion intervention. After all these factors have been considered, the intervention is developed and implemented. The final three steps represent a comprehensive evaluation of the intervention, including process, impact, and outcome measures.[32]

PRECEDE-PROCEED has been used to plan, implement, and evaluate health promotion interventions in school, work, healthcare, and community settings. It has been used to address a number of health issues, including smoking cessation, prevention of infection with the human immunodeficiency virus (HIV), seatbelt use, driving under the influence of alcohol, nutrition, exercise and fitness, blood pressure control, and stress management,[32] in addition to depression and pain in individuals with rheumatoid arthritis.[45] Typically, interventions designed using the PRECEDE-PROCEED model address multiple risk factors and health behaviors and use multiple intervention strategies.

Occupational Therapy Involvement in Health Promotion and Disease Prevention

According to population health measures, persons with disabilities (PWDs) experience health disparities compared with individuals without disabilities. PWDs are more likely to have high blood pressure, use tobacco, be overweight, and experience psychological distress. They are also less likely to get the healthcare they need, have an annual dental visit, engage in fitness activities, or participate in health screenings.[59] The Healthy People 2020 goal in the area of disability and health is to "promote the health and well-being of people with disabilities."[59,76] Several objectives in this area are appropriate for OT intervention (Box 5.1). The objectives in Healthy People 2020 address both individuals with disabilities and the environments in which they function because it has been recognized that disability is the result of the interaction between individual limitations and barriers in the environment.[59,76]

Box 5.1

Healthy People 2020 Disability and Health Objectives

Barriers to Healthcare

DH-4 Reduce the proportion of people with disabilities who report delays in receiving primary and periodic preventive care due to specific barriers

DH-5 Increase the proportion of youth with special healthcare needs whose healthcare provider has discussed transition planning from pediatric to adult healthcare

DH-7 Reduce the proportion of older adults with disabilities who use inappropriate medications

Environment

DH-8 Reduce the proportion of people with disabilities who report physical or program barriers to local health and wellness programs

DH-9 Reduce the proportion of people with disabilities who encounter barriers to participating in home, school, work, or community activities

DH-10 Reduce the proportion of people with disabilities who report barriers to obtaining assistive devices, service animals, technology services, and accessible technologies that they need

DH-11 Increase the proportion of newly constructed and retrofitted U.S. homes and residential buildings that have visitable features

DH-12 Reduce the number of people with disabilities living in congregate care residences

Activities and Participation

DH-13 Increase the proportion of people with disabilities who participate in social, spiritual, recreational, community and civic activities to the degree that they wish

DH-14 Increase the proportion of children and youth with disabilities who spend at least 80% of their time in regular education programs

DH-15 Reduce unemployment among people with disabilities

DH-16 Increase employment among people with disabilities

DH-17 Increase the proportion of adults with disabilities who report sufficient social and emotional support

DH-18 Reduce the proportion of people with disabilities who report serious psychological distress

DH-19 Reduce the proportion of people with disabilities who experience nonfatal unintentional injuries that require medical care

DH-20 Increase the proportion of children with disabilities, birth through age 2 years, who receive early intervention services in home or community-based settings

Modified from Healthy People 2020. http://www.healthypeople.gov/2020/topics-objectives/topic/disability-and-health/objectives

In the "Occupational Therapy Practice Framework: Domain and Process," third edition (OTPF-3),[3] the AOTA describes health promotion and prevention as appropriate intervention approaches for the profession:

Health promotion is equally and essentially concerned with creating the conditions necessary for health at individual, structural, social, and environmental levels through an understanding of the determinants of health: peace, shelter, education, food, income, a stable ecosystem, sustainable resources, social justice, and equity.[59,75]

The AOTA embraces WHO's definition of well-being as a "general term encompassing the total universe of human life domains, including physical, mental and social aspects."[3]

Health promotion programming can assist individuals, families, and communities reach a state of wellness in their lives.[66] Wellness has been described as the "perception of and responsibility for psychological and physical well-being as these contribute to overall satisfaction with one's life situation."[11] OT practitioners facilitate wellness through holistic and client-centered health promotion practice.

OT involvement in health promotion and prevention can assume a variety of forms. For example, primary prevention could include providing education to workers regarding their personal risk factors for injury on the job (eg, poor body mechanics) or altering the environment to reduce the incidence of workplace accidents. Secondary prevention strategies in OT practice include joint protection, energy conservation, and work simplification techniques. Fall prevention programs and home safety evaluations for frail elderly clients are other examples of secondary prevention. OT practitioners are already experts in tertiary prevention because they provide services to maximize function and minimize barriers to occupational performance.[33,66] It is important that OT practitioners begin to engage in primary and secondary prevention to build the evidence for occupational therapy in health and wellness. One population that could benefit from all three levels of prevention is military personnel.[21] As the Affordable Care Act enables an increase in OT services, telehealth OT services in all areas of health promotion and prevention can also be enabled.[16,17]

OT practitioners who develop occupation-based health promotion and prevention programs should be cognizant of the literature in public health and use existing evidence on best practice. The American Public Health Association (APHA) developed standards for the design and implementation of health promotion programs that can guide OT health promotion efforts. These five principles include[9]:

- Addressing multiple risk factors that are measurable and clearly defined
- Focusing on the identified and expressed needs and preferences of the client or target population
- Including evidence-based interventions with demonstrated effectiveness
- Using client and community strengths and available resources
- Designing programs that can be sustained and evaluated

Health Promotion and Occupational Participation

Health promotion interventions assist in enabling people with disabilities to more fully engage and participate in society. According to Hills,[34] there are three "pillars and related assumptions" of health promotion: (1) the primacy of people, (2) empowerment, and (3) enablement.

All three of these constructs, especially the primacy of people, focus on what the profession of occupational therapy calls **client-centered care** or **client-centered practice**. The client-centered practice can be defined as "[an] approach to service that incorporates respect for and partnership with clients as active participants in the therapy process. This approach emphasizes clients' knowledge and experience, strengths, capacity for choice, and overall autonomy."[11]

It is this client-centered approach that is health promoting for individuals with physical disabilities. Respect for and involvement in decision making, particularly in occupational participation, is a foundational similarity in both health promotion and occupational therapy. Occupational therapists facilitate meaning and assist people in seeing a hopeful future through occupational engagement and **enablement** of participation. This focus helps foster optimal health and well-being for people with disabilities. There is increasing OT evidence for client-centered care and client-centered practice.[51]

Empowerment speaks to the development of autonomy and self-control. Occupational therapists are skilled at creating contexts and occupation-based interventions that support and facilitate the feeling of being empowered. Harlowe[33] stated, "To increase control over and to improve one's health, one must not only be empowered to do so but also able to do so. To be able, one must possess the requisite skills, resources and knowledge." People with impairments and disabilities and those at risk for impairment and disability can be knowledgeable about the need to change health behaviors that undermine the promotion of healthy living (eg, smoking); however, they may be lacking skills and resources to achieve optimal well-being. "The fundamental assumption underlying the notion of enablement," said Harlowe,[33] "is that people have capacity to identify their own needs, to solve their own problems and to generally know what is best for them."

To effectively promote health and well-being, occupational therapists should embrace the belief that people are capable of identifying needs and are able to problem-solve life challenges. A practitioner who implements client-centered approaches, rather than expert-centered approaches (those that come from therapists without inclusion of clients or their caregivers), empowers people with disabilities to view themselves as valued and contributing members of society.

OT Practice Notes

OT practitioners must begin to make a paradigm shift and transition from defining themselves as rehabilitation specialists, to specialists in occupation, health promotion, and well-being, using occupation to facilitate healthy living. By listening to the narratives of people with disabilities and engaging in client-centered evaluation and interventions, OTs and OTA can enable people with disabilities and chronic illnesses to maximize their quality of life and participation in society.[44]

Powers[53] has provided a glimpse into the lived experiences of people with disabilities and their perceptions of health and well-being. She believes there is a need to develop more models of health and wellness that specifically address the needs of people with disabilities. However, the models currently used, some of which were discussed earlier, do enhance the knowledge of health professionals regarding people with disabilities. Health and illness can and do coexist on a daily basis for people with physical impairments and disabilities. As Pizzi and Renwick have found:

Living healthy and well is not something new for people with disabilities. Currently, a stereotype exists that suggests people with disabilities are "sick" or are "perpetual patients" who cannot be considered "healthy" or "well." However, for years people with disabilities have used strategies to maintain health and wellness, created supportive relationships, and accessed needed resources from various service systems. It is from these resourceful people that health professionals need to be willing to continue learning about issues related to health, wellness and long-term disability.[52]

Secondary Conditions and People With Disabilities

Secondary conditions can be defined as "those physical, medical, cognitive, emotional, or psychosocial consequences to which persons with disabilities are more susceptible by virtue of an underlying impairment, including adverse outcomes in health, wellness, participation and quality of life."[34]

The term *secondary conditions* expanded the term *comorbidity*, which is often used in medical settings. However, the term secondary condition adds three dimensions that are not fully captured by the term comorbidity: (1) nonmedical events (eg, isolation); (2) conditions that affect the general population (eg, obesity, which has a higher prevalence among people with disabilities); and (3) problems that arise any time during the life span (eg, inaccessible mammography). Children and adults with disabilities can experience secondary conditions any time during their life span.[18]

OT practitioners can aid in the prevention of secondary conditions by increasing client awareness and patient education about health, healthy habits and routines, and strategies to offset increasing secondary conditions or other disability. In view of the increased rates of disability among youth, it is particularly important to target activities and services that address all aspects of health and well-being, including promoting health, preventing secondary conditions, and removing environmental barriers, in addition to providing access to medical care. For an older person with a disability, it is important to target worsening coexisting conditions that may intensify and thus threaten general well-being. For example, declining vision combined with declining hearing can greatly impair mobility, nutrition, and fitness; these impairments may intensify and thus threaten general well-being.[76]

Hough believes that a paradigm shift from disability prevention to prevention of secondary conditions is needed. After the inability to prevent primary disability, "it is within the environment that the negative effects of secondary conditions could be ameliorated and even prevented."[35] Public health agencies often focus efforts toward primary prevention, but secondary conditions need to be of equal concern. The emphasis on policy change and education of health professionals on health promotion for people with disabilities can help foster interventions toward self-management of one's disability.

Stuifbergen et al.[71] emphasized the need for health practitioners to integrate health promotion strategies into neurorehabilitation for people with stroke. Krahn[39] emphasized the need to encourage self-responsibility for health to promote health and well-being while living with a disability, whereas Rimmer[64] viewed health promotion as a means to maintain functional independence by preventing secondary conditions. Trentham and Cockburn[75] stated, "People with disabilities have increased health concerns and susceptibility to secondary conditions. Having a long-term condition increases the need for health promotion that can be medical, physical, social, emotional, or societal."

The development of secondary conditions and occupational impairments can be directly related to a person's mental health. The psychosocial aspects of physical disabilities are as important to identify and help ameliorate as the physical barriers to occupational participation.

People who have activity limitations report having had more days of pain, depression, anxiety, and sleeplessness and fewer days of vitality during the previous month than people who do not report activity limitations. Increased emotional distress, however, does not arise directly from the person's limitations. The distress is likely to stem from encounters with environmental barriers that reduce the individual's ability to participate in life activities and that undermine physical and emotional health.[75]

Exploration of a person's disability, in the context of his or her life situation, and the physical and emotional impacts of that disability on participation exemplifies OT practice committed to optimizing quality of life (QOL). QOL is an outcome of occupational therapy, as defined by the OTPF-3. QOL is "a person's dynamic appraisal of his or her life satisfactions (perceptions of progress toward one's goals), self-concept (the composite of beliefs and feelings about oneself), health and functioning (including health status, self-care capabilities, role competence), and socioeconomic factors (e.g., vocation, education, income)."[3]

Stuifbergen and Rogers[72] interviewed 20 individuals with MS who shared their stories about health promotion, QOL, and factors that affected these areas of health. They identified six life domains related to QOL, including family (most frequently identified domain), functioning to maintain independence, spirituality, work, socioeconomic security, and self-actualization. Six broad themes also emerged related to health-promoting behaviors. According to Pizzi,[48] these included exercise or physical activity, nutritional strategies, lifestyle adjustment, maintaining a positive attitude, health responsibility behaviors, and seeking and receiving interpersonal support. OT practitioners play a key role in helping people actualize QOL through interventions that include these themes. Physical disability does not translate to being unable to participate and experience a good QOL. The paradigm shift to promoting health, well-being, and wellness is necessary to optimize QOL.

Evaluation: Emphasizing the Promotion of Health and Well-Being

Evaluation of people with disabilities must include the life story or narrative of the person as elicited through careful occupational history taking. This occupational profile is coupled with physical, sensorimotor, social, psychological, and emotional assessments to create a holistic view of the person. The most important element in evaluation is incorporating the client's perspectives of health and well-being, in addition to his or her values, beliefs, and contexts of living experiences. Client-centered care promotes healthy views of living for the client and the family system, from the beginning of OT intervention through discharge.

The Pizzi Health and Wellness Assessment (PHWA)[50] is a subjective, occupation-focused, and client-centered assessment tool created for adults. It measures, both qualitatively and quantitatively, self-perceptions of a person's health and wellness in six different categories. It is an assessment that is not focused on the disability, but instead emphasizes the client's abilities and current levels of well-being. Collaboratively, the client and therapist work on strategies that the client identifies as health promoting for each area; the therapist uses clinical reasoning to problem-solve health issues related to occupational performance. A systems perspective was used during the development of this assessment. Thus, it is a useful assessment and research tool for clients and for caregivers of people with disabilities. For example, a caregiver may report additional burden achieving occupational balance of roles and occupations, in addition to the caregiving responsibilities. The caregiver could benefit from OT intervention to address identified needs, based on responses from the PHWA. (The assessment is available by contacting the chapter author Michael Pizzi at mpizzi58@gmail.com.)

Table 5.1 shows a number of assessments from a variety of disciplines that may be helpful to occupational therapists as they consider how to enhance their health promotion interventions with people with disabilities.[36] The purpose of this table is to encourage practitioners to seek resources outside the discipline that may increase options, to facilitate the end goal of enhanced participation in occupations. Inclusion of a tool in this table should not be considered an endorsement of the tool. Readers are encouraged to examine assessment tools critically in terms of reliability, validity, sensitivity, and practicability, in addition to possible training or certification requirements prior to use. Similar tables and lists of assessment tools that are more commonly used and known by OT practitioners have been developed both within and outside the field.[10,19] With all assessments and resources, the OT practitioner should review and consider the material before an assessment is selected for a specific client or client group. When chosen appropriately and used competently, assessments can be an important tool in implementing client-centered care.[41,46] Table 5.2 offers additional guidance and considerations for the selection of an assessment.[67]

Threaded Case Study

Jean, Part 2

For Jean, the PHWA could be used to evaluate the following:

- Occupational habits, routines, and patterns that may be barriers to general health (e.g., smoking, eating habits).
- Balance in daily life activity and barriers to fuller participation in occupation.
- Stress and psychosocial areas that may exacerbate cardiac insufficiency, increase smoking and eating problems, and create insulin imbalance (use stress and depression scales to help assess these areas).
- Physical versus sedentary activity levels and reasons for these activity patterns.
- Risk factors for development of secondary conditions related to her physical function and past medical history.

• Contexts for occupation including the current support system at work and at home. Caregiver assessment, especially level of support for Jean, can be crucial for health promotion programming.

TABLE 5.1

Selected Assessments for Use in Health Promotion Physical Disabilities Practice

Assessment Type	Examples
Adjustment scales	• Profile of Adaptation to Live • Social Support Questionnaire
Other well-being scales	• Perceived Well-being Scale
Arthritis	• Arthritis McMaster-Toronto Arthritis Patient Reference Disability Questionnaire (MACTAR) • Health Assessment Questionnaire (HAQ) • Arthritis Impact Measurement Scales (AIMS)
Back pain	• Disability Questionnaire
Cancer	• Karnofsky Performance Status Measure (KPS) • Functional Living Index: Cancer
COPD	• American Thoracic Society Respiratory Questionnaire and Grade of Breathlessness Scale
Depression	• Beck Depression Inventory
Diabetes	• DCCT Questionnaire
Family scales	• Caregiver Time-Tradeoff Scale • Family Hardiness Inventory
Hardiness scale	• Hardiness Scale
Health risk appraisals	• The Healthier People Network Risk Appraisal • 1999 Youth Risk Behavior Survey
HIV/AIDS	• AIDS Health Assessment Questionnaire
Heart	• New York Heart Association Functional Classification (NYHA)
Life satisfaction scales	• Kansas Family Life Satisfaction Index • Index of Life Satisfaction
Multiple sclerosis	• Expanded Disability Status Scale
Neurologic head injury	• Modified Sickness Impact Profile
Orthopedic	• Musculoskeletal Outcomes Data Evaluation and Management System (MO-DEMS)
Pain	• Medical Outcomes Study Pain Measures (MOS)
Quality of life	• Overall Life Status

AIDS, Acquired immunodeficiency syndrome; *COPD,* chronic obstructive pulmonary disease; *HIV,* human immunodeficiency virus.

Data from Hyner GC, et al, editors: *Society of prospective medicine handbook of health assessment tools,* Stoughton, WI, 1999, Wellness Associates Publications.

TABLE 5.2

Organizing the Search for Assessment Evidence to Discuss With Different Decision Makers

Decision Maker	Decision Maker's Use of Evidence	Question Guiding Search for Evidence
Client and family members	To make informed decisions in choosing assessment procedures	Is goal attainment scaling a reliable and valid method for assessing personally meaningful goal achievement among 75-year-old men with Parkinson's disease?
Manager	To decide which assessment procedures should be supported and provided by the organization	What are the most reliable and valid methods for assessing personally meaningful goal achievement among individuals with Parkinson's disease?
Funder	To determine whether assessment procedures will effectively document important attributes of clients and their responses to rehabilitation	Same question as for manager

From Tickle-Degnen L: Communicating evidence to clients, managers, and funders. In Law M, editor: *Evidence-based rehabilitation: a guide to practice,* Thorofare, NJ, 2002, Slack, p 225.

Intervention

For people with disabilities, health promotion interventions are designed to optimize health status. One focus of these interventions is to help prevent secondary conditions from occurring and thus help people with disabilities maintain a level of well-being that allows them to engage in meaningful life roles. The Framework identifies six areas of focus for intervention: (1) areas of occupation, (2) performance skills, (3) performance patterns, (4) context(s) or physical environment, (5) activity demands, and (6) client factors.[3] All these areas affect each other, and, in turn, affect occupational performance and participation.

Interventions to promote health and well-being are implemented with consideration of all these areas. Five approaches to intervention are listed in the Framework. Although they all can relate to health promotion, the Framework specifically links the "create, promote" approach[3] to health promotion. The Framework indicates that this approach "does not assume a disability is present."[3] It can be used with people with occupational impairments and disability, as it is "designed to provide enriched contextual and activity experiences that will enhance performance for all persons in the natural contexts of life."[3]

As stated earlier, a paradigm shift in practitioners' therapeutic reasoning is needed for them to understand that health, wellness, and disability can be comingled and that interventions to promote healthy living with a disability are vital for a person with disability. Although the intervention approach of create or promote is most closely related to health promotion, the other four approaches (ie, establish/restore, maintain, modify, and prevent)[3] are all related to the creation of healthy lifestyles and well-being. They also should be considered potential approaches for the restoration and promotion of health for individuals with disabilities.

Often, such work is more successful when performed by a multidisciplinary team. An excellent example of a multidisciplinary program that uses several of the approaches discussed previously is the MS Care Center at New York University's Langone Medical Center.[37]

Threaded Case Study

Jean, Part 3

Jean's case shows how a health promotion approach for a person with disability can be implemented. In addition to standard OT services, a health promotion approach might be appropriate for this client or her family.

- If Jean's occupational habits, routines, and patterns are maladaptive and are barriers to healthy living, then patient education around developing healthy habits (including how her habits can result in further medical complications) should be implemented.

- An imbalance in occupations and occupational performance can contribute to the exacerbation of stress and to cardiac issues and can affect insulin production. Increasing Jean's awareness of the need for balance in daily life, including a balance of work, play, rest, sleep, and leisure, can assist her in creating a new structure for her daily living and optimizing her quality of life.

- Stress, depression, and other psychosocial factors can exacerbate preexisting conditions and lead to inactivity, poor self-esteem, and eventually poorer health. Client-centered care that incorporates meaningful and interesting occupation relevant to the person can help offset psychosocial conditions. Areas of concern could be feelings of worthlessness or ineffectiveness because one cannot occupationally engage in meaningful life activity. Jean may experience these issues because of her limited (and potentially limiting) medical condition. Exploring the impacts of stress, depression, and other factors on occupational performance and creating new occupational strategies for Jean can improve occupational performance and lead to Jean developing a future that includes "preventive occupations"—in this case, preventing further or future depression and managing her stress.

- After Jean's activity levels have been assessed, occupational interventions that promote a healthier heart, decrease smoking and overeating, and improve general mental and physical fitness are primary for her. Once Jean is aware of her abilities and develops a knowledge based on her real and perceived levels of activity, the OT practitioner can help her modify and adapt her lifestyle to incorporate activity that optimizes mental and physical health. It is important for Jean to optimize health for both present and future occupational performance in multiple contexts.

- Interventions must include measures to prevent the development of secondary conditions. For example, Jean has developed the warning sign (transient ischemic attack [TIA]) of potential future stroke. Preventive occupations can include increasing walks outdoors by 5 minutes each week to reach a daily target of 30 minutes maximum, working with an OT practitioner to help decrease smoking and overeating habits, or developing a stress management program. These health promotion ideas can be habituated in the acute care and home care settings and followed through by Jean and her loved ones.

- Caregiver support is critical for implementing and following through with a health promotion program. In Jean's case, she requires strong support to help her recognize and prevent future health problems (eg, reminders, environmental and verbal cues, ongoing education). She also will need support with smoking cessation, developing healthy eating (and cooking) habits, and increasing optimism for a healthy and bright future.

Summary

Readers were introduced to health promotion, well-being, and wellness terminology within the context of physical disability practice. The power of symbols was explained, and the roles of important constructs (eg, occupational justice) and the principles and practice of health promotion in helping to support best practice were demonstrated. Although practitioners have long promoted optimal health for clients of all ages, there has been little discussion about theoretical foundations for evaluation and intervention in health promotion. The OTPF-3 is a helpful guide that can assist practitioners in bridging gaps in service delivery and integrating health promotion into everyday practice. Through the Framework, the AOTA emphasizes occupational engagement and participation in life as the means to health and **wellness**, **quality of life**, and **well-being**. OT practitioners create and promote healthy living through careful attention to the physical, psychosocial, spiritual, social, and emotional abilities and challenges that support, or serve as barriers to, occupational performance. Holistic evaluation and goal planning using a client-centered approach should include health promotion goals that are codeveloped by the client and the practitioner.

Engagement in occupation to support participation in context is a key focus of the Framework. A health promotion approach enhances awareness of barriers to health and wellness, and strategies are developed to optimize health and well-being and prevent future health problems. Risk factors are considered, and interventions are implemented to support participation while a new lifestyle that is meaningful to the client is created. Client factors, although important to address to optimize occupational performance, are integrated into a top-down approach to care when a health promotion program is provided. In the case study, Jean can engage in a physical activity program designed to improve her cardiac status while she develops strategies to control her pain and discomfort (which are the secondary complications of her diabetes) as she works to decrease or cease smoking. If Jean decreases or stops smoking, this also will have a positive impact on the overall health of her family, especially her grandchildren, by decreasing or removing the health risks of secondary smoke exposure.

As practitioners learn more about health promotion, prevention, and wellness, they will be better equipped to promote healthy living within the context of a person's lifestyle. Client-centered and occupation-centered care that includes health promotion and focuses on the whole person living with disability can be occupational therapy's unique contribution to humanity.

Review Questions

1. Consider the importance of symbols. Do you think the current international symbol for accessibility is inclusive of all individuals with physical disabilities? Why or why not? Sketch an alternative symbol.
2. Describe the historical relationship between social activism and occupational justice for individuals with disabilities.
3. Identify an objective from Healthy People 2020 to support a new health promotion program you want to develop for your client group.
4. Describe the determinants of health as identified in Healthy People 2020 and discuss how occupational therapy can address these determinants.
5. Identify the levels of prevention, and give examples of potential occupational therapy interventions at each level.
6. Choose a health behavior of interest and describe the stages of change associated with that health behavior using the transtheoretical model.
7. Discuss how OTs and OTAs can facilitate resiliency for their clients with disabilities.
8. How would health promotion approaches fit within the Occupational Therapy Practice Framework?

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Personal and Social Contexts of Disability

Implications for Occupational Therapists

Sandra E. Burnett *

CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Describe the philosophy of the independent living movement and compare and contrast its view of the medical model and the social model of disability. Also, discuss the implications of the independent living movement philosophy in occupational therapy practice.
2. Describe the personal context of the disability experience, noting the effects of individual differences, gender, type of disability, interests, beliefs, and stage of life. Also, explain the usefulness of the stage models of disability adaptation.
3. Describe the social context of disability using the concepts of stigma, stereotypes, liminality, and spread. Also, discuss the effects on social context of person-first language, the culture of disability, and universal design principles.
4. Describe the ways the *International Classification of Functioning, Disability and Health* (ICF) challenges worldwide, mainstream ideas of health and disability.
5. Discuss various relationship issues between the occupational therapist and the person with a disability.

KEY TERMS

Devaluation

Independent living movement

Liminality

Medical model

Person-first language

Social model

Spread

Stereotype

Stigma

Threaded Case Study

Angela, Part 1

The following case study is a first-person account by Angela More, who describes her experience of living with a severe physical disability that she acquired as an infant.[63]

In Western society we live in an environment where image is valued and sought after. Acquiring spastic cerebral palsy through no fault of one's own directly challenges and contradicts this. We tend to base our judgments of other people on the way they "look" before we even speak to them or get to know them. For many centuries Western society has valued and aspired to having the "perfect" image and body shape.

The children's nursery rhyme "Humpty Dumpty" illustrates that as far back as the 1600's when something was broken people felt there was a "need" to correct the damage and fix the problem. Maybe "Humpty Dumpty" was an obese person who fell off the wall, maybe he was an intoxicated soldier, maybe it was a name of a large cannon that was sitting on the wall of Colchester … which was set up to protect the city. No matter what the situation, the reader is left with a feeling that whenever there was something wrong with Humpty Dumpty, there was a need to correct the error *and fix what was broken. Because he was "different" or "not normal" in one way or another he was not valued for his role by members of his local community. The reader is left to form his or her own opinion. Society continues to hold those views to this very day.*

I am a secondary emergency teacher, have completed a Masters in Special Needs along with having a permanent acquired physical disability, spastic cerebral palsy, affecting my four limbs. This was caused after an initial medical examination was "botched" by an unsupervised intern—the specialist left the theatre during the procedure when I was 14 weeks of age, over forty years ago. Further medical testing was arranged because there was a belief that I may have had hydrocephalus—swelling and excess fluid buildup around my brain causing it to be unnecessarily enlarged for my age. In my family's case this seems to be an hereditary trait that has passed from my father who has a large head. It's interesting to note that an obstetrician made a comment to my sister on the size of her toddler's head. Since 1970 I have had a range of both positive and negative medical experiences. As a child who wasn't able to comprehend what and why things were happening I was very frightened and often very upset. As an adult I am able to understand what and why something is going on and I ask questions when needed.

"Normal" has always been completing the same things but in a different way to other people while intending to reach the same outcome of "success." There are many ways to skin a cat and "normal" is a term that has a very broad definition which is dependent upon the individual and the situation at hand. What is "normal" for me will be "different" for someone else. What is "normal" for another person will be "different" for me. It's the differences between individuals that we come to value later on in life. That I cope in a different manner from others has clearly been aided by being able to make use of information technology—laptop, mobile phones, printers, etc.—along with a feeling that the acquired physical disability that I have is a small part of the overall person that I am. Before I became a person with an acquired disability I was a normal, happy, healthy baby and even now although I will always have a disability I have excellent health and choose not to be defined by having acquired a disability. Unlike some other people I consider myself to be a person who "acquired" a disability instead of being a "disabled" person. Having an acquired physical disability is a small part of the person I am. The manner in which I acquired a severe physical disability is what I have come to value along with the fact that I have done well in many areas of life while having such a severe condition.

Unlike people who had disabilities in the 19th century who were not given such an opportunity, I have the opportunity to participate freely in society. Traditionally people who had disabilities in Europe during early 20th century (1930's) Germany were considered along with those who were Jews, gypsies or homosexuals to be "pseudo humans" … who were considered to be the "deserving poor" who were "appropriate objects for pity, protection and charity" … who were deliberately excluded. They were seen as "victims" who were different and were segregated from their local communities because the view was held that they had nothing to offer and were feared as they were often controlled by copious amounts of medication.

The Medical Model of Disability, which operated until the mid 1970's in Australia, maintained the view that people who had a disability needed to be "cured and cared for" … which automatically disempowered and disengaged them within their own communities. The Medical Model of Disability defined an individual by his or her disability and sought to control the person's access to medical care, education, employment, housing and leisure. At no stage did this Model of Disability provide families with any notion of "hope" for their member who had the disability and usually painted a very black and bleak picture for their future outlook.

Medicine still doesn't offer a lot of hope for people with conditions as serious as spastic cerebral palsy. Traditionally on medical advice individuals with severe physical disabilities were admitted to fully serviced institutions where all of their physical needs were met within the one facility away from their families and the general community, which reinforced the "stigma" of fear and difference. Once admitted to such institutions it was uncommon for people to leave them. It wasn't until after the days of deinstitutionalization that people with disabilities formed self-help groups, started to seek and exercise their rights to equal opportunities, and commenced making a contribution to the local communities in which they lived. In Australia, this took place during the late 1960's and 1970's and was supported through the choice that my parents and others in similar situations made when they chose to keep their disabled children within the family unit even though they were advised to "leave the baby" in a hospital as it would be likely to die a natural death sooner rather than later.

As a small child I can clearly recall not a lot of "hope" offered from medical professionals for my own lifelong outcomes and now it's interesting to think that no one has ever really taken a look back to see what I have accomplished. From a medical point of view as a young child I [was] able to recall there were many appointments, a few operations, living with the label "Disability" 215 and very intense physiotherapy performed by my mother up until the time of puberty when my family was told that there was not a lot more that could be done to improve my situation. At one stage later on I did make inquiries into having my hands straightened but didn't follow it through when I was told they "would look better but wouldn't function any better." There was not much point in going through major surgery for little or no improvement. Apart from that I have never been the type of person who has sought to "doctor shop" to try and find a way of improving my physical being.

Nine months ago after walking in off the street for a mammogram one afternoon it was found that I had early stage breast cancer. As a result of this diagnosis I had a mastectomy and am about to complete my 6th and final round of optional chemotherapy as a preventive measure. I had all the necessary tests completed which included a CAT scan which came back clear, a bone scan which was clear, my heart checked, many blood tests, a port put in my arm to prevent my veins from deteriorating under a local anesthetic in addition to any other necessary treatment. Radiation therapy was very quickly ruled out as an option because I am unable to raise my left arm above my head. This rather suited me because I would not be at all comfortable being on a bed that needed to move in and out of the radiotherapy machine.

Having these tests completed reinforced to me that the disability I acquired was exactly that—acquired—through an unnecessary chain of events. My health has been excellent for over forty years and having spastic cerebral palsy hasn't affected it. With no history of cancer in my family it has been like dealing with the great "unknown" on so many levels but as an adult I am determined to exhaust all of my options in order to overcome this. At the time when the initial diagnosis was made I was extremely concerned about the effect surgery and treatment would have on my disability. Fortunately I needn't have worried because there has been no effect at all. In addition the surgery took place on the same date 42 years later. The surgery went well and I was discharged within two days of the procedure and made a good recovery before starting chemotherapy. I did smile when both the surgeon and anaesthetist were quick to inform me separately that "there was a product available now called Botox …" that may get my left arm to be able to form a fist. Quietly and confidently I reminded them both that I was there to be treated for breast cancer and although I appreciated their thoughts I had accepted my disability many years ago. The surgeon the following day commented on my "constructiveness." I smiled and thought why fix what isn't broken. It would have been different if I had gone seeking treatment to fix the disability.

While I was extremely shocked at being diagnosed with a serious health condition at a young age I *feel very fortunate that this was able to be picked up and treated quickly. While what has taken place in one sense seems extreme, as a preventive measure I feel it was the way to go. In a country like Australia I had gone from being outside the health system to front and centre within eight days. In some other parts of the world such diagnostic testing is simply not available let alone treatable. One would simply die and the cause would not become known until an autopsy was completed.*

There were many falls, many tears and major fears as a young child. However, as an adult, while there are still some occasional falls I consider myself to be in a good position because I understand what event took place on a particular date and the reason why it happened. Presently having no hair my scalp bears testament to the number and severity of falls that I had as a child by the scarring that is clearly visible. I know where the incident happened and understand that no one in their right mind would wish to inflict this type of disability onto a small and innocent baby. While it's visual and one can clearly see that there is a problem I consider it to be but a small part of the overall person that I am and how I perceive it determines how other people in turn perceive it to be.

Over forty years I really haven't had a lot to do with the healthcare system as a result of acquiring spastic cerebral palsy because I chose to accept it and not fight it. I haven't sought to be cured or fixed. I am still a daughter, sister, aunt, sister-in-law, teacher, cousin, niece, friend and neighbour regardless of what state of health my body is in. As long as I am relatively healthy I will always be happy and contented with life.

Critical Thinking Questions

1. How does Angela describe society's view of normalcy and difference in comparison with her view?

2. What impairment-based difficulties and participation restrictions are described?

3. Discuss Angela's use of language about herself.

Moore, Angela. A medical mishap. Narrative inquiry in Bioethics 3:3, 213–216, 2013, Johns Hopkins University Press. Reprinted with permission of Johns Hopkins University Press.

Throughout its existence, the profession of occupational therapy (OT) has promoted independence and self-direction for those whose lives include the experience of disability. The current Occupational Therapy Practice Framework (OTPF-3) supports this long-held value, declaring that the overarching goal of OT is “achieving health, well-being, and participation in life through engagement in occupation” (OTPF-3, p. S4).[5] Since the mid-1970s, the **independent living movement** has gained both scholarly and public support in its efforts to promote the same end goal. It has transformed both the models of disability and the ways we think about disability. Depending on how OT practitioners (as members of the healthcare and rehabilitation team) and independent living movement activists (composed primarily of leaders with disabilities) interact, the result can be a marriage of commonly held goals, or a battleground of cross-purposes. This chapter describes the ways OTs may approach a call for accord with independent living activists.

Social scientists, such as Irving Zola, who had both high academic, scholarly credentials and personal experience with physical disability, began an infusion of their work into the rehabilitation and social program literature in the early 1980s. Two of Zola's books, *Missing Pieces: A Chronicle of Living with a Disability*[102] and *Ordinary Lives: Voices of Disability and Disease,*[103] provide an insider's discovery of the unspoken-of social experience of disability that had been concealed in plain view. Zola's field notes chronicle a discovery self-framed within the social status of the researcher having a physical disability that others could easily see. For many who were also drawn to the independent living movement, it was the proverbial elephant in the room, finally acknowledged in their professional lives.

The independent living movement, which achieved public recognition in the early 1970s, is a political social justice, civil rights challenge to prior disability policy, practice, and research.[23] It is aligned with other minority groups (eg, race, gender, ethnicity) in a call for equality in the dominant society, a civil rights movement founded on the idea that the difficulties of having a disability are primarily based on the myths, fears, and stereotypes established in society today.[80] This movement seeks to modify the convention of habilitating the isolated individual with disability through social and environmental changes.[80] A major political achievement was passage of the Americans with Disabilities Act (ADA), which was signed into law in 1990, and the enactment of the ADA Amendments Act of 2008 (and subsequent partial amendments in 2010 and 2011) (see Chapters 2 and 15). The ADA's broad definition of disability emphasizes that perhaps the most significant factor people with various disabilities have in common is the experience of disability-based discrimination.[37,38] This civil rights movement has had its share of detractors, including representatives of the healthcare industry, but it has sustained an expansive momentum.[42]

The social justice movement successfully entered the international arena on May 3, 2008, with the United Nations' Convention on the Rights of Persons with Disabilities (CRPD). The CRPD treaty obligates the UN member nations that sign it to provide equal access to healthcare and related services for people with disabilities; it represents the first legally binding international instrument that specifically protects the rights of persons with disabilities. The UN has estimated that 1 billion people (residing in 1 of 4 households) have at least one disabling condition.[31] The CRPD is also the first treaty in which nongovernmental organizations were present during negotiations and could offer interventions. People with disabilities participated as members of organizations for persons with disabilities, delegations from many countries, and UN organizations. Partly because of this inclusive process, the CRPD has received wide support, and as of 2016, 157 countries had ratified it.[31]

The core principles of the CRPD are respect for human dignity, nondiscrimination, full participation, social inclusion, equality of opportunity, and accessibility.[86] The American Occupational Therapy Association (AOTA) is in full agreement with this focus. The AOTA's "Occupational Therapy Practice *Framework: Domain and Process*," third edition (OTPF-3), the current form of the Framework, emphasizes these two points:

- The relationship between occupation, justice, and client-centered practice is increasingly a focus of the OT profession.[5,15]
- Occupational therapy proclaims the necessity and power of occupation in the everyday lives of all human beings. The disruption and return of occupation for those with disability is our therapeutic focus. Health is supported and maintained when individuals are able to engage in their valued occupations. Occupation always occurs within the context of interrelated conditions that will affect client performance.[5,15]

The occupational therapist must recognize that the social environment and personal context of disability are inextricably intertwined in the lived experience of those with disability, and this must be taken into consideration when finding ways to facilitate engagement in occupation. This chapter seeks to illuminate these contexts so that valued goals are achieved.

Client-Centered Self-Report

A justified complaint by those who have found their voice in the independent living movement is that medical and rehabilitation professionals focus on an attempt to classify the individual with a disability and do not listen to the client's personal account.[48,68] The medical rehabilitation tradition of case presentation seeks to frame the individual with the disability in the professional's point of view. There can be numerous goals for a “case” description: treatment justification, entitlement to support services, legal testimony as an expert witness, reimbursement of costs, social science research, educational process, and the like. The role of the OT is to work with the client to achieve an individual desired outcome.[89] Occupational therapists are called to create a client-centered description of the individual's occupational self, one that must include the interrelated conditions of the social and personal contexts both surrounding and within the client. We must include the personal view of the client's own context to frame an accurate occupational picture that is responsive to the individual's values and goals.

Personal Context

Disability Experience

People who acquire disability share the common experience of feelings of shame and inferiority, along with avoidance of being identified as a person with disability.[98]

Neuroscience research, using state-of-the-art brain imaging, has confirmed what biological, psychological, and sociologic studies and theories have proposed; chiefly, that humans are social beings, and a neurological response at the most basic physiological level is evident when conditions of social interaction are varied.[2] In short, we are drawn toward interaction with "our kind," and isolation from others may be deemed socially abnormal.

Community psychologists note that the individual forms an identity in relation to the social environment. For those who deviate from societal-based norms, problems arise when individuals are assigned an identity and a status that is demeaning and lacks elements of personal choice and human rights.[72]

A commonly experienced effect of having a disability is the social stigma associated with all individuals with a disability, regardless of the condition.[92] The psychological effects of being labeled a "disabled individual" is considered to be the process of **devaluation**. To be continuously perceived as an individual "blemished" in form or function is psychologically demeaning, regardless of the nature of the individual condition.[92] The broadness of the term *disabled* imbues each individual with a disability with characteristics that are outside the norm.[92]

The individual with a disability must attend to an array of stimuli perceived as abnormal: some biological (eg, paralysis); some environmental (eg, inaccessible entrances); and some social (eg, the patronizing behavior of others or preferential access to an event). It is a continuous flow of perceptions, which are not experienced by those who are not disabled. In short, many of the experiences of an individual with a disability are not shared by the normative society. Isolation and a lack of accord with one's thoughts and feelings compound the list of nonnormative situations.[92]

In defining the experience of disability, social scientists[92] and psychologists have constructed what can only be described as the psychology of disability. Of interest, however, is that exploring the differences inherent in the social experiences of individuals with a disability may result in exaggerations that widen the gap in perceived differences from the social norm. Thus, devaluation of the individual with a disability may be perpetuated by those seeking to understand and even modify the conventional social perceptions. The fact is, human beings are more alike than different, regardless of variances in their physical bodies, sensory capacities, or intellectual abilities.[14]

It has been suggested that individuals with a disability shape their personal identities and social conception from their personal experiences through the modes of nonconformity and the outcomes of interactions with others in society. Specifically, if the individual considers his or her situation as nonconformative, it is due to the imposition of external societal factors and not a symptom of a condition.[84] What is actually known about the similarities and differences between people with and people without disability? Siller[84] reported that as soon as one departs from the direct fact of disability, evidence can be provided to demonstrate that people with disabilities do or do not have different developmental tracks, social skills and precepts, defensive orientations, empathetic potential, and so on. The data suggest that if people with disabilities do present themselves as different, it is often a secondary consequence of the social climate, rather than of inherent disability-specific phenomena.[84]

Another study reported that a group of people with disability showed no differences in life satisfaction, frustration, or happiness compared with a group without disability.[94] The only difference found was on ratings of the difficulty of life. People with disability judged their lives to be more difficult and more likely to remain so. For example, people with chronic but not fatal health problems may not only seem to be quite happy, they also may derive some happiness from their ability to cope with their difficulty. We may question the assumption that physical limitations are directly related to happiness. Instead, many people with disabilities may find happiness despite their disabilities, even though the able-bodied public may expect otherwise.

Individual Differences

Social scientists have observed that an individual's reactions to having a disability are influenced not only by the time of onset, type of onset, functions impaired, severity and stability of the disability, visibility of the disability, and experience of pain; they also are affected by the person's gender, interests, values and goals, inner resources, personality and temperament, self-image, the activities affected, and environmental factors.[92]

This observation is supported by Angela's first-person narrative in the case study: "'Normal' has always been completing the same things but in a different way to other people while intending to reach the same outcome of 'success.'"

Vash and Crewe[92] believed that different disabilities (eg, blindness, paralysis) generate different reactions because each creates different problems or challenges. However, the insider-outsider perspective also applies to people with disability. Thus, the person with a disability may feel that his or her condition is not as difficult as that of others. For example, a person who is blind may feel that it would be worse to be deaf. This idea has also proven to hold for the severity of the individual condition. A person with the inability to walk may have the view that this disability is not nearly as difficult as having no legs. Reactions are also tempered by the impact of the disability on the valued skills and capacities the person has lost. For example, a person who loves music more than the visual arts, such as photography, may have a stronger reaction to loss of hearing than a person who had a more dominant inclination with another sensory channel (eg, a "visual person" with the opposite pattern). Similarly, the severity of disability may not have a direct, one-to-one relationship with the person's reaction to it. (Note the use of the word *may* throughout this paragraph, indicating that reactions are individualized and unpredictable.)

The visibility or invisibility of impairment may influence a person's response to his or her disability because of social reactions. For example, invisible disabilities, such as pain, may create difficulties because other people expect the person to perform in impossible ways. One woman with arthritis indicated that it was easier for her to go grocery shopping when she wore her hand splints because then her disability was visible and people would carry her packages for her without her having to ask.[92]

The stability of the disability or the extent to which it changes over time may influence reactions both for the individual with a disability and for those surrounding him or her. In some progressive disabilities, the individual faces uncertainty as to the degree of limitation and, in some cases, the likelihood of a hastened death. Reactions to such disabilities are shaped by these realities and by what the affected people tell themselves about their projected futures.[92] When hope for neither containment nor cure is substantiated, the person may experience a new round of disappointment, fear, or anger. The prospect of a terminal condition can affect each person in individual ways. Some individuals may ignore even the experience of pain, which tends to overtake consciousness. Reactions to pain are highly influenced by culture. Particularly important for occupational therapists is the issue of finding and implementing resources to assist the client in developing effective and gratifying lifestyles. The occupations, activities and performance patterns affected by a disability become the focus of the OT. Core issues addressed by the OT must also include the individual client's spiritual or philosophical base (ie, what fulfills the individual).

Gender has also been found to elicit some of the most problematic issues for clients in their relationships with others. Gendered societal expectations dictate that individuals strive to achieve often idyllic sexual roles. For example, the ideal for women to be physically perfect specimens or to carry the major responsibility for managing the home and caring for children may be of more concern for a female client than a male client.

Temporal elements of activity are part of the impact of disablement. The ways the disability interferes with what a person is doing, with the interruption of ongoing activities, will influence the individual's reactions. Activities never done but imagined as future goals may be equally powerful influences in the person's reactions.

Interests, values, and goals influence a person's reaction to his or her disablement. The individual with a limited range of interests may react more negatively to a disability that interferes with or prevents pursuit of these interests, whereas an individual with a wide range of interests and goals may adapt more readily. Many people may not even be aware of their own interests, values, and goals and therefore may not be conscious of the ones that have the potential to lead to satisfaction after acquiring a disability. Thus, the client with multiple interests, occupations, activities, and goals has a greater probability of achieving satisfying participation in life through engagement in occupation. The resources that the individual possesses for coping with and enjoying life are assets that may counterbalance the devastation of loss of function. Some of these, such as social skills and persistence, may be developed to a level enabling paid employment, whereas others, such as artistic talent or leisure skills, may contribute to a more satisfying life.[92]

An often overlooked aspect of the individual with a disability is the importance of spiritual and philosophical beliefs in dealing with the disablement. People who acknowledge a spiritual dimension of life and who have a philosophy of life into which disablement can be integrated in a meaningful, nondestructive way may be better able to deal with having a disability.[92] Specific religious beliefs may or may not be helpful. A study of life after a stroke among African Caribbean women in the United Kingdom described a tension involving three elements: between religious beliefs and faith (resignation to "God's will") and the medical approach to stroke (following medical rules for healthy living); and the potential benefits that religion and church play in stroke recovery.[64] The person who views having a disability as punishment for past sins will respond differently from one who views the disability as a test or opportunity for spiritual development.

The OT must acknowledge the importance of the person's environment in influencing his or her reactions to having disability. Immediate environmental qualities, such as family support and acceptance, income, community resources, and loyal friends, are powerful contributors. If a client is hospitalized, the institutional environment also has a profound effect, especially the attitudes and behaviors of the staff members. The culture and its support (or lack thereof) for resolving functional problems or protecting the civil rights of people with disability are other significant influences.

Stage Models of Adjustment to Disability

The medical model generally provides the medical rehabilitation team with a four-stage process of adjustment or adaptation to the experience of disability (Box 6.1).[65]

Box 6.1

Medical Model

Four Stages of Adjustment to the Experience of Disability

Stage 1: Vigilance

Becoming engulfed at the initial point of injury or acute illness. Within the intense, immediate crisis of the event, many individuals report a separation of the subjective and objective body. They experience an internal state of calmness contrasted with outward behavior of extreme distress and screaming in response to severe pain. This stage ends when the person surrenders to the care of others, often emergency medical personnel.

Stage 2: Disruption

Taking time out, a disruption of reality, often described as feeling as if one is in a fog. Significant others do not merely provide emotional support, but also serve as an orienting force in an otherwise confusing, chaotic environment. They serve as an emotional anchor in a disordered world of the acute care medical environment.

Stage 3: Enduring the Self

Confronting and regrouping, improvement in reality orientation with the implications of the injury recognized. This is the stage in which the severity of the physical limitations is faced. Support from others is needed to control a sense of panic and fear of the diminished physical ability. At this stage even small gains witnessed in therapy sessions are interpreted as evidence that a full recovery is possible. This preserved sense of hope for reclaiming previous abilities may help the person endure the initial healing process for burns, amputation, and spinal cord injuries by allowing the individual to hold onto his or her faith in medical miracles and the ability to return to prior physical ability.

Stage 4: Striving to Regain the Self

Merging the old and new realities is a process marked by frustration in the attempts to regain previously taken-for-granted tasks (eg, walking and feeding oneself) through the use of compensatory methods. There is a feeling of exhaustion in developing new routines, frustration with the limited physical capacity to participate in a range of activities, and a need to reformulate goals.

Adapted from Morse JM, O'Brien B: Preserving self: from victim, to patient, to disabled person, *J Adv Nurs* 21:886, 1995.

Evidence exists only for emotional distress, which is commonly experienced as an initial response that tends to diminish over time; however, even that is not a universal experience. Rehabilitation researchers are turning to a far more complex process involving changes in the body, body image, and self-concept, and the interactions between the person and the environment. For example, little attention has been given to individual personality differences (ie, personal context), which are well recognized as contributors to all human endeavors (eg, work, marriage, play, education, and occupations) expressed in an environment. Rather, the disability has been seen as the sole determinant of the individual personal experience.

The terms *adaptation, adjustment,* and *acceptance* are commonly applied to the process of resolving the negative experiences of having a disability. In recent years, social scientists aligned with the social model of disability have questioned the usefulness of such terms. They point out that service professionals have become preoccupied with the psychological loss, or stages of bereavement, process to describe appropriate adjustment by those with an impairment. The studies usually cited, which involve a four-stage process of psychological adjustment and rehabilitation applied to those with a spinal cord injury, are troublesome for the social model scientists.[8,9] That process is usually thus: the initial reaction of shock and horror is followed by denial of the situation, leading to anger at others, bargaining, and finally to depression as a necessity for coming to terms with the acquired impairment. The acceptance, or adjustment, process takes 1 to 2 years to resolve.[8] The process draws from Kübler-Ross's seminal work describing the grief process, the stages of loss of those who are dying, with an implicit assumption that the former, nondisabled self is dead and must be mourned.[50]

The **social model** views the notion of adaptation, adjustment, or acceptance within an unjust society as abhorrent at the most basic level of human rights and social justice. Other minority groups have not tolerated such treatment in democratic societies, and disability rights activists believe that those with disabilities should not, either. They point to a major flaw in these stage models: what about the physical condition that is progressive in nature (eg, multiple sclerosis, rheumatoid arthritis) or limiting; physical changes as the body ages associated with lifelong disorders (eg, spina bifida); or early in life trauma (eg, spinal cord injury, or post-polio syndrome)? The stages of loss concept, common in the medical model, offers little to community-based occupational therapy, which more typically addresses the problems of chronic or progressive disability. Some might say that the stage of loss concept, at best, suits the emotional needs of clinicians to have a sense of closure and resolution as patients move out of acute medical rehabilitation.

Social Model of Disability

There has always been tension between the medical model of disability, which emphasizes an individual's physical or mental deficit, and the social model of disability, which highlights the barriers and prejudice that exclude people with disabilities from fully engaging in society and accessing appropriate healthcare (see Chapter 2). Unfortunately, one of the biggest barriers to accessing appropriate healthcare is the attitude of health professionals, which might further isolate and stigmatize people with disabilities. Despite what many health professionals might assume, people with disabilities can be healthy, do not necessarily need to be "fixed," are often independent, and might well be consulting the health professional for a reason unrelated to the disability. Conversely, people with chronic conditions, such as chronic obstructive pulmonary disease (COPD), frequently are debilitated by their condition, yet are often not perceived by health professionals as having a disability. Such perceptions matter; people with disabilities have the same health needs as other people and are entitled to specific rights, including the right to make choices about their healthcare.[99]

Healthcare in general is often inaccessible for those with disabilities. The Disability Rights Education and Defense Fund (DREDF) has produced an acclaimed video series, *Healthcare Stories,* that focuses on widespread barriers to care (*http://dredf.org/healthcarestories/*). Three short excerpts from this series feature stories about inaccessible examination tables and weight scales and healthcare provider misperceptions and stereotypes. Advocates and practitioners alike recount their personal experiences and recommend actions for improving care. These downloadable videos present an all-important human perspective and affirm the barriers to care identified in a decade of research. The OT literature documents specific prejudice toward those who are obese.[93]

Bioethicist Peter Singer[83] has proposed that healthcare rationing decisions be based on and quantified according to a quality-adjusted life-year (QALY), which might assess the relative value of life with a disability by comparing it to the value of life without a disability. This is in stark contrast to a social justice model, in which each individual has equal value.

Stages of Life and Self-Concept

Many views of the individual and of groups of people divide the human life cycle into three categories: childhood, adulthood, and old age. The stages, statuses, and transitions are defined largely by social institutions (ie, the family, economic demands, and education) and the dominant culture. One might expect that by identifying the onset of a physical impairment in the life cycle, one may know the trajectory of many factors, including self-concept. The stage of life at which disability occurs is thought to influence the person because it affects the way he or she is perceived by others and the developmental tasks that might be interrupted. In that vein, the three main trajectories commonly identified are (1) people whose impairment is diagnosed at birth or in early childhood; (2) those who acquire an impairment during adolescence or the early adult years, usually through illness or injury; and (3) older people whose impairment is most often attributed to the aging process.[8]

The person who is born with a disability or acquires one in infancy or childhood may experience isolation or separation from the mainstream in family life, play, and education. The trajectory of an early-onset disability is thought to include socialization with pervasively abnormally low expectations and a lifestyle with few positive role models to demonstrate alternative ways. Families and special-needs schools may hide children with congenital impairments to protect them from discrimination and rejection by bullying peers. A "disabled identity" results in the child with a disability who grows up in a household and community with no other disabled person, has lengthy periods of hospitalization, is provided segregated special education services, and lives in a largely inaccessible physical environment.[8]

A 2003 study of self-image of a group of Swedish young people with cerebral palsy revealed that most respondents viewed themselves in a very positive manner and rated markedly higher self-image than norm groups.[1] The influence of a generally positive or negative attitude toward oneself formed early in life and the sparse interaction with others outside the family have been proposed as explanations for these research findings. Future studies must focus on the relationship between self-image and social interaction with people outside the immediate family as the individual with an impairment begins to interact with a wider social group.

Barnes and Mercer[8] concluded that many young people with disabilities do not experience the full impact of disablement until they seek to participate in more peer-directed leisure pursuits or are expected to join the workforce. Compared to nondisabled peers, young people with disabilities report lower job aspirations, poor or nonexistent career advice, employer discrimination, and a feeling of marginalization in the job market. There is evidence that the age of key major life transition indicators (eg, leaving home, getting married, becoming a parent, and entering the job market) occurs later among those with disabilities than those without disabilities.[8]

It cannot be assumed that negative effects on self-esteem will continue in people who experience an early-onset disability. A longitudinal study found that although adolescent girls with cerebral palsy scored significantly lower on physical, social, and personal self-esteem evaluations, as adults the same individuals no longer scored significantly different from able-bodied groups.[60] The authors speculated that factors leading to their subjects' change in self-esteem may have been due to an expanded range of environments in which to interact, better social relationships, or a wider variety of experiences in education, work, and commerce than in earlier years.

A study of self-evaluations of global self-worth in adolescents with disability (eg, cerebral palsy, orofacial clefts, and spina bifida) found that the participants' self-evaluations did not differ from those of an able-bodied comparison group. The assumption that self-esteem is necessarily reduced by a disability effect needs to be reassessed in light of recent studies.[49]

A person who acquires a disability later in life may face different issues, such as the need to change vocations, find a marital partner, or remain a part of his or her culture through the routines of daily life.[11,92] Some are forced into a sudden and substantial reevaluation of their identities, a need perhaps reinforced within a short time by downward economic and social mobility. A distinction can be made between experiencing discontinuity with a sharp shift into unemployment and the drift of a more gradual process of downward mobility. Generally, a chronic illness is less drastic than an accident resulting in disability, affording the individual the opportunity to plan and adjust to threats to self-identity.[8]

It has been proposed that individuals who acquire an impairment in middle age may view the onset of a disability as an unexpected, personal tragedy more often than do those who are elderly. The elderly and those who surround them, both family and service providers, may interpret the disability experience as an inevitable fact of life and therefore more of a normal course of events.[8]

Social scientists are calling for research involving people with disabilities that includes much more descriptive factors, such as the visibility of the impairment, the distinct type of impairment, whether the impairment was preventable, the age of onset, the influence of public perception on the individual, and social interactions. Increasingly, many people with disabilities who come from various backgrounds are learning to think about disability as a social justice issue rather than as a category of individual deficiency. Some surveys have indicated that Americans with disabilities who are young enough to have been influenced by the disability rights movement are more likely than older counterparts to identify themselves as members of a minority group; namely, the disability community.[32]

Carol Gill[32] has called for “deindividualizing the problem of disability,” contrasting this view with seeing disability as a personal tragedy. Understanding the social determinants of the devalued status by challenging the disabling society reinforces the valid and whole feelings held by those who are disabled. Plainly stated, if the individual with a disability views personal experience as a problem highly influenced by factors outside herself or himself, this perspective provides a way to effectively challenge societal perceptions of a devalued status.

Individuals with disabilities often demonstrate remarkable strength and achievement in the face of environmental obstacles and social exclusion. Those seeking to truly understand the disability experience should consider the aspects of the disability identity that engender creativity and an enhanced awareness of many commonly unappreciated aspects of human experience.[32]

Understanding Individual Experience

To avoid turning a category such as disability into an inflexible framework for identity, occupational therapists must develop methods that elicit the personal experiences and opinions of those who are disabled.[1] The narrative process for discovery of the individual is a recommended method. The process relies less on observable behavior and more on how people use their own stories to gain an understanding of everyday experience and emotion. It allows us to analyze the ways that personal identity is shaped by social interaction while maintaining the individual studied as an active agent.[8] Project Muse, which captured Angela Moore's narrative, is an example of such a process in the field of bioethics.

A therapy program for clients with a disability should include client-centered exploration into the individual perspective. Initially, to help better define the client perspective, research has shown that discussing the meaning of core categories can lead to insight about the feelings and attitudes of the client.[24] Examples of core category meanings have included (but are not restricted to) illness, independence, activity, altruism, self-caring, and self-respect. Researchers demonstrated that the independence, activity, and altruism categories actively directed behavior before and during treatment and that the last two meanings (self-caring and self-respect) emerged as treatment progressed as a transformation process. Explanation of the categories identified should be a part of the rehabilitation intervention, with both therapist and client benefiting from the increased awareness and self-reflection of the client.

A study by Padilla[68] used this phenomenological approach to describe the lived experience of disability of a woman who had sustained a head injury 21 years before. The woman identified themes of nostalgia, abandonment, and hope and what the core categories meant to her. More important than simply defining these terms, she reflected on how these meanings had shaped her life experiences for those 21 years. The outcome for this individual focused on changing her perspective from that of a passive victim to an active constructor of her own identity.[8]

Revaluating these themes with the individual may allow both the therapist and the client to discover the unique disability experience.

Social Context

Social Status and Disability

The Chicago city ordinance presented in Box 6.2 is an example of the segregation and discrimination society has openly communicated to those with disabilities. A more extreme example is the extermination of 200,000 people with disabilities in the death camps of the Nazi regime in World War II. Our 21st century perspective may allow us to scoff and feel distanced from such obvious prejudice; these may seem to be events consigned to another place, another time. However, our own present-day society behaves somewhere along a continuum that still includes discrimination and injustice, and this is difficult to acknowledge. Nonetheless, this is an inquiry we must not shy away from; the cost to our professional integrity would be too high without it, and our ability to provide a useful service would be compromised without such an understanding.

Box 6.2

Chicago City Ordinance, 1911, Repealed in 1974

A city ordinance passed in Chicago in 1911, which was not repealed until 1974, read as follows:

"No person who is diseased, maimed, mutilated, or in any way deformed so as to be [an] unsightly or disgusting object or improper person to be allowed in or on the public ways or other public places in this city, shall therein or thereon expose himself to public view."

Goffman's classic work, *Stigma: Notes on the Management of Spoiled Identity,*[33] used the term **stigma** to describe the social discrediting process in strained relations between disabled and nondisabled people[32] that reduces the life chances of people with disability or other differences. In this process, an obvious impairment, or knowledge of a hidden one, signifies a moral deficiency. The individual with stigma is seen as not quite human. Society tends to impute a wide range of imperfections on the basis of the impairment.

As are individuals from other minority groups, those with disabilities are categorized with stereotypes. The standard definition of a **stereotype** is an unvarying form or pattern, a fixed notion, having no individuality, as though cast from a mold.[95] Stereotyping is part of the stigmatization process applied to those perceived to exhibit certain qualities. Stigma may be expressed as a societal reaction to fear of the unknown. One explanation for stereotypes applied to those with disabilities is that little direct experience, despite recent mainstreaming in education and the removal of some environmental barriers, produces little real knowledge of what to expect in daily life.

Individuals with visible disabilities may be discredited in social situations, without regard for their actual abilities. Segal et al.[79] stated, "The exclusion of persons with physical disabilities from educational settings and work situations regardless of their ability to participate in and perform all required activities is well recorded in the literature."

Several researchers have noted the popular media portrayals of those with disabilities, which form and reinforce the basis of our common stereotypes, even for those of us in health professions (Box 6.3).[68] For example, Fleischer and Zames[28] found that "films present people with disabilities either condescendingly as 'inspirational,' endeavoring to be as 'normal' as possible by 'overcoming' their limitations, or as disfigured monsters 'slashing and hacking their way to box office success.'" Cahill and Norden,[18] in their discussion of stereotypic characterizations of women with disabilities in the media, found the two most frequent categories of portrayal were the disabled ingénue victim and the awe-inspiring overachiever. The disabled ingénue is young and pretty but significantly helpless because of her disability. The ingénue may be victimized or terrorized by others. Usually she is cured of her malady and able to return to the mainstream by the end of the story. Her return, or "reabsorption," often produces an ability to have a new perspective on life. Similarly, the awe-inspiring overachiever is attractive and succeeds in reaching extraordinary levels of competitive acclaim, only to be taken down by an incurable disability. She eventually "overcomes" her disability with unrelenting personal fortitude and often unexplained economic resources.

Box 6.3

Media Images That Reflect "Handicapist" Stereotypes

1. *The disabled person as pitiable and pathetic*. Found in charity telethons, perpetuating the image of people with disabilities as objects of pity. Their stories are often told in terms of people who are victims of a tragic fate.

2. *The disabled person as "Supercrip."* Heartwarming stories that depict great courage, wherein someone likable either succeeds in triumphing or succumbs heroically; these are usually considered "inspirational" stories. This image leaves a lot of ordinary people with disabilities feeling like failures if they haven't done something extraordinary.

3. *The disabled person as sinister, evil, and criminal*. This stereotype plays on deeply held fears and prejudices; the disabled villain (especially one with a psychiatric illness) is almost always someone who is dangerous, unpredictable, and evil.

4. *The disabled person as better off dead*. The "better dead than disabled syndrome" is one way in which the media imply that with medical costs soaring and resources limited, a disabled person would seek suicide because life is unbearable. Society, especially the family, is thereby relieved of caring for the disabled individual, who is not whole or useful.

5. *The disabled person as maladjusted; that is, his or her own worst enemy*. "If only disabled persons were not so bitter and would accept themselves, they would have better lives" is the general statement of this stereotype. Usually it involves a nondisabled person who helps someone with a disability see the "bright side" of his or her impairment. It contains the mythology that people with disabilities need guidance because they are unable to make sound judgments.

6. *The disabled person as a burden*. Family responsibilities and duty form the core of this stereotype, which is built on the assumption that people with disabilities need someone else to take care of them. Like the stereotype of disabled people as better off dead, it engenders the belief that the burden, whether financial or emotional, is so compelling that it ruins families and their lives.

7. *The disabled person as unable to live a successful life*. The media have distorted society's view of people with disabilities by limiting their presence in the portrayal of day-to-day life. Although more disabled people are beginning to appear in cameo-like scenes or as extras, they are seldom seen in ordinary workplace situations or as happy, healthy family members.

From Switzer JV: *Disability rights: American disability policy and the fight for equality,* Washington, DC, 2003, Georgetown University Press.

The traditional approach used in telethons and other fund-raising ventures, in which people with disabilities may be portrayed as victims, reinforces negative attitudes, stereotypes, and stigma. More recently, with pressure from disability advocacy groups, some network television programs and commercials have included people with disabilities as regular participants in daily life, as workers or family members.

Increasingly, international medical and public health literature reflects a recognition that stigma, discrimination, and social exclusion of individuals with disabilities warrants direct action by diverse societies. A few examples are the current views about the rights of individuals with disabilities in Ghana[76]; discrimination against differently abled children among rural communities in India and the need for action[41]; research in Indonesia on stigma affecting those with disabilities[58]; and, in Brazil, an analysis of the sociofamilial and community inclusion and social participation of people with disabilities to improve access to healthcare.[27]

Disability as a Collective Experience

Vash and Crewe[92] recounted a rehabilitation conference a number of years ago when an address by a psychiatrist included the speaker alternatively standing up and then sitting back down in a wheelchair several times. The speaker challenged the audience to deny that their sense of his competence changed as he stood before them or sat in the wheelchair. Vash reported that when a discussion followed, most acknowledged that their perception of his competence had fluctuated;

the speaker was more credible and worth attention when he was standing. The demonstration forced them to acknowledge their own, previously denied, prejudice and was emotionally charged for much of the audience. A wheelchair can be a powerful social symbol, conveying devaluation of the person in it.

Zola[102] observed that, at its worst, society denigrates, stigmatizes, and distances itself from people with chronic conditions. He experienced little encouragement to integrate his disability identity into his life because this would be interpreted as forgoing the fight to be normal. In letting his disability surface as a real and not necessarily bad part of himself, he was able to shed his super strong "I can do it myself" attitudes and be more demanding for what he needed. Only later did he come to believe that he had the right to ask for or demand certain accommodations. He began to refuse invitations for speaking engagements unless they were held in a fully accessible facility (not only for him as the speaker, but also for the audience).

Another insider's view of disability was provided in 1990 in the book *The Body Silent*, by Robert Murphy,[66] an anthropologist who developed a progressive spinal cord tumor that ultimately led to quadriplegia. His account particularly captures the medical and rehabilitation setting from the perspective of the client. In describing his initial reaction, he wrote, "But what depressed me above all else was the realization that I had lost my freedom, that I was to be an occasional prisoner of hospitals for some time to come, that my future was under the control of the medical establishment."[66] He reported the feeling as like falling into a vast web, a trap from which he might never escape.

The hospitalized individual must conform to the routine imposed by the medical establishment. For example, Murphy spent 5 weeks on one ward where he was bathed at 5:30 every morning because the day shift nurses were too busy to do it. The chain of authority from physicians on down creates a bureaucratic structure that breeds and feeds on impersonality.[66] The totality (of social isolation) of such institutions is greater in long-term care facilities, such as mental health and rehabilitation centers. A closed-off, total institution generally attempts to erase prior identity and make the person assume a new one, imposed by authority. The hospital requires that the "inmates" think of themselves primarily as patients, a condition of conformity and subservience.

Murphy highlighted the experience of an increased social isolation as some of his friends avoided him.[66] He often encountered physical barriers in his environment, which restricted opportunities for social contact. He applied a term from anthropology, **liminality**, to the observation that people with disability have the social experience of pervasive exclusion from ordinary life, the denial of full humanity, an indeterminate limbolike state of being in the world; in other words, the marginal status of individuals who have not yet passed a test of full societal membership. Those with such social status have a kind of invisibility; just as their bodies are impaired, so is their social standing. As Goffman noted, "Caught in a transitional state between isolation and social emergence," people with disabilities "do not count as proven citizens of the culture."[32] This limbolike state affects all social interaction. "Their persons are regarded as contaminated; eyes are averted and people take care not to approach wheelchairs too closely."[32] One of his colleagues viewed wheelchairs as portable seclusion huts or isolation chambers.

Murphy was surprised to discover that in attending meetings of organizations formed by people with disability, often more attention was paid to the opinions of experts who were able bodied than to his views, in spite of his having a disability and being a professor of anthropology.[66] Those with disabilities may hold the same social attitudes from the culture about disability and behave in ways consistent with those negative views.

A major aspect of Murphy's life was his work as a professor, which he continued as long as possible. But even with his status as an internationally recognized anthropologist and researcher, hospital personnel often saw him as an anomaly (an observation shared by other professionals with disabilities in more recent times).[62] A hospital social worker asked him, "What was your occupation?" even though he was working full time and doing research in areas related to medical expertise. With their mindset, hospital workers seemed unable to place him in the mainstream of society. Murphy concluded that people with disability must make extra efforts to establish themselves as autonomous, worthy individuals.[66] Gill stated:

In certain ways, many disabled persons are forced to lead dual lives. First, they are repeatedly mistaken for something they are not: tragic, heroic, pathetic, not full humans. Persons with a wide range of impairments report extensive experience with such identity misattributions. Second, *disabled people must submerge their spontaneous reactions and authentic feelings to smooth over relations with others, from strangers to family members to the personal assistants they rely on to maneuver through each day.*[32]

Murphy's book ended with this observation:

But the essence of the well-lived life is the defiance of negativity, inertia and death. Life has a liturgy which must be constantly celebrated and renewed; it is a feast whose sacrament is consummated in the paralytic's breaking out from his prison of flesh and bone, and in his quest for autonomy.[66]

Beatrice Wright, a social psychologist, studied and wrote for many years about society's reactions to people with disability.[98] She used the term **spread** to describe how the presence of disability or an atypical physique serves as a stimulus to inferences, assumptions, or expectations about the person who has a disability. For example, a person who is blind may be shouted at, as though lack of vision also indicates impaired hearing; or a person with cerebral palsy and a speech impairment may be assumed to be mentally retarded. An extreme manifestation of spread is the belief that an individual's life must be a tragedy because he or she has a disability. This attitude may be expressed in such statements as, "I would rather be dead than have multiple sclerosis." The assumption that the presence of a disabling condition is a life sentence to a tragic existence denies that satisfaction and happiness may ever be achieved. This attitude is of particular ethical concern today, when genetic counseling and euthanasia may provide a socially acceptable means of exterminating people with disability.[90] If life is seen as tragic or not worth living, it is a fairly easy step to argue that it would be better for everyone if people with disability ceased to exist.[71]

Wright's work describing efforts to integrate disability with a positive sense of self explicitly recognizes that the devalued status of those with disability is imposed on such people collectively.[98] Gill[32] pointed out that individuals with disabilities make assessments (of asset values in comparison with comparative-status values) in terms of contributions to one's life. She used the example of the skill in using adaptive equipment; although others may judge the use of such devices as inferior (compared with "normal" functioning), people with disabilities regard them as assets because they have learned to appreciate the benefit derived from their use.

Occupational Therapy Practice and the Independent Living Philosophy

Until recently, much of the emphasis in rehabilitation has been on modifying the individual to adapt to the existing environment. Individuals have been modified by machines, surgery, physical therapy, occupational therapy, psychotherapy, vocational counseling, social work, prosthetic and orthotic devices, education, training, and so on.[92] This emphasis on modification of the person is termed the **medical model** (or biomedical model) of intervention. It is based on the belief that there must be intervention, treatment, repair or correction of pathology, of that which is a deviation from the norm. The norm may be physiological, anatomical, behavioral, or functional. The cause of the problem, in this model, is intrinsic to the person; normalization is the goal. In contrast, these normalization models are considered erroneous and dangerous by those aligned with the independent living philosophy, the social model of disability. Of particular concern is the tendency to isolate specific differences and then use those differences to determine and explain the consequences at a societal level.[29] This tendency creates a kind of logical fallacy, in which the evidence for what is normal is then used to explain the resultant problems that prevent participation in society.

In his landmark article first published in 1979, DeJong[23] described the differences between the medical rehabilitation model, and the independent living model and its sister, the social model of disability. In the medical model, the physician is the primary decision maker, and healthcare professionals are considered the experts. The problem is defined as the patient's impairment or disease; the solution lies in the services delivered by the healthcare professionals. Oftentimes, the goal of rehabilitation is for the patient to be independent in performing activities of daily living (ADLs). The client is expected to participate willingly in the program established by the healthcare professionals, and success is determined by the patient's compliance with the prescribed program and attainment of goals established by the medical rehabilitation team.[14]

Fleischer and Zames[28] pointed out that with the emergence of those with severe disabilities from secluded institutions, in combination with independent living strategies that produced participation in the community, a critical force gained momentum, creating the disability rights movement. Previously, many who became prime movers in the fledgling civil rights struggle for people with disabilities might have been hidden away in segregated institutions or become homebound. Edward Roberts, deceased father of the worldwide independent living movement, had to sleep in an iron lung. Both Roberts and Judith E. Heumann, the former U.S. assistant secretary of education, founder of Disabled in Action, and currently the special advisor for international disability rights at the U.S. Department of State, required attendant care for ADLs. In the 1990s it was reported that Fred Fay, cofounder of the Center for Independent Living and the American Coalition of Citizens with Disabilities, would lie on his back all day, every day, managing not only his home but also state and national political campaigns and international disability advocacy programs using a combination of personal assistance and three computers.[14]

Bowen pointed out that OT practitioners should not deceive themselves into believing they are using an independent living, or social, model because the professional role is to help people live independently.[3-5] This is merely a simple shift of words, not the core of the model. The independent living movement and the associated model are quite different and separate approaches to practice from the traditional medical model used by most practitioners.[14]

When the independent living model is used, the person receiving services is considered a consumer, not a patient; is the expert who knows his or her own needs; and is the one who should be the primary decision maker. In this model, the healthcare service provider describes what he or she can do with the consumer, and the consumer then decides what aspects of the service he or she wants to use. The foremost issues addressed are the inaccessible environment, negative attitudes held by others about disabilities, and the medical rehabilitation process, which tends to produce dependence on others (see the later section Client-Centered Practice: A Shift from the Medical to the Social Model).

Hammel, an occupational therapist, led a major research project that stressed that:

… across environmental factors, rehabilitation professionals also could more actively and intentionally incorporate consumer direction, empowerment, and activation strategies into rehabilitation services so people with disabilities become more informed consumers and feel empowered to navigate and manage systems, services, and resources needed to live and participate in the community long term, including the integration of peer mentoring and social learning self-efficacy, building groups into rehabilitation delivery.[37]

Occupational therapists may initiate peer support groups and encourage patients to participate in online disability support groups. These problems are best resolved through self-help and consumer control of decision making, self-advocacy, peer counseling, and removal of attitudinal and architectural barriers. The goal of independent living is full participation and integration into the entire society.[14]

Consumer-controlled and consumer-directed independent living programs offering a broad spectrum of services, including some that OT practitioners have considered hallmarks of the profession (eg, assistive device recommendation and daily living skills training), are funded through federal, state, local, and private resources. In 1993 the AOTA published a position paper outlining the role of occupational therapy in such programs. The general practice of the professional per se does not differ from other settings. The major difference is that the consumer selects which services to use, rather than receiving those chosen by the therapist. With the community-based nature of the settings (in contrast to healthcare facility–based settings), the services are directly related to the consumer's ability to function in his or her roles in the local community. The practitioner may need a higher level of creativity to address these diverse role-related functional activities.

OT Practice Notes

The independent living philosophy requires that the therapist play a supporting role in helping the consumer be the principal player as problems with the environment are solved. This role contrasts with the therapist's more common approach, in which therapeutic activities are directed to restore abilities.[14]

Bowen[14] stated that practitioners often fall short in implementation of an independent living philosophy; namely, striving to make others aware of the handicapping nature of the environment. The focused goal, using the independent living philosophy, is on problems that exist in the physical and social environment, not on a deficit in the person with a disability. Bowen's research noted that practitioners write therapeutic goals that seek to change the client 12 times more often than they do goals that focus on altering the environment.[14] Other OT researchers have reported an extreme lack of knowledge about architectural accessibility regulations among OT practitioners, which compromises their ability to promote integration into the community and empower consumers who use wheelchairs.[73]

Person-First Language

The language used to communicate ideas about people with a disability is important because it conveys images about these individuals that may diminish their status as human beings. Kailes, a disability policy consultant who has a lifelong disability, wrote:

Language is powerful. It structures our reality and influences our attitudes and behavior. Words can empower, encourage, confuse, discriminate, patronize, denigrate, inflame, start wars and bring about peace. Words can elicit love and manifest hate, and words can paint vivid and long lasting pictures.[43]

For example, in the jargon of the medical environment, disabled people may be called “quads,” “paras,” “CPs” or “that stroke down the hall.” Such categorization leads to viewing individuals as stereotypic examples, engulfed by their impairments.[13] Some individuals are of the opinion that referring to people as “the disabled” or “a disabled person” makes the disability swallow up their entire identity, leaving them outside the mainstream of humanity. How, then, might OT practitioners use language in a spirit of dignity?

In her discussion of the complexities of disability policy, Switzer noted:

[There is] virtually universal agreement that pejorative terms that objectify disabled persons (such as deformed or wheel-chair bound) diminish the importance of the individual and create the perception of people only in terms of their disability. Similarly, attempts to develop euphemisms (physically challenged, height-impaired) generally are thought to be misguided attempts that still identify persons by their disability alone.[87]

For people with disabilities (PWDs) to develop a sense of pride, culture, and community, past negative attitudes must be changed. The use of language that recognizes that the person comes first (ie, a person with a disability) acknowledges that the individual is a human being before being someone with a disability.[87] This shift in the use of language is widely known as **person-first language**.[53]

All struggles for basic human rights have included the significant issue of what labels will be used by and about a particular people. With other minority groups, examples have included “Negro,” which was replaced by “black” and then changed to “African American”; “Indian,” which was changed to “Native American” or “People of First Nations”; and “ladies” or “girls,” who are now more commonly called “women.” Kailes has reminded us that terms such as *crippled, disabled,* and *handicapped* are labels imposed from outside the community of people with disabilities, from definitions constructed by social services, medical institutions, governments, and employers.

The preferred terms continue to evolve and change. Negative attitudes, values, biases, and stereotypes can be amended by using disability-related language that is precise, objective, and neutral. Disability-related terms are often subjective and indirectly carry a feeling or bias through innuendo and tone. But the effect of these terms on those with disabilities can be very direct and disturbing; they can cause a sharp cringe, a flash of anger, or shut down interaction when the person is confronted with “ablest” and “handicapist” language. Use of such language creates social distance, establishes an inequality in the interaction, and produces demeaning expectations.[43]

What should we call the recipient of occupational therapy—*patient, client,* or *patient-client* (Box 6.4)? *Patient* conveys a sense both of ethical responsibility on the part of practitioners,[75] and of passivity and dependence on the part of those receiving care.[66] *Client,* on the other hand, conveys merely an economic relationship,[81] as does *consumer*. A product or service might be sold to a client with the "Buyer beware" ethic of a free market economy; however, our professional ethics demands the provision of service based entirely on the benefits it affords the recipients. Perhaps what is needed is a sensitive inquiry by the therapist as to what term the particular individual prefers.

Box 6.4

Use of Language

Disabled Versus Handicapped

The term *handicapped* connotes the negative image of a person on the street corner with a "handicap" in hand, begging for money. The word *disability* also is not perfect because it still implies a negative—what a person cannot do. However, it has become the word most widely used and accepted among people with disabilities. A disability is a condition, and a handicap is a barrier or obstacle that a person with a disability may encounter in the environment. People are not handicapped by their disability all the time. A wheelchair user is not handicapped in an environment where there are no steps. A disability can mean that a person may do something differently than a person without a disability, but with equal participation and equal results. The phrase *disabled people* is a shortcut to the more involved and sometimes more awkward but preferred expression *people with disabilities*. It depicts people with disabilities as people, with multidimensional characteristics in addition to their disability.

For example, a woman who has a disability as a result of polio and uses a wheelchair may also be a mother, a wife, an executive, a student, a citizen, a board member, a gifted public speaker, and more. A man who has quadriplegia as a result of an auto accident is not a "vegetable." Although he has a significant physical disability, he may also be an active, contributing, productive member of society. Disabled people can represent differentness and separateness, and we sometimes reduce a person's identity to only his or her disability; we don't refer to people with broken legs as "broken-leg people." An exception to this guideline is people who are deaf who refer to themselves as the "Deaf with a capital D." Many people who are deaf consider themselves members of a culture that has its own language. There is also emerging discussion within the disability community that supports the phrase *disabled people* as representing a sense of pride, culture, common history, and experience.

Wheelchair User Versus Wheelchair Bound or Confined to a Wheelchair

People are not bound to wheelchairs. *Wheelchair bound* or *confined to a wheelchair* conveys a stereotype that sets people with disabilities apart from others and portrays people who use wheelchairs as devalued, impotent, slow, and passive. People use wheelchairs to increase their mobility, similar to the way people use cars. Many people who use wheelchairs can walk but choose to use a wheelchair or a scooter because of such functional limitations as reduced endurance, decreased balance, or slow walking speed. Often, ability, productivity, independence, ease, and speed of movement are increased by wheelchair use. For many, a wheelchair means increased mobility and freedom; it does not mean imprisonment! People who use wheelchairs can transfer to cars and chairs. Thus they are neither confined nor bound to their wheelchairs.

Patient

Most people are patients at some point, but this does not mean that people are constant patients and always should be called patients. Patient is a noun that frequently gets paired with people with disabilities. It is common to hear expressions such as, "a multiple sclerosis patient is in my class," "he is an Alzheimer's patient," or "stroke patients walk in the mall every day." The words conjure up a vision of people walking in the mall pushing poles hung with intravenous (IV) bags, or wearing electrocardiograph (ECG) wires attached to their chests and accompanied by their doctors. Pairing people with disabilities with *patient* overmedicalizes people. It gives them a permanent status of "eternal and chronic patients" and reinforces a common misconception that people with disabilities are all sick. People with disabilities are not constant patients, and most people with disabilities are not sick.

Crippled

The term *crippled* is derived from an old English word meaning "to creep." Webster's New World

Dictionary gives a second meaning to the word *cripple,* which is "inferior." These are derogatory images that perpetuate negative stereotypes!

Overcome

People cope with, adjust to, and live with a disability. Disability is a characteristic, and just as a person does not overcome being black, a person does not overcome having a disability. People overcome social, economic, psychological, attitudinal, architectural, transportation, educational, and employment barriers.

Special

People with disabilities should not be labeled as *special*. Although the term is often used in descriptions such as *special education,* it is patronizing, inappropriate, and distancing. It is not necessary. *Special* is often viewed by the disability community as a euphemism for segregated because it implies differentness and apartness.

Suffer

An individual who has a disability does not necessarily suffer. *Suffer* conveys a stereotypical attitude of never-ending mourning. If one wants to say a particular person is suffering, this point should be developed explicitly. Mourning is one of the stages involved in adjusting to disability. It is not a chronic state.

Victim

The word *victim* is appropriate to use immediately after a diagnosis or an injury, or for someone who has experienced some form of abuse (victim of a violent crime, accident victim, or rape victim). It is inappropriate to use the word to describe an ongoing status. A person is not a lifetime multiple sclerosis victim, cerebral palsy victim, or stroke victim. Being constantly referred to as a victim reinforces the helplessness and degradation of the initial experience.

From Kailes JI: *Language is more than a trivial concern!* 2010. Self-published. http://www.jik.com.

Although all three editions of the OTPF use the word *client* to name the recipients of occupational therapy, it is clear that the developers of the Framework have struggled with this term, and they recommend that OTs adopt the terminology preferred or used by the recipients of their services.[3-5]

Culture of Disability

J. P. Shapiro,[80] a highly regarded journalist, wrote about the new group consciousness emerging through a powerful coalition of literally millions of people with disabilities, their families, and those working with them. He noted the start of a disability culture, which did not exist nationally even as recently as the late 1970s. British social scientists Barnes and Mercer[9] more recently stated that the disability culture is a sense of common identity and interests that unites disabled people and separates them from those who are non-disabled.

As Steven Brown, cofounder of the Institute on Disability Culture in Las Cruces, New Mexico, said:

People with disabilities have forged a group identity. We share a common history of oppression and a common bond of resilience. We generate art, music, literature, and other expressions of our lives and our culture, infused from our experience of disability. Most importantly, we are proud of ourselves as people with disabilities. We claim our disabilities with pride as part of our identity. We are who we are: we are people with disabilities.[28]

The notion of "disability pride," as an echo of "black pride" or "gay pride," was dismissed as unachievable even within the independent living movement during the mid-1970s. In the summer of 2004, however, the first Disability Pride Parade was held in Chicago. (Disability Pride's website is *http://www.ieccil.org/independent-living/disability-pride*.) Sarah Triano, co-chair of the 2004 parade's planning committee, said:

Disability Pride represents a rejection of the notion that our physical, sensory, mental, and cognitive *differences from the non-disabled standard are wrong or bad in any way, and is a statement of our self-acceptance, dignity and pride. It is a public expression of our belief that our disabilities are a natural part of human diversity, a celebration of our heritage and culture, and a validation of our experience. Disability Pride is an integral part of movement building, and a direct challenge to systemic ableism and stigmatizing definitions of disability. It is a militant act of self-definition, a purposive valuing of that which is socially devalued, and an attempt to untangle ourselves from the complex matrix of negative beliefs, attitudes, and feelings that grow from the dominant group's assumption that there is something inherently wrong with our disabilities and identity.*

The emergence of the disability arts movement marks a significant stage in the transition to a positive portrayal of disabled people, building on the social model of disability. From the mid-1980s, there has been a substantial increase in work by disabled poets, musicians, artists, and entertainers that articulates the experience and value of the "disabled" lifestyle.[9]Art, literature, and performance, from the time of Shakespeare to the present day physically integrated dance with Axis Dance Company and the Dancing Wheels Company and School, aspire to convey the universality of human experience. For more than 20 years, the late John Callahan, an irreverent cartoonist and self-stated "quadriplegic in a wheelchair," depicted a point of view of life, including the experience of disability, which was published in newspapers across the nation.[61] Callahan's autobiography, *Don't Worry He Won't Get Far on Foot,* made it to *The New York Times* bestseller list.

As Fleischer and Zames wrote, "Disdainful of pity, disability culture celebrates its heritage and sense of community, using various forms of expression common to other cultures such as, for example, film, literature, dance, and painting."[28]

The UCLA National Arts and Disability Center is dedicated to promoting the full inclusion of children and adults with disabilities into the visual, performing, media, and literary arts communities. *Beyond Victims and Villains: Contemporary Plays by Disabled Playwrights*[55] and *Bodies in Commotion: Disability and Performance*[77] are well-regarded examples. Josh Blue, a comedian with cerebral palsy, is another example of mainstream entertainment through the lens of the person with a disability. Sports and games, heralds of cultural pursuit, are also evident in the culture of disability. The term *disabled athlete* has been reclaimed from sports medicine and orthopedics to mean competitive athletes with disabilities. Every major city marathon includes "runners" with wheels. The international Paralympics, begun in 1960, is held every 4 years in tandem with the Olympic Games; it is now the second biggest sporting event in the world. A personal narrative by a British Paralympic competitor, a wheelchair tennis player who experienced a spinal cord injury (SCI) after a motorcycle accident in 2001 that left her paralyzed from the waist down, gives an alternative account of disability that reflects a positive, if different, social identity.[44]

The 2005 film *Murderball,* about athletes with paraplegia who play full-contact rugby in Mad Max–style wheelchairs and who competed in the Paralympic Games in Athens, Greece, was nominated for an Oscar from the Academy of Motion Pictures.[40] Professional wheelchair skaters are showcased at skate parks.[26]

The National Center on Health, Physical Activity and Disability (NCHPAD) focuses on building national leadership in the disability community that aligns with ongoing and future Healthy Communities/Community Transformation initiatives to promote community health inclusion activities in physical activity and nutrition. The center's Community Health Inclusion Sustainability Planning Guide: An Addendum to a Sustainability Planning Guide for Healthy Communities (*http://www.nchpad.org/CHISP.pdf*) can be used to help create an Inclusive Health Coalition.

James Charlton's book, *Nothing About Us without Us: Disability Oppression and Empowerment,* details the worldwide "grassroots disability activism" of those with disabilities. He stated, "A consciousness of empowerment is growing among people with disabilities … it has to do with being proud of self and having a culture that fortifies and spreads the feeling."[19]

John Hockenberry,[39] the well-known journalist and author of *Moving Violations, A Memoir: War Zones, Wheelchairs, and Declarations of Independence,* has a spinal cord injury and uses a wheelchair. He sees disability in a novel way, as a cultural resource:

Why is it that a person would not be considered educated or privileged if he went to school and never learned there was a France or a French language? But if a person went through school and knew nothing about disability, never met a disabled person, never heard of American Sign Language, he might be considered not only educated, but also lucky? Maybe we in the disability *community need to get out of the clinical realm, even out of the equity realm, into the cultural realm, and show that a strategy that leads to inclusion makes a better community for everyone.*[39]

Murphy, in *The Body Silent,* described how his degenerative disability impelled him to examine the society of people with disabilities with the same analytic tools he used to study esoteric cultures in remote geographic areas, the classic field study location of his discipline[66]:

Just as an anthropologist gets a better perspective on his own culture through the long and deep study of a radically different one, my extended sojourn in disability has given me, like it or not, a measure of estrangement far beyond the yield of any trip. I now stand somewhat apart from American culture, making me in many ways a stranger. And with this estrangement has come a greater urge to penetrate the veneer of cultural differences and reach an understanding of the underlying unity of all human experience.[66]

Why should an occupational therapist know about this evolving social phenomenon—disability culture? Is our contribution so bound to a medical model that we cannot acknowledge this cultural expression? What value is our relationship with those who have disabilities if not to support participation in all aspects of occupation, including those expressing a disability cultural perspective?

Design and Disability

Bickenbach,[12] a disability rights law and policymaker, has drawn on Irving Zola's work, reminding us that the "special needs" approach to disability is inevitably shortsighted. If we see the mismatch between impairments and the social, attitudinal, architectural, medical, economic, and political environment as merely a problem facing the individual with a disability, then we are ignoring that disability is an essential feature of the human condition. It is not whether a disability will occur, but when; not so much which one, but how many and in what combination. The entire population is at risk for the impairments associated with chronic illness and disability. As people live longer, the incidence of disability increases. Viewing disability as an abnormality does not provide a realistic picture of the human experience. Bickenbach, in his discussion of disability as a human rights issue, underlined the fact that disability is a constant and fundamental part of human experience and that no individual has a perfect set of abilities for all contexts; there are no fixed boundaries dividing all the variations in human abilities. Our usual description of contrast between ability and disability is, in fact, a continuum of functionality in various settings.[12]

This perspective affects occupational therapy's role in the realm of assistive technology and modification of the environment to enhance individual performance of occupational behavior. Our literature is overflowing with discussions about assistive technology (see Chapter 17) and environmental modifications; applications with various diagnostic classifications, methods for training in the use of assistive technology, the usefulness of providing a specialized device to enhance performance, and home modifications. The concept of universal design (the way the environment may be designed to support individual differences) is not as prominent in our professional literature. This idea includes the built environment, information technology, and consumer products, in addition to a host of commercial and social transactions, usable by all people, to the greatest extent possible, without the need for adaptation or specialized design. The concept is this: if devices (eg, buildings, computers, educational services) are designed with the needs of people with disabilities in mind, they will be more usable for all users, regardless of whether they have disabilities.

Disability is just one of many characteristics that an individual might have that should influence the design of our environments. An example of universal design is ramped entries, which are required by federal law (Americans with Disabilities Act Accessibility Guidelines [ADAAG]) in public buildings (including transportation services, such as airports and train stations) and designed for those who use wheelchairs. As that design requirement has become increasingly implemented, the use of wheeled luggage by all travelers, in addition to parents pushing children in strollers and delivery staff with rolling carts, has become commonplace. Just imagine the impact on home modification if new housing construction design included the requirement for one entrance easily adaptable and a bathroom door wide enough for wheelchair access (see Chapter 15).

Activists in the independent living movement have influenced the personal computer and digital device industry to integrate a multitude of individual preferences, from the size and type of the font to the ease with which adaptive technologies such as speech recognition and alternative keyboards interact with operating systems. In another example of successful advocacy, standards were issued under the Rehabilitation Act in 2000 to address access to electronic and information technology for people with physical, sensory, or cognitive disabilities (see the website *http://www.access-board.gov/guidelines-and-standards/communications-and-it/about-the-section-508-standards*). Universal design in instruction is becoming evident as educators are increasingly trained to include multiple modalities of visual, auditory, and tactile systems to address the needs of people with wide differences in the ability to see, hear, speak, move, read, write, understand English, attend, organize, engage, and remember.[16]

Some argue that universal design principles could make assistive technology unnecessary in many situations involving an impairment. A canopener that has been designed for one-handed use by anyone busy preparing multiple steps in a recipe will also be usable by the cook who has hemiparesis caused by a cerebrovascular accident (CVA).

Universally designed devices and aids may be one remedy for the stigmatization attached to special equipment. As Daarragh et al.[22] pointed out, we know from research with older people that "[the] potential usefulness of a device is often offset in the minds of clients by concerns about social acceptability and aesthetics." There will always be a need for individually prescribed equipment because impairments and individual needs are associated with so many variations of disability.

Interactional Process: the Person With a Disability and the Environment

International Classification of Functioning, Disability, and Health

In 2001 the World Health Organization (WHO) restructured its classification of health and health-related domains (*the International Classification of Functioning, Disability and Health* [ICF]) that describes body functions and structures, activities, and participation. The domains are classified from body, individual, and societal perspectives. The ICF also includes a list of environmental factors because the individual performs within a context. The aim of the ICF classification is to provide a unified and standard language and framework to describe changes in body function and structure, what a person with a health condition can do in a standard environment (the person's level of capacity), and what the person actually does in his or her usual environment (the person's level of performance). The text produced with the language depends on the users, their creativity, and their scientific orientation. This text is a companion to WHO's *International Classification of Disease, Tenth Revision* (ICD-10).[96] For health practitioners, including occupational therapists, the ICF challenges mainstream ideas on how health and disability are understood.

The ICF stresses health and functioning, rather than disability. Abandoned is the notion that disability begins at the point where health ends. The ICF is a tool for measuring the act of functioning, without regard for the etiology of the impairment. This radical shift emphasizes the person's level of health, not the individual disability.[97]

Fougeyrollas and Beauregard[29] pointed out that the revised ICF is more aligned with social ecology's theoretical description of disability, and distances itself from reductionist social theory by emphasizing the role of environmental factors. It is also more in accord with the disability rights movement. As did the first two editions of the OTPF, the OTPF-3 continues to use ICF terminology to enhance communication with professionals in other healthcare areas.[3-5,35] Disciplines such as ergonomics and occupational therapy consider the environment to be an essential component of human behavior. To illustrate this shift in thinking, social ecologists point particularly to models of human occupation used in occupational therapy, such as the ecology of human performance,[25] the human occupation model,[46] and the person-environment-occupational model.[52] OT theory development has had significant influence in changing the paradigm used in rehabilitation by applying holistic and ecological principles to an understanding of the human condition.[29]

Historically, occupational therapy has been associated with the field of medicine and its emphasis on etiology, or causation, to explain function and disability. In contrast, our profession is presently building an understanding of occupation as a social construction. In keeping with a social model of disability, our focus on occupation produces, as Padilla[68] said, an "understanding of people for who they are, have come to be, and are in the process of becoming."

Health, as defined by WHO, is a state of physical, mental, and social well-being. It is the capacity of the individual to function optimally within his or her environment or the adaptation of the person to his or her environment or setting.[29] The ICF measures biological changes in body function or structure, but places equal emphasis on the contextual domains of personal and environmental factors. Components of health identify the constituents of health (Table 6.1), whereas consequences of health focus on what may follow as a result of disease. This is a shift from an exclusive view of disability from the medical model (ie, directly caused by disease, trauma, or other health conditions that require individual treatment by professionals) to a paradigm that allows for integration of a social model, in which disability is not an attribute of an individual but rather a complex collection of conditions, many of which are created by the social environment (Box 6.5). The social model requires social action, and it is the collective responsibility of society at large to make the environmental modifications necessary for the full participation of people with disabilities in all areas of social life.[96]

TABLE 6.1

Elements of Health and Their Components

Element	Components
Functioning and disability	Body functions and structures Activities and participation
Contextual factors	Environmental factors Personal factors

ICF, International Classification of Functioning, Disability and Health.

Box 6.5

Environmental Factors Identified by the ICF

- Products and technology
- Natural environment and human-made changes to environment
- Support and relationships
- Attitudes
- Services, systems, and policies

ICF, International Classification of Functioning, Disability and Health.

According to WHO, neither the medical model nor the social model provides a complete picture of disability, although both are partially useful. The complex phenomenon called *disability* can be viewed at the level of a person's body, and also primarily viewed at the social level. It is always a dynamic exchange between the characteristics of the person and the overall context within which the person is operating, but some aspects of disability reside within the person (eg, the cellular changes associated with a disease process), whereas other aspects are essentially external (eg, the fears and prejudice of others about the disease). Thus, application of both the medical model and the social model is appropriate. The best model of disability is one that synthesizes what is accurate in each model, without excluding the other viewpoint. WHO has proposed calling this the *bio-psychosocial model* and has based the ICF on such a synthesis. The goal is integration of the medical and social factors to produce a coherent view of health, incorporating biological, individual, and social perspectives.[97]

The ICF allows for the real-world observation that two people with the same disease can have different levels of functioning, and two people with the same level of functioning do not necessarily have the same health problem (Table 6.2). Two individuals will generally have different environmental and personal factors interacting with distinct body functions.

TABLE 6.2

Example of ICF Terminology

Condition	Impairment	Activity Limitation	Participation Restriction
Spinal injury	Paralysis	Incapable of using public transportation	Lack of accommodations in public transportation leads to no participation in religious activities.
Bipolar illness	Cognitive and emotional dysfunction	Incapable of managing finances	Lack of credit leads to homelessness.

ICF, International Classification of Functioning, Disability and Health.

In OT practice, the shift from relying on the medical model (that is, away from fixing a problem in the individual) to integrating the social model, which accounts for the interaction of the person and the environment, has led to evolving theoretical constructs.[21,47] For example, the therapeutic notion of adaptation to environment, in which individuals are expected to transform themselves through therapy, has been questioned by occupational science theorists. Rather, an interactional, dynamic, reciprocal adaptation of the person and the environment emphasizes more the social model approach. Cutchin[21] proposed the concept of place integration instead of adaptation to environment, in which "people are more a part of their environment, and environments more a part of people," with the person's "motivations and processes never fully independent from the physical, social, and cultural realms that shape the self and desires." In his conclusion, Cutchin underlined that client and practitioner are reflexive social selves, with the potential for "the therapeutic moment, one in which the client and therapist are united by place and social ties and by the collaborative effort to coordinate occupation so that person and place become once again integrated and whole."[21]

A Canadian study of women wheelchair users underscored these evolving theoretical constructs. The researchers concluded that the barriers these women experienced were a lack of space, stairs, difficult to reach spaces, poor transportation, and limited community access. The study recognized the importance of the many strategies the women used to regain control over their environment and to attain autonomy and participation in the community. The researchers called on clinicians to be sensitive to the meaning of home by including the relationship between body and environmental features that surround that meaning.[74]

Swedish researchers Lexell et al.,[57] who studied people with multiple sclerosis (MS), similarly concluded that professionals need to broaden their repertoire to address the social conditions that influence meaningful occupations. They described the way those with MS in their study claimed that they were forced to prioritize the most necessary occupations over the most desired occupations and those that could be conducted at any time over those that needed to be preplanned. Planning and addressing the balance of occupations over time is a more complex situation than previously recognized. Moreover, because planning and balance of occupations over time seems so strongly influenced by other people, interventions must be aimed not only at the client, but also at other people involved in the client's occupational engagement.

Relationship Between the OT and the Person With a Disability

Angela Moore's narrative of her experience with spastic cerebral palsy in the case study at the beginning of the chapter does not describe any current contact with rehabilitation specialists. Her account of the younger stages of life does reveal many social and personal experiences with medical professionals. Rather, her narrative describes the long and arduous journey through multiple interventions, multiple best-guessed speculations, and recommendations, and little of the immediate support seen with aspects of medical rehabilitation in trauma or a sudden, distinct condition onset.

Ethical Considerations

Professional healthcare consultation is generally not a choice; rather, the need arises from trauma or a more insidious dysfunction that affects an individual's well-being. Healthcare providers must honor the vulnerability of those who engage us in their quest for restored well-being. Care and thoughtfulness must prevail to ensure our respect, dignity, and ethical responsibility for those who seek occupational therapy.

OT values center on a humanistic concern for the individual,[68] particularly individuals who have a chronic, severe, and lifelong disability and who will never be cured.[100] Some OT practitioners may be engaged by a person with a temporary disability (eg, an injury to the hand that regains most or even all of its former function) or may work in prevention programs designed to reduce work injuries; these professionals generally do not have contact with those considered disabled. However, most people served by occupational therapists have lifelong conditions that cannot be "cured"[6]; therefore, most of those served do not escape the potential for devaluation, stigma, liminality, stereotyping, and the experience of a world designed primarily for those without their differences. Some will have differences that are not observable in casual contact (eg, autoimmune deficiencies, seizure disorders, pain, heart and pulmonary dysfunctions); yet, once discovered or disclosed by others, these differences produce similar personal and social results.

Rather than eradicating disease, occupational therapists identify and strengthen the healthy aspects or potential of the person. Self-directedness and self-responsibility of the person are emphasized rather than compliance or adherence to orders. A generalist, integrated view of the person as an individual who interacts with his or her environment guides OT practice rather than a specialist, reductive perspective. This integration requires emphasis on daily life activities and engagement in the occupations expected by the culture. The therapeutic relationships of occupational therapists should be based on mutual cooperation[82] rather than an active therapist and passive patient approach. The recipient of our service should be viewed as an agent or actor with goals, interests, and motives, and not as one whose behavior is determined by merely physical laws[56]; we have faith in potential ability, actualized by engagement in activity. The recipient's productivity and participation, rather than relief from responsibility, are emphasized.

OT Practice Notes

Occupational therapists seek to facilitate a balance of performance in areas of occupation, such as work, rest, play, sleep, and activities of daily living (ADLs), and to help restore a sense of well-being.[3] To accomplish this goal, the occupational therapist must understand the individual's experience and point of view, instead of relying on observation as the only credible source of information.

Although many occupational therapists provide services in a medical model milieu, we view the client in a way that is different from the traditional medical perspective of diagnosis, cure, and recovery and should follow a different thought process. Our concern with the capacity to engage in daily life activities means that our scope of practice must include not only the hospital setting but also home and community. Thus, occupational therapy may practice both within and outside of the medical milieu, often helping clients to become agents in their own return to health and well-being. In this sense, OT practice bridges the sometimes alien world of acute medical care with engagement in the world of home, family, and culture.

The Therapist as an Environmental Factor

OTs and other rehabilitation professionals are a distinct part of the social context for those with disabilities; OTs are an environmental factor for an individual as he or she seeks a sense of well-being. Behaviors, beliefs, and demonstrated attitudes have a bearing on the lived experience of the person OTs seek to serve. OTs bring to the environment cultural biases (eg, woman as homemaker, man as breadwinner), religious beliefs (eg, illness as a manifestation of sin or divine intervention), and attitudes toward disability and disablement (eg, the mass media stereotypes). Personal mindset may be in conflict with the desire for an authentic understanding of each individual. For example, in discussing bioethics, Asch reported that "rehabilitation specialists … dramatically underestimate life satisfaction of people with disabilities, regardless of the length of time they had been in the field or the number of people they had worked with."[7] It is reasonable to conclude that such underestimation affects the quality of the interaction between the person served and the specialist and that it must influence the social context of the relationship.

Basnett,[10] a physician with a cervical spinal cord injury, argued that the predominant influences on healthcare professionals and their attitudes are the norms of society. Often reinforced by training and practice and biased predominantly by seeing people with disabilities when they are sick, health professionals can develop a view of disability that is at substantial variance from its reality for many disabled people. This can affect vital decisions involving health professionals that affect disabled people. His research found that (1) in general, health professionals' attitudes became more negative as professional education proceeded; (2) a power imbalance existed in the relationship between the professional and the patient; and (3) the functional limitations and differences of people with disabilities were highlighted, rather than their strengths and similarities. He noted that other professionals, such as occupational therapists, who specialize more in disability and varying functional limitations, may develop a different view than physicians.

Wright observed that the goals of rehabilitation, independence, and self-directedness must be nurtured during rehabilitation.[98] She proposed that comanagement could result in improved outcomes. She observed that helping relationships might get in the way by conveying subservience and less power for the person being helped and by reinforcing the view that the expert has or should have the answers. The client might expect and want the professional to take complete charge. In some circumstances, such as acute medical care, this approach is necessary and commendable. However, shifting responsibility and power to the therapist can interfere substantially with the goals of rehabilitation and OT, especially the goal of independent living. Wright, therefore, asserted that "it is essential that the client be brought into a directorship role as soon as [is] feasible."[98] A central research finding of Guidetti et al.,[34] the "therapeutic relationship as enabling possibility,"[34] underscored this conclusion about self-care intervention.

Wright also acknowledged that rehabilitation specialists may have needs that interfere with comanagement.[98] They might need to assert themselves, display their knowledge, gain power, or achieve satisfaction in an authoritative role. Wright also cited the increasing pressure for efficiency and cost containment in the system as a stumbling block because comanagement may require more time and effort than would professional prescriptions. Her advice was, “Don't get stuck with the problem; move on to the solution” to prod constructive thinking.

Research has supported the findings about the long-term effects of comanagement. In a study by Wright,[98] a group of 100 patients with severe disability underwent rehabilitation in a hospital that encouraged their maximum involvement and participation. One year after discharge, their status was compared with that of a control group that had completed a conventional rehabilitation program at the same hospital. The experimental group showed a greater degree of sustained improvement in self-care and ambulation and a lower mortality rate. Wright concluded that, whenever feasible, comanagement on the part of the client should be promoted.[98] The therapist should support this belief by showing that he or she respects the patient, by being friendly and caring, and by showing concern about the patient's overall welfare. Basic social civilities are important, such as knocking on the door of the hospital room, introducing oneself, and addressing the recipient of services by name. The professional needs “to question at all times whether the client is at the helm” or whether the person is being “paternalistically directed.” This last test is especially important for occupational therapists who may work in an environment in which professional authoritarianism is the norm.

Therapeutic Use of Self

Gill stated that even though there are negative depictions in the literature, many people with disabilities have commendable relationships with nondisabled family members, friends, intimate partners, health professionals, and employers; relationships that, in fact, promote health.[31] She reported that many individuals with disabilities have given descriptive narratives of their lives in which key nondisabled people are themselves without disability prejudice, are aware of prejudice when it appears, and are allied in despising it. These allies appear to learn who their disabled associates are in their “full glory and their full ordinariness.”[32]

Ann Neville-Jan[67] was an occupational therapist and professor with spina bifida. In her autoethnography of the “world of pain,” she described how an authentic and respectful relationship may be created. Referring to Elizabeth Yerxa's 1967 Eleanor Clarke Slagle lecture, she reminded us that “authentic occupational therapy implies a commitment to a patient's meaning system and a relationship that is best described as ‘being there’ with our patients.”[67] Quoting Clark et al.,[20] she stated, “ ‘Techniques of collaboration, building empathy, inclusion of the ordinary, listening, and reflection’ are important for understanding patients' stories of their world of occupation, and, thereby, developing trust and hope.” She also wrote:

In my story there were two professionals who engendered trust and hope consistently whether treatment worked or not. We were partners; they listened and shared stories from their lives, their families, and their interests. They were empathetic listeners. … They were not rushed or impatient as I told them about my daily struggles with pain. They didn't try to change the topic to one that was not pain-related.[67]

Darragh et al.,[22] from their research with participants with brain injury, described similar qualities and traits necessary for the positive perception of treatment.

Neville-Jan's account of the authentic practitioners' behavior contrasts discernibly with Vash and Crewe's description of devaluation: disdain for a lesser, inferior being, seen as incapable, not useful, probably a burden, unattractive, and of a lower status.[92] The call for the authentic practitioner is for one who does not devalue the individual with a disability.

Smith,[85] a professor in the field of education who also has a disability, has called for a relationship of allies, joined for a common purpose; the OT professional must be an individual who respects, values, and supports, in a collaborative manner, the goals and aspirations of the client, knowing that that person may speak and act on his or her own behalf. This is not the same as being an advocate, who speaks for another or presumes to know what the other wants or needs. In the words of Yerxa, “Formulating wise questions requires establishing a partnership with those we wish to serve” and “we need to understand [the] relationship [of routines of daily life] to both personal goals and the environment as seen through the eyes of the individual.”[101]

Client-Centered Practice: A Shift From the Medical to the Social Model

Client-centered practice has gained importance over the past 30 years. Occupational therapists consider it essential to have a partnership with the client, one in which the client identifies issues to be addressed and collaborates in the selection and implementation of interventions. Adoption of this approach coincides with more therapists working in settings that expect a client-centered practice: schools, independent living centers, community settings, and health promotion centers.[54]

Chuck Close, a highly regarded visual artist, was interviewed several years after his successful return to the competitive world of art after extensive rehabilitation for a collapsed spinal artery, which left him almost completely paralyzed. A brace device on his partially mobile hand, a sophisticated wheelchair, and other aids allow him to paint. He rightfully criticized the attempts of therapists to engage him in housekeeping tasks when engagement in art and art creation was, and continues to be, the defining occupation of his being, despite his physical limitations. Finding a few paints and a way to make marks with paint in the basement of the rehabilitation center was the turning point of his "recovery."[30]

Occupational therapists working in rehabilitation centers frequently place much more emphasis on technical goals (eg, range of motion and muscle strengthening) than on the skills needed for independent living.[69] Independent living skills require the OT to include a client's participation in preferred occupations, which involves not only the environment in which these occupations take place, but also the socialization that supports engagement in these occupations. Occupational therapists should devote more time and energy to preparing patients for the capacity to function in their own communities.[69]

Lyons and colleagues,[59] who are OT practitioners in a major rehabilitation center, noted that the "shift from the medical model which encourages the client to take responsibility for making decisions" about the course of treatment, presents a unique opportunity for OTs to return to a more authentic, occupation-based approach to practice and to rediscover their roots in client-centered practice. These researchers also described the many benefits of their reinvention of practice to a truly client-centered and occupation-based approach within a medical model setting, thereby declaring occupational therapy's unique approach to client care and positioning their leadership in client-centered care on the rehabilitation team. Their methods for achieving such a focus include the use of a semistructured occupational performance questionnaire, the Canadian Occupational Performance Measure (COPM),[51] an occupational story-telling and story-making narrative designed to enable the OT to come to better know the client. The researchers also use occupational kits to engage clients in occupations of their choice, such as gardening, letter writing, pet care, fishing, scrapbooking, and car care. The reinvention of practice, to return to an authentic, occupation-based approach, is a win for the profession and a win for those we hope to serve.[59]

Occupational therapists can help redefine disability.[78] This redefinition would include working for changes in social attitudes and practices so that society would recognize the dignity and worth of people with disability, granting their rights to self-definition and self-direction. The occupational therapist would strive to work in (social model) as a consultant, helper, and advocate, rather than as a diagnostician or a prescriber and manager of treatment. Schlaff[78] recommended that the consumer become self-directed and that both the consumer and the occupational therapist work to remove community barriers and disincentives for economic independence.

Life Satisfaction and Quality of Life

The concepts of life satisfaction and quality of life are very important elements of the discussion of the personal and social contexts of physical disabilities.[70] Life satisfaction is considered to be the subjective component of an individual's overall quality of life.[91] How satisfied an individual is with his or her life may include such factors as satisfaction with family life, engagement in leisure activities, vocational pursuits, self-care, and sexual expression. Satisfaction does not require the same level of participation from each individual, but instead reflects how the person values his or her level of participation in various life situations. A preponderance of the literature on the psychosocial issues of physical disability for those with a variety of chronic disabling conditions (whether acute, progressive, or congenital onset) describes using an individual's perceived quality of life or life satisfaction as a measure of the person's success in adapting to or overcoming the emotional consequences of these diagnoses. Self-reported absence of depression, anxiety, and suicidal ideation are deemed evidence of mental health, which is frequently equated with a high quality of life and life satisfaction.[45,88]

Of particular relevance to occupational therapy is what clients report as contributing to their quality of life and life satisfaction. In the early 1980s, Burnett and Yerxa[17] found that individuals with a disability, while satisfied with their performance of personal ADLs after discharge from rehabilitation, felt ill prepared for functioning in the home and community. More recent studies have indicated that individuals with a disability who reported a high quality of life and life satisfaction regarded socialization (friendship), leisure, and productive occupations as most responsible for their high ratings. In fact, for the four participants in Pendleton's qualitative study on the friendships of successful women with physical disability, friendship-supported participation in occupation, and participation in occupation, in turn, facilitated their friendship.[70]

Studies in Sweden showed that among community-based people who had had strokes, life satisfaction was not correlated with the degree of physical impairment, but rather with the person's ability to achieve his or her own valued goals.[13]

Threaded Case Study

Angela, Part 2

Angela's account of the experience of living with spastic cerebral palsy was not written to form a relationship with an OT practitioner or, for that matter, any other professional. Rather, this insider's reflection was written, in the Project Muse editors' words, to explore bioethical topics and, on behalf of individuals with disabilities, to "share deeply personal accounts of how their lives are affected by their disabilities and the way society views their disabilities."

With that understanding, one should not be drawn into speculation, based on her account, about what Angela may or may not find useful from a practitioner. Instead, reflect on her use of language to describe her disability and her view of health: How has Angela's perception of herself changed over time? What has contributed to those changes? What impairment-based difficulties does she describe? What interventions have been rejected? What effect does her disability have within treatment for an unrelated disease?

In a commentary on the Project Muse narratives, Lorna Hallahan, a bioethicist, wrote:

Acknowledging that respect compromised is a doorway to oppression in which the autonomy of the person is sacrificed in the interests of social hygiene and service efficiency opens a wide sphere for solidarity building and action. In order to understand the potency of this mechanism which masquerades as care, we need to know the history of exclusion, rights denial and violence that has shaped our social responses to those labeled disabled. It is this history, alive today, that produces and reproduces affliction.[36]

Angela's story highlights the theory of profoundly negative experiences caused by societal factors. Hallahan's conclusions help reinforce the idea that respectful understanding of all the factors affecting full participation is the first step toward collaborative partnership with those who have a disability.

Summary

This chapter explored the personal and social contexts of physical disability and the implications for occupational therapists. The individual experiences of people with disabilities are necessary resources for practitioners to create a meaningful and useful approach to the problems of living with disability.

Distinctions between the medical model, and the social model and its sister, the independent living philosophy, as applied to the experience of disability, give us important lessons for creating useful relationships with those who may benefit from our professional knowledge and skills. As we explore engagement in a unique pattern of occupations, in unique environments with individuals who have specific interests, we seek to improve the potential satisfaction of that experience for that individual. Our attention must include the removal of barriers to that engagement in occupations.

Using our professional expertise, we practitioners, along with other professionals, become an integral part of a client's environment through our direct contact and construction of a rehabilitation (or health promotion) environment. We are bound by the ethical standards and the mission of our profession to foster relationships that promote quality of life and personal autonomy. The language we use conveys a powerful affective message and must reflect our values. As members of the larger society exposed to mass media images of disability, we may need to examine our own biases—namely, “handicapist” stereotypes—that create attitudinal barriers for those with disabilities.

Our commitment to improving the life opportunities of people with disabilities directs us to always strive for improvement in our practice and knowledge base. Our thoughtful desire for, and valuing of, positive change in the human condition must lead us to continual self-examination, throughout our individual careers.

Review Questions

1. How would a therapist approach a clinical situation if following an independent living movement philosophy? In what ways does the approach differ from traditional treatment?
2. What are some of the individual elements that affect the personal context of the disability experience?
3. What do we know about stage models of disability adaptation? In what ways are they useful?
4. How do stigma, stereotypes, liminality, and spread influence the social context of disability?
5. What are innovative ways of conceptualizing disability, culture, and the environment?
6. In what ways does the ICF promote a biopsychosocial model of disability? How has this model gained support from OT theorists?
7. In what ways does the occupational therapist become an environmental factor with the person who has a disability?
8. What is the therapeutic use of self and why is it important?
9. How can OT practice become occupation centered and client centered?
10. What do we know about quality of life and life satisfaction among individuals with disabilities?

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Teaching Activities in Occupational Therapy

Pamela Richardson, Rochelle McLaughlin

CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Discuss purposes and outcome goals for teaching in occupational therapy.
2. Analyze how teaching strategies will differ, depending on the characteristics of the client, task, and context.
3. Apply to occupational therapy interventions current knowledge about factors that influence motivation and active participation.
4. Provide appropriate instruction, feedback, and practice tailored to individual tasks and client goals.
5. Promote transfer of learning to real-life situations through effective teaching strategies.
6. Implement occupational therapy interventions designed to promote self-monitoring and strategy development.
7. Define mindfulness and the therapeutic use of self.
8. Explain ways in which the therapeutic use of self can be cultivated and fostered.
9. Describe ways in which the Western medicine medical culture and Western societal and cultural norms in general can undermine our capacity to cultivate and foster the therapeutic use of self.
0. Identify ways in which mindfulness is currently embedded within the Western medical system.
1. Examine ways in which the act and practice of embodying mindfulness as an occupational therapist can enhance the cultivation and development of the therapeutic use of self.
2. Assess and justify the efficacy of mindfulness as a skillful way to develop the therapeutic use of self.
3. Differentiate between mindful occupational participation and automatic-pilot mode occupational participation.

KEY TERMS

Blocked practice
Contextual interference
Declarative learning
Extrinsic feedback
Intrinsic feedback
Metacognition
Procedural learning
Random practice
Somatosensory instruction
Strategies
Transfer of learning
Verbal instruction
Visual instruction

KEY PHRASES

The development of the therapeutic use of self
Prepared and effective interpersonal interaction
Mindfulness-based healthcare practitioners
***Quality* of the engagement and participation in occupations**

Section 1 Teaching Strategies in Occupational Therapy

Pamela Richardson

Teaching is a fundamental skill for occupational therapists. Therapists spend much of their time with clients teaching a variety of activities. Effectiveness as a teacher depends on the therapist's ability to organize the environment and the instructional methods to meet the learning needs of the individual client. This chapter discusses the process of teaching for occupational therapists working with clients who have physical disabilities. It also presents the reasons occupational therapists teach activities, the phases and types of learning, and principles of teaching and learning with this population.

Why Occupational Therapists Teach

Occupational therapists use a variety of teaching techniques in their interventions. Occupational therapists engage in teaching activities for the following reasons:

Threaded Case Study

Li, Part 1

Li is a 67-year-old retired high school science teacher who was hit by a car as he walked across a city street. Before his accident, he was active in a variety of volunteer activities that included teaching English as a second language at an adult education program, working as a docent at the local botanical gardens, and leading nature hikes in a nearby county park. He also was an amateur watercolor artist who had recently begun to receive recognition for his landscape paintings.

Upon referral to occupational therapy, he was nonambulatory because of a fracture of the pelvis and right femur. He also had fractures of his right clavicle and humerus and multiple fractures of his dominant right forearm and hand. He had a severe concussion and experienced dizziness and impaired balance, memory loss, and episodes of confusion.

In the initial occupational therapy evaluation Li stated his desire to return to his volunteer activities and his painting. He understood that the healing and rehabilitation process would take time, and his immediate concern was to regain physical capacity so that he could be more independent in his self-care. His wife attended his occupational therapy sessions and was committed to assisting him in his recovery.

Critical Thinking Questions

1. What does Li need to learn?

2. What strategies should Li's therapist use to facilitate his learning?

3. What should Li learn first?

1. *To help clients relearn skills lost as a result of illness or injury*. Clients may need to relearn how to perform daily occupations such as eating and dressing. They may also need to relearn basic performance skills, such as the ability to maintain sitting or standing balance, reaching, or grasping. In the case of Li, his head injury affected both short- and long-term memory, impairing his ability to perform self-care skills. One of the first goals of his OT program was to relearn hygiene and grooming skills so that he could regain independence in this aspect of self-care.

2. *To develop alternative or compensatory strategies for performing valued occupations*. Clients may need to be taught new ways to perform familiar activities. Alternative or compensatory strategies can also be taught to prevent injury and increase safety. These strategies may be temporary, as in the case of an individual who needs to learn hip precautions after hip replacement surgery, or permanent, as in the case of an individual who needs to learn to use a tenodesis grasp after a complete spinal cord injury at the C6 level. In some cases adaptive equipment may be needed to achieve independence, and instruction in the use of adaptive equipment must be included in the teaching of compensatory

strategies. Li's occupational therapist instructed him in adaptive dressing and bathing techniques so that he could maintain independence in these activities while his fractures healed.

3. *To develop new performance skills to support role performance in the context of a disabling condition*. In some cases clients will need to learn new skills to enable participation in daily occupations. Propelling a wheelchair, operating a prosthetic device, and managing a bowel and bladder program are examples of new skills that clients with specific disabilities must learn. Li's therapist worked with him to develop a reminder system to compensate for his memory loss. He learned to record and keep important information with him in his phone so that he could easily access phone numbers, appointments, and other needed information.

4. *To provide therapeutic challenges that will help to improve performance skills to support participation in areas of occupation*. Therapists may teach clients activities that provide physical and/or cognitive challenges to facilitate the rehabilitation process. Activities such as board games and crafts can be used to improve strength, dexterity, postural control, and problem-solving and sequencing skills, among others. Clients may need to be instructed in the rules or procedures of the activity, and also in how to position or organize themselves to engage in the activity. To improve dexterity in Li's injured right arm after the cast was removed, and also to improve his attention and task orientation, his therapist instructed him in paint-by-number activities. These activities addressed his deficits in both motor and process skills and supported his return to participation in his valued occupation of watercolor painting.

5. *To instruct family members or caregivers in activities that will enhance the client's independence and/or safety in daily occupations.* If the client is not able to learn to perform an activity using compensatory and/or adaptive strategies, it is necessary to teach family members or caregivers how to assist or supervise the client in the activity. Many self-care and home activities may require assistance or supervision to ensure safety. Environmental modifications may need to be made to ensure the safety of the client and the caregiver and to facilitate maximal independence for the client. Li's wife was instructed on how to help him with wheelchair transfers. She was also instructed on how to cue him to use his reminder notebook at home.

Phases of Learning

Learning generally proceeds through three phases. These phases are the acquisition phase, the retention phase, and the generalization, or transfer, phase. The acquisition, or learning, phase that occurs during initial instruction and practice is often characterized by numerous errors of performance as the learner develops strategies and schemata for how to successfully complete the task. The retention phase is demonstrated during subsequent sessions, when the learner demonstrates recall or retention of the task in a similar situation. **Transfer of learning**, or generalization of skill, is seen when the learner is able to spontaneously perform the task in different environments, such as the client who is able to correctly apply hip precautions at home after learning the precautions in the therapy clinic.

Learning Capacities

Not all clients are able to transfer skills learned in one environment into other contexts. Clients who cannot transfer learning will need environmental modifications, supervision, and/or cueing to engage successfully in the activity being taught. Therefore, the therapist needs to determine each client's capacity for retaining and transferring knowledge so that therapist and client can establish appropriate goals and use appropriate teaching methods.

Dynamic assessment is one approach used to determine an individual's capacity to benefit from instruction. In this assessment framework an interactive process is used whereby the therapist uses feedback, encouragement, and guidance to facilitate an individual's optimal performance using a test-teach-retest format.[111] Dynamic assessment complements more traditional assessment methods, giving therapists the opportunity to observe learning and change, which can help guide intervention. Li's therapist used this strategy to teach safe transfer skills early in his rehabilitation program. After providing initial instruction, she asked him to demonstrate a transfer. She then provided additional instruction to address unsafe techniques she observed. After the reinstruction she again had him demonstrate the transfer to determine if he was incorporating her feedback. She repeated this process in each session until she was confident that he was able to consistently use safe technique.

Transfer of knowledge can be evaluated by changing one or more attributes of the task and observing whether the client is still able to perform the task. For instance, a therapist who has been teaching upper body dressing can change the type of garment used in the task, the location or orientation of the garment relative to the client, or the client's positioning. A client who is not able to perform the task with one or more attributes changed may not be capable of transferring new skills.

OT Practice Note

Learning capacities can change dramatically in some clients because of spontaneous recovery from neurologic insults, so therapists should frequently reassess clients to determine whether teaching methods and goals need to be adjusted.

Procedural and Declarative Learning

Therapists teach tasks in which learning occurs both consciously and unconsciously. Knowledge is demonstrated in different ways for the two types of tasks. **Procedural learning** occurs for tasks that are typically performed automatically, without attention or conscious thought, such as many motor and perceptual skills. Procedural knowledge is developed through repeated practice in varying contexts. For instance, an individual learns to maneuver a wheelchair through a process of procedural learning, while gradually developing a movement schema for the activity.[84] **Verbal instruction** alone is of little value. Rather, the procedures for performing this activity are learned through opportunities to experiment with different combinations of arm or arm and leg movements to achieve propulsion in a variety of directions and speeds. Learning is expressed through performance; therefore, individuals who have limitations in cognition or language can still demonstrate procedural knowledge.

Declarative learning creates knowledge that can be cognitively recalled. Learning a multistep activity, such as tying a shoelace or performing a transfer, is often facilitated if the client can verbalize the steps of the task while completing it. Learning can also be demonstrated by verbally describing (declaring) the steps involved in completing the activity. Through repetition of an activity, declarative knowledge can become procedural, as the movement becomes more automatic and requires less cognitive attention. Mental rehearsal is an effective technique for enhancing declarative learning. During mental rehearsal the individual practices the activity sequence by reviewing it mentally or by verbalizing the process. This method can be used effectively with clients who, because of weakness or fatigue, are limited in their ability to physically practice an activity. However, because of the cognitive requirements, clients with significant cognitive or language deficits may not be able to express declarative knowledge.

Principles of Teaching and Learning in Occupational Therapy

The process of teaching involves a sequence of clinical reasoning decisions. Regardless of the characteristics of the client and the activity, basic learning principles can be applied to any teaching and learning situation.

The principles listed in Box 7.1 illustrate that before initiating a teaching activity, the occupational therapist must be aware of (1) the client's cognitive capacity, (2) occupations that have value to the client and the family, (3) the attributes of the task being taught, and (4) the context in which the client will be expected to perform the activity. The therapist needs to gather this information during the initial assessment to create an accurate knowledge base from which to develop the intervention plan, the choice of activities, and the method of teaching. Effective intervention requires appropriate, evidence-based application of these principles to each client's unique situation. Two examples of this include the framework of occupational gradation and goal-directed training. The framework of occupational gradation is a method of systematically manipulating properties of the task, the person, the object, and the environment to optimally challenge an individual's functional performance, specifically in terms of upper extremity motor skills. This framework incorporates principles of motor learning, motor control, personal factors, environmental factors, and properties of tasks and objects. Meaningfulness of the task, client goals, and ability to incorporate the task into daily life are also key considerations.[84] The goal-directed training approach uses client-selected goals to create active problem-solving opportunities for the client. Intervention is focused on the task to be achieved, rather than on impairments that may limit performance. This approach is based on the dynamic systems models of motor control and motor learning and the ecologic occupation-based models of intervention. Progress is measured through incremental steps using goal attainment scaling.[64]

Box 7.1

Principles of Teaching and Learning in Occupational Therapy

- Identify an activity that has meaning or value to the client and/or family.
- Choose an instructional mode that is compatible with the client's cognition and the characteristics of the task to be taught.
- Organize the learning environment.
- Provide reinforcement and grading of activities.
- Structure feedback and practice schedules.
- Help client develop self-awareness and self-monitoring skills.

Each of these approaches combines occupation-centered activities and active engagement of the client, with application of specific motor learning and teaching techniques tailored to the cognitive and motor abilities of the client. Procedural reasoning and narrative reasoning assist the therapist in determining the appropriate configuration of goals, activities, and teaching methods for each individual. The principles of teaching and learning in occupational therapy are further discussed in the following sections.

Identify a Meaningful Occupation, Activity, or Task

When conducting a client-centered assessment, the therapist explores which occupations have the greatest value and importance to the client. Engagement in these occupations can serve both as outcomes of intervention and as activities used in the intervention process. The client will be motivated to be an active partner in the therapy process if the activities are perceived to be meaningful.[112] If the client does not have the capability to engage in the occupation itself, performance skills and activities that contribute to participation in the occupation are often addressed in the intervention. The client needs to be informed of how developing or improving these skills will contribute to the ability to engage in the valued occupation. Doing so helps the client ascribe meaning to the activities and facilitates optimal participation.

Li's occupational therapist learned of his skill as a painter during the initial interview with Li and his wife. The therapist was able to use Li's motivation to return to this valued occupation to guide the choice of drawing and painting activities to improve function in his injured arm. The therapist also was able to explain to Li how his participation in other therapeutic activities to improve strength, range of motion, and endurance would contribute to his ability to resume his occupation of painting, in addition to independence in daily living skills. The therapist's attention to Li's interests and values created trust that led to a productive learning partnership.[30]

Choose Instructional Mode Compatible With Client's Cognition

When many people think about the act of teaching, verbal instruction is what comes to mind. Verbal instruction is an effective means of conveying information in many situations. It is an efficient method for instructing groups, such as in back-safety classes, during training in hip precautions after hip replacement surgery, and through instruction in body mechanics and ergonomic principles for employee groups. Verbal instruction can also be used effectively when instructing individual clients. Verbal cues can be used to provide reinforcement or to give information about the next step in the sequence or the quality of performance. Verbal cues can be an effective way to provide feedback in the early and middle stages of learning; however, it should be phased out as soon as possible so that the client does not become dependent on verbal cues to complete the task. Family members and caregivers can be instructed on how to provide appropriate verbal cues if the client is unable to recall a task sequence independently. Li's wife was present during instruction on transfer techniques, and the therapist taught her brief verbal cues she could use to remind Li of key steps of the transfer process.

Visual instruction is effective for clients who have cognitive and/or attention deficits and difficulty processing verbal language, and also for tasks that are too complex to describe verbally. The therapist demonstrates the activity, and the client observes the therapist and follows the therapist's example. The therapist can repeat the demonstration as many times as necessary for the client to accurately reproduce the task. The therapist can also break the task into steps, demonstrating one step at a time and continuing to the next step as the client completes the previous step. Other forms of visual instruction include drawings or photographs that can be used to remind a client and/or caregiver about the task sequence or desired performance outcome. Visual instruction can effectively be paired with verbal instruction, but therapists must avoid overwhelming the client with combined verbal and visual input.

Somatosensory instruction is a third mode of instruction. This involves the use of tactile, proprioceptive, and kinesthetic cues to help guide the speed and direction of a movement. Manual guidance is a form of somatosensory instruction that is especially effective for procedural learning, such as the process of weight shifting and postural adjustment involved in coming from sit to stand. Hand-over-hand assistance is effective in teaching activities to clients who have cognitive and/or sensory processing deficits; the therapist guides the client's hands in completion of a task.

Li's therapist used all three instructional modes. Verbal instruction was most effective for reteaching self-care skills; verbal cueing was used to orient Li to the task sequence during the acquisition phase of learning. Visual instruction was used to teach many of the therapeutic activities the therapist used to enhance upper extremity function. Somatosensory instruction was effective for balance retraining.

Structure the Learning Environment

Choosing the appropriate environment in which to instruct a client is critical to teaching success. If a client is confused or easily distracted, a quiet environment with minimal visual distraction is often needed when teaching of a task is begun. As the client becomes more proficient in the skill being taught, visual and auditory distractions need to be introduced so that the environment more closely resembles the one in which the client will eventually engage in the activity. For instance, a therapist working with a client on self-feeding may initially conduct the intervention in the client's room. As the client becomes more proficient and confident, the therapist may move the intervention to the facility's dining room, where multiple distractions are present. In addition to providing challenges to the client's attention, the dining room provides opportunities for social interaction, which may act as a motivator for the client to further improve self-feeding skills.

Similarly, clients need opportunities to practice new skills in a variety of environments so that they are proficient in meeting environmental challenges. A client who is learning how to control a wheelchair needs to practice both outdoors and indoors on a variety of surfaces. A client who is working on refining grasp and dexterity needs experience in manipulating objects of a variety of sizes, shapes, and weights while engaging in functional tasks with a variety of demands similar to those that will be encountered in the client's daily activities.

Li's therapist determined that his initial confusion necessitated a quiet, minimally stimulating environment for initiation of teaching in self-care skills. As Li's confusion cleared, he was able to work in the therapy clinic on activities to improve balance and upper extremity skills, and later he worked in the kitchen and garden areas on more demanding and varied skills.

Provide Reinforcement and Grading of Activities

The concept of reinforcement comes from operant conditioning theory, which states that behaviors that are rewarded or reinforced tend to be repeated.[50] Many types of reinforcement may be used. For some clients, social reinforcement such as a smile or verbal encouragement creates motivation to continue. Other clients may require more tangible rewards, such as rest periods, snacks, favorite activities, and so on. Still other clients are motivated by visible indications of their progress. Use of a graph or chart to demonstrate daily improvement in performance skills or client factors such as grip strength, sitting tolerance, or range of motion can help a client to engage more actively in the therapy process. These are examples of extrinsic reinforcement.

Many clients are motivated by completion of a task; for instance, preparing a snack and then eating it, or dressing themselves independently so they can visit with friends. Completion of the task provides intrinsic reinforcement, seen in the individual's satisfaction in his or her ability to participate in desirable activities as a result of completing the task. An activity that is motivating and meaningful to the client can increase active participation and improve intervention outcomes.

Several studies have shown (1) that adding purposeful or imagery-based occupations to rote exercise results in more repetitions than are used for rote exercise alone,[36] (2) that clients select occupationally embedded activities over rote exercise tasks,[121] and (3) that added-purpose occupations result in greater retention and transfer of motor learning than occur with rote exercise.[23] Sietsema et al.[106] found that better scapular abduction and efficiency of forward reach were achieved when clients with traumatic brain injury focused on reaching to control a game panel than when they focused on how far they could reach an arm forward. Similarly, Nelson et al.[77] showed that intervention to improve coordinated forearm pronation-supination was more effective in stroke rehabilitation when clients focused on turning an adapted dice thrower in the context of a game than when they focused on the movement itself. Wu et al.[120] found that intervention to improve symmetric posture in adults with hemiplegia had significantly better outcomes when subjects focused on wood sanding and bean bag toss games. These studies support the effectiveness of teaching meaningful activities and occupations in the rehabilitation process.

In addition to structuring the type of reinforcement, the therapist needs to carefully grade the challenges of the activity, so the client can experience success and mastery during the process of learning the activity. If the client has too much difficulty completing a task, social reinforcement or inherent meaningfulness of the activity will not be enough to override frustration or fatigue. Therefore, therapists must analyze the activity and determine how to grade the activity to meet the learning and reinforcement needs of the individual client. This includes deciding on the most appropriate mode of instruction (as described in the previous section), what type of reinforcement will facilitate intrinsic motivation, and how best to structure feedback and practice schedules; these decisions are discussed in the next section.

Li's therapist knew that his strong desire to return to his occupation of leading nature hikes would motivate him to improve his balance and standing tolerance. The therapist explained how a variety of activities involving challenges to Li's sitting and standing balance would help him regain his postural stability. Li participated actively in these tasks and generated ideas for additional tasks that could be incorporated into his OT program; he also practiced outside of the therapy environment. His intrinsic motivation to perform these tasks in varied contexts was evident in his improved balance skills.

Structure Feedback and Practice

Feedback is information about a response[83] that can provide knowledge about the quality of the learner's performance or the results of the performance. **Intrinsic feedback** is generated by an individual's sensory systems. An individual learning to hit a golf ball uses visual and somatosensory feedback to evaluate performance. The visual system is used to align the head of the golf club and the golfer's body in correct orientation to the ball. Kinesthetic and proprioceptive inputs inform the golfer about joint position and the location of body segments in space; this allows the golfer to make the necessary postural adjustments and upper extremity movements to bring the club head into contact with the ball while using appropriate speed and force.

Extrinsic feedback is information from an outside source. The trajectory of the golf ball, the distance of the drive, and the location of the ball on the fairway all provide extrinsic feedback about the results of the golfer's actions. An observer can provide extrinsic feedback about task performance by giving the golfer information such as, “Your stance was too open,” “You did not follow through far enough on the swing,” or “Your head position was good.” For clients whose sensory recognition or processing abilities have been impaired, extrinsic feedback from a therapist or technological device can provide useful supplementary information to facilitate learning during the acquisition phase. Technological feedback mechanisms include biofeedback systems, virtual reality and gaming technology,[53] and digital displays of kinetic or cardiovascular data on exercise equipment. These feedback systems can allow manipulation of practice conditions and often provide more immediate and consistent feedback than can be obtained from a therapist.

Although extrinsic feedback may be helpful early in the learning process, clients will achieve greater independence and efficiency in activities by developing the ability to continue learning through intrinsic rather than extrinsic feedback. In fact, extrinsic feedback may not produce optimal learning and may create dependency, with deterioration in performance if the feedback is removed.[54] Therefore, extrinsic feedback must be gradually decreased if the client's goal is independent performance in a variety of performance contexts.

Practice is a powerful component of the occupational therapy process. The ways in which a therapist structures practice conditions can influence a client's success in retention and transfer of learning. Several aspects of practice are discussed in the following paragraphs.

Li experienced mild sensory loss in his right arm as part of his injury. When his cast was removed and active rehabilitation commenced, he benefited from extrinsic verbal and somatosensory feedback provided by his therapist about the quality of his movement. As his upper extremity function improved, the therapist gradually decreased the amount of extrinsic feedback provided. Li learned to use intrinsic feedback to adjust the timing, speed, and direction of his movements while engaged in a variety of functional activities designed to improve strength, range of motion, and dexterity. Participation in practice sessions that included varied task challenges helped him to learn strategies that could be transferred to many activities.

Contextual Interference

Contextual interference refers to factors in the learning environment that increase the difficulty of initial learning. Limiting extrinsic feedback provided about the results of performance is one example of contextual interference. A therapist who is attempting to limit extrinsic feedback will minimize the amount of verbal feedback about performance and/or the amount of manual guidance provided during the task. Performance during the acquisition phase may be poorer with high contextual interference; retention and generalization are more effective. This may occur because a high level of contextual interference forces the learner to rely on intrinsic feedback and to adapt motor and cognitive strategies to complete the task, resulting in more effective learning.[41]

Blocked and Random Practice Schedules

Blocked and random practice schedules are examples of low and high contextual interference, respectively. During **blocked practice**, clients practice one task until they master it. This is followed by practice of a second task until it is also mastered. In **random practice**, clients attempt multiple tasks or variations of a task before they have mastered any one of the tasks. A random practice schedule may be used to teach wheelchair transfer skills. The client practices each of several transfers during the course of a single session. For example, the client will practice moving between the wheelchair and a therapy mat, between the wheelchair and a chair, and between a toilet and the wheelchair. A random practice schedule for improving postural stability might include having the client stand on a variety of unstable surfaces, such as an equilibrium board, a balance beam, or a foam cushion, while playing a game of catch. These types of practice schedules may slow the initial acquisition of skills but are better for long-term retention of these skills[23] and for transfer of the learning to another context or task.[31] This is because random practice engages deeper cognitive processing than blocked practice. As a result, the stronger motor memory formed facilitates retention, particularly for more complex motor tasks.[44,80]

Whole Versus Part Practice

Breaking a task into its component parts for teaching purposes is useful only if the task can naturally be divided into discrete, recognizable units.[119] This is so because continuous skills (or whole task performance) are easier to remember than discrete responses.[93] For example, once a person has learned to ride a bicycle, this motor skill will be retained even without practicing for many years. Continuous skills should be taught in their entirety rather than in segments. For example, the activity of making vegetable soup includes several discrete tasks, including chopping vegetables, measuring ingredients, assembling the ingredients in the soup pot, and cooking the ingredients. During one session, the therapist could teach a client to chop the vegetables; the other components of the task could be taught in subsequent sessions. However, for the activity of making a pot of coffee, the task components (measuring the water, pouring it into the coffeemaker, measuring the coffee, putting the coffee into the coffeemaker, turning on the coffeemaker) need to be completed in a specific order. Teaching any of these task components in isolation would not result in meaningful learning or independent activity performance. For best retention and generalization, making coffee should be taught as a complete task, rather than having the client practice a different portion of the task during each therapy session.

To facilitate the learning process, the therapist may provide demonstration, verbal cueing, or manual guidance as needed for selected aspects of the task. This way the client experiences completion of the task on each trial, and the therapist gradually gives less assistance as practice sessions continue.

Cognitive Strategies

A growing body of literature supports the efficacy of cognitive strategies in helping individuals to learn motor skills. Cognitive strategies are goal-directed, consciously controlled processes that support motor learning and include memory, problem solving, mental imagery, perception, and **metacognition**.[69] Cognitive strategies can be general or specific. General strategies are used in a variety of situations, and specific strategies are used for a particular task. Evidence from a variety of studies suggests that cognitive strategies can assist individuals with stroke to transfer skills to different environments.[55,56,69,116] Cognitive strategies can be used in conjunction with practice in variable contexts to facilitate learning of motor and functional performance skills.

Practice Contexts

Practice under variable contexts enhances transfer of learning. Optimal retention and transfer of motor skills occur when the practice context is natural rather than simulated.[60,66] This may reflect the fact that the enriched, natural environment provides more sources of feedback and information about performance than the more impoverished simulated environment. However, transfer of learning is better when the demands of the practice environment more closely resemble the demands of the environment in which the client will eventually be expected to perform.[121] Therefore, teaching kitchen skills in a client's own home or in a kitchen environment that is very similar to the client's kitchen will result in better task performance when the client engages in the task at home.

Client factors may also influence outcomes related to the practice context. A meta-analysis of the effects of context found that treatment effects were much greater for populations with neurologic impairments than for those without neurologic impairment.[54] Errorless learning, also known as systematic instruction, is an intervention paradigm based on the principle that learning will occur more quickly and efficiently if the learner does not engage in trial and error throughout the learning process. This learning strategy has been used effectively with individuals who have cognitive or memory deficits as a result of acquired brain injury or dementia,[86] but it has also been effective in facilitating learning of a practical skill (fitting a prosthetic limb) during the rehabilitation process.[16]

One aspect of the practice context that has received little research attention is the role of the social environment in task learning. The importance of the social context of occupational performance and of the occupation of social participation is endorsed by the Occupational Therapy Practice Framework: Domain and Process, third edition (OTPF-3).[2] Working with other clients in a group promotes socialization, cooperation, and competition, which can increase clients' motivation. Acquisition of skills is enhanced through observation of others who are learning a task. Additionally, group intervention can promote the development of problem-solving skills and can create a bridge between the supervised therapy environment and the unsupervised home environment.[13]

Help Client Develop Self-Awareness and Self-Monitoring Skills

To maximize the retention and transfer of learning, clients must develop the ability to self-monitor, so they are not dependent on extrinsic feedback and reinforcement. The knowledge and regulation of personal cognitive processes and capacities is known as *metacognition*.[45] It includes awareness of personal strengths and limitations and the ability to evaluate task difficulty, to plan ahead, to choose appropriate strategies, and to shift strategies in response to environmental cues. Although metacognition is typically discussed in relation to improving cognitive skills, self-awareness and monitoring of relevant performance skills may be equally important prerequisites to developing effective motor, interpersonal, and coping strategies. Specifically, an intervention directed toward helping clients develop enhanced awareness of body kinematics and alignment may be an important component of motor learning.[12] Self-review of performance and guided planning for tackling the challenges of future tasks are key factors in the therapeutic process and are critical prerequisites to a person's ability to generate and apply appropriate strategies.

Strategies are organized plans or sets of rules that guide action in a variety of situations.[90] Motor strategies include the repertoire of kinematic linkages and schemata that underlie the performance of skilled, efficient movement. The process of stepping to the side when one is abruptly jostled is a motor strategy for the maintenance of standing balance.[101] Cognitive strategies include the variety of tactics used to facilitate processing, storage, retrieval, and manipulation of information. Using a mnemonic device to remember a phone number is a cognitive strategy. Interpersonal strategies help in social interactions with other individuals. A person who uses direct eye contact and greets another by name when being introduced is using an interpersonal strategy. Coping strategies allow people to adapt constructively to stress. Coping strategies can include deep breathing, exercise, or relaxation activities.

Strategies provide individuals with foundational skills that can be adapted to the changing demands of occupational tasks within a variety of contexts. Thus, learning is more likely to be transferred to new situations when opportunities arise to develop foundational strategies.[107] Individuals develop strategies through a process of encountering problems, implementing solutions, and monitoring the effects of these solutions. Occupational therapists use activities to help clients develop useful strategies by presenting task challenges within a safe environment that provide opportunities to try out different solutions.[90]

As Li was nearing discharge from occupational therapy services, the therapist worked with him to develop strategies to facilitate his occupational performance. Although his memory was improved, recall of names and numbers was still poor, so the cognitive strategy of using a notebook for recording important information was continued. In addition, to cope with persistent mild deficits in balance, Li and his therapist developed a motor strategy of keeping a sturdy table nearby when he stood to talk to visitors at the botanical gardens. This strategy provided a support that he could lean on or hold onto if needed, and it was a strategy that also could be used in other situations.

Factors That Influence the Learning Process

The ultimate goal of learning is to create strategies and skills that individuals can apply flexibly in a variety of contexts and occupations. As this chapter has presented, occupational therapists have many methods available to them to help their clients achieve this goal. The concepts discussed in this chapter that facilitate transfer of learning to other environments are listed in Box 7.2.

Threaded Case Study

Li, Part 2

In the case of Li, the therapist used the information gathered in the initial assessment process to determine what she should teach Li and his wife, and in what order she should teach various tasks, activities, and occupations. She began with hygiene tasks because these could be accomplished in a sitting position and because of Li's stated desire to perform these tasks independently. She also taught transfer skills and adapted activity of daily living (ADL) techniques so that Li could maximize his mobility, safety, and functional independence in a wheelchair while his lower extremity fractures healed.

As Li's healing progressed, his therapist was able to begin teaching tasks to improve postural stability and upper extremity strength and coordination. Occupations taught during this phase included ADLs and instrumental ADLs (IADLs), in addition to activities designed to improve motor skills. As Li's performance skills improved, the therapist was able to introduce more complex tasks and occupations that further challenged his motor and process skills and prepared him to return to his valued occupations of painting, hiking, and teaching.

As Li's discharge from therapy neared, the therapist changed her focus to teaching cognitive and motor strategies that Li could use to help compensate for residual deficits in balance and memory. Throughout the intervention process the therapist reassessed Li's functional status so that she could adjust her teaching strategies to his current cognitive and motor skills and to the specific demands of the task and environment.

Box 7.2

Factors That Support Transfer of Learning

- Active participation
- Occupationally embedded instruction
- Intrinsic feedback
- Contextual interference
- Random practice schedules
- Naturalistic contexts
- Whole task practice
- Strategy development

Section 1 Summary

Occupational therapists teach activities for a variety of reasons. They reteach familiar activities, teach alternate or compensatory strategies of performing valued activities, teach new performance skills to support role performance, teach therapeutic challenges to improve performance skills to support occupational participation, and teach caregivers and/or family members to facilitate the client's independence and safety in the home environment.

Occupational therapists use a variety of teaching strategies to promote skill acquisition, skill retention, and transfer of learning. Procedural and declarative learning represent unconscious and conscious learning processes, respectively.

Occupational therapists maximize the learning process by (1) identifying activities that have meaning or value to the client/family, (2) providing instruction tailored to the needs of the individual and the task, (3) structuring the environment to facilitate learning, (4) providing reinforcement and grading of activities to establish intrinsic motivation, (5) structuring feedback and practice to facilitate acquisition, retention, and transfer of learning, and (6) helping clients develop self-awareness and self-monitoring skills.

Section 2 the Therapeutic Use of Self: Embodying Mindfulness in Occupational Therapy

Rochelle McLaughlin

The experience you have today will influence the molecular composition of your body for the next 80 days, because that's how long the average protein synthesized in your body today will hang around in the future,

So plan your day accordingly.

Dr. Steven Cole, Professor of Medicine and Psychiatry at UCLA

Threaded Case Study

Irene, Part 1

Irene, an experienced occupational therapist (OT), works full time in a rehabilitation hospital in her metropolitan area. In the past Irene has experienced a great deal of gratification from her work as an OT. However, over the past several years she has steadily been experiencing increasing levels of stress at home due to family complexities, such as her husband being recently laid off from his job and her 4-year-old daughter demonstrating increasing signs and symptoms of having difficulty with focusing, effectively interacting with her family, intensifying nutrient-poor food preferences, increasing sensory seeking and avoiding behaviors, sleeplessness, and lability. Irene's father was also recently diagnosed with and experiencing significant disability from Lyme disease. Irene is currently her father's primary caregiver because her mother has passed away. On top of her family responsibilities and intensities, Irene's work hours and workload are intense, and there are increasing demands for productivity standards, professionalism, technological standards, and “billability” throughout the hospital. She is finding it increasingly difficult to skillfully and effectively meet the needs of the complexity of the patient-family-care demands, the intense productivity standards at work, the caseload, the complex needs of her team, and taking care of herself.

Irene has identified personal psychophysiologic signs and symptoms of her difficulty in meeting and responding to the complex family and work demands, such as insomnia; decreased libido; frequent chest and sinus infections; shallow breathing; muscle tension; headaches; back pain; digestive issues; increasingly poor food choices; craving caffeine, sugar, and refined carbohydrates; increased media use and a frazzled sense of always being “overly busy”; decreased motivation; reduced productivity; feelings of cynicism and hopelessness; a sense of depersonalization; and disengagement from routines and activities that she might consider restorative and nourishing.

Irene wishes that she could have greater ease and well-being in her work and in her family life. She wishes she felt more effective at work and more connected to her family and community. She feels stuck and feels that there must be a healthier, more effective way to be in relationship to her life's intensities.

Critical Thinking Questions

1. How might Irene's access to valuable clinical reasoning and critical thinking skills be limited or impaired? In what specific ways might she not be able to meet the demands of our complex profession of OT and patient care? Consider her ability or inability to build or not build meaningful rapport with her clients or her capacity or incapacity to use herself in an effective and therapeutic way.

2. What are Irene's patterns of occupational engagement? How have they changed, and why have they changed? Consider her **quality of the engagement and participation in occupations**. What barriers are affecting her success in her roles as a mother, wife, and caregiver?

3. Consider Irene's priorities and desired targeted outcomes related to occupational performance, prevention, participation, role competence, health and wellness, quality of life, and well-being?

The development of the therapeutic use of self can be considered the single most important line of intervention we can provide as occupational therapists, and *the therapeutic use of self* has been added to the process overview of the OTPF-3, published in 2014.[1,2] However, there is still little focus in the literature or even in occupational therapy education on *how* to develop, access, and implement this critical yet elusive skill.

Irene's situation, our case example, is unfortunately not unique. The current medical environment in which occupational therapists work tends not to instill institutional cultural norms for fostering or supporting these skills for their employees. The modern Western medicine medical environment itself actually tends to disproportionately value productivity and self-sacrifice over employee health and well-being. The healthcare system is also being increasingly overburdened by the chronic public health disease crisis. Industry experts state that hospital admissions have been continuously rising over the past 30 years, to the point where U.S. hospitals are being stretched to their limits—placing a heavy burden of care on the staff.[3,8] It is not surprising, then, that burnout and chronic disease statistics among healthcare professionals are staggering and growing. The U.S. reports a 25% to 70% burnout rate among healthcare workers, depending upon the working conditions; the UK reports a 70% burnout rate; and Canadian oncology healthcare workers report unfortunate statistics of up to 45% burnout rate.[a]

Although these statistics demonstrate dire circumstances for healthcare workers, there is promising and emerging research demonstrating the beneficial and encompassing effects of the development of the skills and qualities of mindfulness as a sorely needed remedy, effective intervention, and healing modality to meet the mental, emotional, physical, contextual, and therapeutic needs of our world's healthcare workers and the individuals they work with.[b] The characteristics of **mindfulness-based healthcare practitioners** (MBHPs; healthcare workers who are embodied mindfulness practitioners) are aligned with the characteristics of providers who demonstrate skillful and effective therapeutic use of self.[c]

The practices, skills, characteristics, and qualities of mindfulness take time to develop in one's life and work, just as the development of the therapeutic use of self does, and yet they are incredibly portable, practical, and useful. Employing mindfulness in occupational therapy practice with the intention to develop one's capacity to use oneself in an effective and therapeutic manner is not a quick fix for any of the complex problems an OT encounters in his or her life and work. According to extensive research, however, the implications of this kind of training are profound and far-reaching.[d] In this chapter, with the assistance of Irene's case example, we'll take a look at how the embodiment of the qualities and skills of mindfulness in occupational therapy can elicit the development of the therapeutic use of self and enhance our health, well-being, effectiveness, and sense of purpose and meaning.

The Therapeutic Use of Self

The Commission on Practice of the American Occupational Therapy Association (AOTA) added "the therapeutic use of self" to the OTPF-3 process overview in 2014. This change was made to ensure that practitioners understand that use of the self as a therapeutic agent is integral to the practice of occupational therapy and is used in *all* interactions with *all* clients.[1,2] The commission states that the *therapeutic use of self* allows occupational therapy practitioners to develop and manage their therapeutic relationship with clients using skillful narrative and clinical reasoning[51,89]; empathy[110]; and a client-centered,[20,76,79] collaborative approach to service delivery. Open communication ensures that practitioners connect with clients at an emotional level to assist them with the current life situation.[33,34] The use of the self in a therapeutic way is defined as the capacity and skill to utilize oneself in such a way that one becomes an *effective* tool in the evaluation and intervention process.[1,2]

The following highlights a few qualities and characteristics of the effective use of the therapeutic use of self to help us begin to articulate the practice and skills. They can be described as being embedded within the Mindfulness Model,[99] which, as described by Shapiro et al.,[99] highlights three important aspects of the development of the therapeutic use of self: the level of attention (LOA), the attitude (A), and the intention (I) the occupational therapist brings to therapeutic relationships. As you consider the list below, identify whether the characteristic, quality, or behavior is expressed by a *level of attention, attitude,* or *intention (or all three)* on the part of the therapist. For example, for Irene to be able to recognize her own emotional responses, she must have set an *intention* to be present *(level of attention)* to her emotional experiences as they express themselves in her body; to honor her own emotional experience, she must begin to cultivate an *attitude* of openness, curiosity, kindness, and compassion toward her internal experiences. Therefore, for this example (Fig. 7.1), all three of the characteristics defined by Shapiro and colleagues are present.

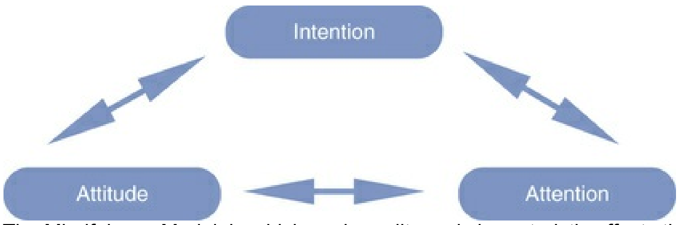

FIG 7.1 The Mindfulness Model, in which each quality and characteristic affects the others.

It is important to recognize that the skills the therapist uses in the therapeutic relationship also must be embedded within the his or her personal life. If, for example, Irene is unable to recognize her own emotional state or she tends to numb or subjugate herself to her own feelings and not process or metabolize them, her capacity to recognize and be in skillful relationship to another's pain and suffering will be limited and stunted. This would significantly affect the skillfulness and development of Irene's therapeutic use of self and would contribute to burnout and affect her therapeutic and personal relationships.

Attuning to oneself and another person with awareness of the full context of the situation with the intention to provide **prepared and effective interpersonal interaction**.[102] Prepared and effective interpersonal interaction requires a specific intention, level of attention, attitude, and skill set on the part of the therapist that can be explicitly developed via mindfulness training in the therapist's personal and work life over the course of years; it thereby becomes a "practice" and a "way of being" and includes (but is not limited to) the following list of characteristics and qualities.

These characteristics and qualities can also be related to occupational therapy's established core values and standards of conduct (Table 7.1), illustrating the relationship between characteristics and qualities of mindfulness skills, prepared and effective interpersonal interaction, and the therapeutic use of self with OT's core values, ethical principles, and standards of conduct. The profession of occupational therapy is grounded in seven longstanding core values (CVs): (1) altruism, (2) equality, (3) freedom, (4) justice, (5) dignity, (6) truth, and (7) prudence. It also follows six ethical principles and standards of conduct (PSCs) for determining the most ethical course of action: (1) beneficence, (2) nonmaleficence, (3) autonomy, (4) justice, (5) veracity, and (6) fidelity. These concepts or words are not regularly used in our modern lexicon, but each word benefits from a greater depth of inquiry and engagement so that there is a deeper understanding of its true meaning and potential impact. In-depth study of the original documents wherein these principles are fully defined and discussed is essential. It is beyond the scope of this chapter to explore the Occupational Therapy Code of Ethics (2015); however, the reader is urged to do his or her own expanded investigation into the personal, cultural, societal, and even spiritual meaning they each hold.

TABLE 7.1

Characteristics and Qualities of Mindfulness Practice in Relationship to the OT Core Values and OT Ethical Principles and Standards of Conduct

These characteristics and qualities are catalyzed by the practice of mindfulness in the development of the therapeutic use of self.

Characteristics and Qualities	OT Core Values	OT Ethical Principles and Standards of Conduct
Be able to recognize, acknowledge, validate, and honor one's emotions, feelings, and experiences, both the therapist's own and the client's.	Altruism, dignity, truth, and prudence	Beneficence, nonmaleficence
Practice mindful, open, curious, embodied presence while listening. Actually hearing what another person is saying without the overlay of judgments and ruminations. This includes "listening" to one's own feelings and emotions.	Altruism, equality, freedom, justice, dignity, truth, and prudence	Beneficence, nonmaleficence, autonomy, justice, veracity, fidelity
Provide gentle, authentic, and kind reassurance (for oneself and the other) that may alleviate fear or anxiety.	Altruism, dignity, and prudence	Beneficence, nonmaleficence
Obtain necessary information, understanding the facts and full context of the situation to identify, provide, and prioritize	Altruism, equality, freedom,	Beneficence, nonmaleficence,

the focus of the intervention plan.	dignity, truth, and prudence	autonomy, justice, veracity, fidelity
Identify and provide appropriate and helpful support and resources.	Altruism, equality, freedom, justice, dignity, truth, and prudence	Beneficence, nonmaleficence, autonomy, justice, veracity, fidelity
Identify, obtain, and provide effective and skillful support and behavioral and attitudinal modeling.	Altruism, dignity, and prudence	Beneficence, nonmaleficence
Be (for oneself and the other) open to, recognize, promote, and honor growth, change, and development.	Altruism, equality, freedom, justice, dignity, truth, and prudence	Beneficence, nonmaleficence, autonomy, justice, veracity, fidelity
Improve the quality of engagement, function, and participation in occupations.	Altruism, equality, freedom, justice, dignity, truth, and prudence	Beneficence, nonmaleficence, autonomy, justice, veracity, fidelity
Foster greater capacity to skillfully manage and relate to the inevitable stresses of life. Skillfully responding, recognizing when "reacting" and making conscious choices about how to relate to inner and outer stressors or a given situation skillfully and effectively.	Altruism, dignity, truth, and prudence	Beneficence, nonmaleficence, veracity, fidelity
Develop the skills of the "conscious use of self," "reflective observation," and "situational awareness."	Altruism, dignity, truth, and prudence	Beneficence, nonmaleficence, veracity, fidelity
Being present and open to the spontaneous, impermanent, and complex nature of life and the engagement in the profession of OT.	Altruism, dignity, truth, and prudence	Beneficence, nonmaleficence, veracity, fidelity
Recognition, inclusion, and celebration of individuality and diversity.	Altruism, equality, freedom, justice, dignity, truth, and prudence	Beneficence, nonmaleficence, autonomy, justice, veracity, fidelity
Respect for the integrity, dignity, and rights of each individual, including one's own.	Altruism, equality, freedom, justice, dignity, truth, and prudence	Beneficence, nonmaleficence, autonomy, justice, veracity, fidelity
Enhancing empathic drives: entering the experience of/with another individual without the loss of one's own sense of experience, practice of establishing healthy, loving boundaries, and groundedness.	Altruism, dignity, truth, and prudence	Beneficence, nonmaleficence, veracity, fidelity
The capacity to recognize, honor, and express humility, integrity, and honesty.	Altruism, dignity, truth, and prudence	Beneficence, nonmaleficence, veracity, fidelity
Unconditional positive regard for oneself, the client, the situation.	Altruism, dignity, truth, and prudence	Beneficence, nonmaleficence, veracity, fidelity
Mental clarity and flexibility. Self-awareness, understanding, and insight.	Altruism, dignity, truth, and prudence	Beneficence, nonmaleficence, veracity, fidelity
Explicitly guided by personal (intuited) values and morals that may or may not necessarily be expressed by those of modern industrialized society or Western medicine.	Altruism, dignity, truth, and prudence	Beneficence, nonmaleficence, justice, veracity, fidelity
Radical self-care, self-compassion, and nourishment of the parasympathetic nervous system via intentional lifestyle choices.	Altruism, dignity, truth, and prudence	Beneficence, nonmaleficence, veracity

This list of characteristics and qualities of prepared and effective interpersonal interaction can easily just become another concept or intellectual understanding that somehow one is just supposed to succumb to or "get" because it sounds nice. The key to living the qualities and characteristics with heart and authenticity is dependent upon one's ability to cultivate a new Way of Being in all aspects of one's life. This becomes a reality when the individual makes a commitment to himself or herself: to engage with the practices of mindfulness and "do the work" of integrating all aspects of oneself, of learning to turn toward one's own version of the full catastrophe, of cultivating courage to be with rather than run away from life's challenges, to nourish oneself with radical unconditional love, and to live wholeheartedly. This Way of Being comes with dedicated practice. One can build mindful awareness skills as a powerful and meaningful way to relearn what has been covered and "dis-cover" and bring this about in your life. Although it may not be a quick fix, it is a fruitful journey, one that is so sorely needed during this time of such complexity and utter distraction. Every single present moment is an opportunity to do just that, and every time you engage with and manifest these mindfulness qualities in your life, they will be deepened, until your entire life becomes one consistent stream of awake, authentic, whole-hearted, and present living. It is well worth the effort because over time and diligent effort, shift happens.

Environmental Effects on the Development of the Therapeutic Use of Self

Most would agree that the development of the therapeutic use of self is a welcome and necessary component to being and becoming an effective occupational therapist. The challenge lies in the fact that health professionals, including occupational therapists, are working in increasingly fast-paced, production-oriented, resource-driven environments in Western medicine that disproportionately value hard work and self-sacrifice over employee health and well-being. Increased productivity standards, increased client loads, and self-care discrepancy measures among health professionals demonstrate staggering and unfortunate impacts on the health professional's mental, physical, and moral health. Research has demonstrated that the resulting burnout among health professionals significantly impacts and reduces client outcomes, the development of the therapeutic use of self, and rapport building.[a]

Burnout refers to a state of emotional exhaustion in health and mental health workers that can manifest in the form of mental health problems, physical ailments, illness, and disease, and it is on the rise.[25,61,63,82] Depression, suicide, substance abuse, sexual misconduct, burnout, and relational problems can all be realistic and serious concerns for therapists who do not effectively care for themselves and do not have the skills to effectively engage with the unique and staggering personal and occupational stressors they face.[7] Burnout has been associated with suboptimal patient care.[98,99] Dr. Stephen Porges, in his book, *The Polyvagal Theory: Neurophysiological Foundations of Emotion,* *Attachment, Communication, and Self-regulation* (2011),[85] describes in great detail the very unfortunate effects of fight, flight, and freeze modes of engagement and the devastating consequences of the chronic sympathetic nervous system activation mode of operating on interpersonal relationships. In his book, *The Body Keeps the Score: Brain, Mind, and Body in the Healing of Trauma,*[115] (2014), Dr. Bessel van der Kolk explains why sympathetic nervous system activation affects concentration and memory and leads to difficulty forming trusting relationships, in addition to difficulty attending to and feeling at home in one's own body.

Irene's situation articulates these unfortunate realities; she is clearly not demonstrating skills that would enable her to be in effective and skillful relationship to the suffering in her personal or professional life. She is numbing and subjugating her own suffering in a variety of dysfunctional and misguided ways, which is deepening the level of suffering she is experiencing from external stressors. Irene's internal stressors of declining mental, emotional, and physical health are compounding the suffering even further and significantly affecting her interpersonal relationships and effectiveness as an occupational therapist.

Recognizing and acknowledging this current reality for so many health professionals can certainly make anyone feel hopeless about the situation; however, there is good news. The good news, as stated by Elizabeth Lesser, author of *Broken Open: How Difficult Times Can Help Us Grow,*[52] (2005), is this: every experience of struggle offers us what we need to be born anew. As we turn toward and deeply acknowledge the true and deep suffering occurring within the current reality of Western medicine, we can begin the work to rise out of this dark night stronger and more empowered than ever before. We can do this co-collectively and co-creatively, and there are maps to help guide us on this journey of transformation. In this chapter we will be exploring aspects of the development of mindfulness as that guiding compass.

The knowledge that therapists can do harm to their clients and themselves by not being aware of and attending to their own needs in a compassionate way and not having developed the skills to be in relationship to this degree of intensity in which they participate has driven this growing body of research. An ever-increasing number of studies demonstrate that the skills of mindfulness appear to be an effective intervention for many, if not most, of these social, emotional, physical, occupational, contextual, moral, ethical, and environmental ills.[a] Research suggests that mindfulness training for healthcare professionals can function as a viable, practical, and useful tool for promoting effective and skillful engagement in one's profession.[38] The development of body awareness in particular has been shown to be a powerful healing practice.[85,115]

Skilled and effective occupational therapists are propelled and motivated by the profession's core values, ethical standards, and principles of care. The preamble to the Occupational Therapy Code of Ethics (2015) states:

… ethical action goes beyond rote compliance with these Principles and is a manifestation of moral character and mindful reflection. It is a commitment to benefit others, to virtuous practice of artistry and science, to genuinely good behaviors, and to noble acts of courage. Recognizing and resolving ethical issues is a systematic process that includes analysis of the complex dynamics of situations, weighing of consequences, making reasoned decisions, taking action, and reflecting on outcomes.

As an example the code lists Principle 2 as "nonmaleficence," which states that "Occupational Therapy personnel shall intentionally refrain from actions that cause harm." Specifically, subprinciple 2C states that we must recognize and take appropriate action to remedy personal problems and limitations that might cause harm to recipients of service, colleagues, students, research participants, or others. Subprinciple 2D states that we must avoid any undue influences that may impair practice and compromise the ability to safely and competently provide OT services, education, or research.[1]

For Irene, participating in mindfulness training, developing awareness, getting meaningful support, and making slow, steady, and mindful lifestyle changes can remedy her personal problems that negatively affect her capacity to be guided by her core values and develop the mental clarity and intuitive intentions to implement meaningful ethical standards and principles of care. Mindfulness training that is engaged in with heartfulness will also cultivate the necessary degree of self-compassion as one begins to see the implications of one's actions and choices and intentionally directs one's actions and choices so that they are steadfastly in alignment with one's deeper (or higher self) personal and professional values and mores.

Mindfulness and the Enhancement of the Therapeutic Use of Self

Using mindfulness as the scaffolding or bedrock for enhancing the development of the therapeutic use of self in occupational therapy seems intuitively appropriate because many studies have demonstrated the potential beneficial effects of specific mindfulness training on healthcare professionals' personal self-care, in addition to improvements in interpersonal relationships. Such professionals are found to be markedly more fully present with clients and their needs, less resentful, less reactive, and less defensive. Additionally, they demonstrate increased positive affect and self-compassion, more self-awareness and acceptance, improved attention and concentration, enhanced life satisfaction and meaning, and improved morale. Furthermore, they show increased performance and decision making, improved self-regulation and impulse control, improved empathic responses, enhanced creativity, and improved senses of self-mastery, self-esteem, self-trust, and mental flexibility.[4,6,35,96] These specific qualities of attention, attitude, and intention are foundational components in the development of the therapeutic use of self and can have profound and far-reaching effects.[14,89,100,114]

Mindfulness is the skill of being deliberately attentive to one's experience; in the present, as it unfolds, without the often unacknowledged overlay of judgments and conceptualizations.[5] This does not mean that the therapist would suddenly become a perpetually unflustered and calm person. In fact, turning toward one's experience with courage can initially be more challenging than we might think. However, with steadfast practice and curiosity, the human capacity to be mindful provides a wholesome way to attend to our subjective experiences and helps us learn, grow, and overcome the unskillful habits of mind that cause us to suffer unnecessarily.[113] The practice of nonjudgmental noticing what is here for you in the moment takes courage, and over time this sense of courage can grow and instill a personal sense of strength and empowerment. It is clear that mindfulness appears to help foster states of mind that are conducive to developing and enhancing the therapeutic use of self.[38,103,104,108]

Although it may sound simple to attend to the present moment, the mind's default mode is entropy, and because we live in a society that does not typically appreciate or teach the skills of harnessing psychic energy, our modern society tends to condone the use of external stimuli—such as, in Irene's example, media and television, excessive busyness, mindless autopilot mode occupational participation, and other distractions—in a desperate attempt to focus our minds or in an attempt to avoid the discomfort of a disordered or dysfunctional mind.[11,15] We begin to recognize how familial, societal, and cultural conditioning encourages us to avoid and deny discomfort of any kind and notice and begin to appreciate ways in which the formal mindfulness practices can both deepen the awareness of life's challenges and help us recognize our capacity as human beings to be in skillful relationship to them. In her book, *A Mind of Your Own* (2016),[10] Dr. Kelly Brogan encourages us to recognize and question this kind of conditioning, so we can begin to reclaim our personal power and innate wisdom to heal our bodies and reclaim our lives. As Kabat-Zinn wrote, "If there was such a thing as a self-distraction index, in the technologically-bombarded society we live in today, it would be going through the roof."[42,43] To repeat the opening quote for this section: Dr. Steven Cole, professor of medicine and psychiatry at the University of California—Los Angeles, has stated, "The experience you have today will influence the molecular composition of your body for the next 80 days, because that's how long the average protein synthesized in your body today will hang around in the future, So plan your day accordingly."

In response, one might ask: *Okay, so how do we do this?* The key practices necessary for the cultivation of mindful awareness are the formal practices or meditations. The formal practices are a form of mental and physical exercises that are meant to strengthen and deepen the inherent human capacity to bring our awareness to the present moments of our lives.[99,102,105] Because mindfulness is the skill of leaning into the present moments of our lives without judgment, it is important that we approach the practices in this spirit, relinquishing preconceptions, as much as we can, about the practices and cultivating an open and curious state of mind. This offers us greater opportunity to benefit from them and deepen our experiences and growth. Of course, a healthy dose of skepticism is valuable; testing out the practices for each individual is important, and reflecting on and acknowledging the experiences throughout the process of developing insight, empathy, compassion, and understanding are crucial.[79] This is a true expression of "evidence-based practice"; when we can recognize the fruits of practicing these skills as "self-evident," they become personal, palpable, and incredibly healing.

Therefore, the key to using mindfulness with the intention of developing the therapeutic use of self in the context of occupational therapy is the steadfast personal work with the formal and informal mindfulness practices. Mindfulness practices are highly adaptable for any population and can be applied to participation in any occupation, such as sitting, eating, washing hands, driving, walking, shopping, taking in media, studying, reading, expressing loving kindness, and so on. Although the practices may seem simple at first, what comes up for us can actually be quite complex, offering infinite opportunities to bring the foundational qualities of compassion and kindness to our present-moment experiences.[91] Offering compassion (a desire to alleviate suffering) to ourselves throughout the journey is quite possibly the greatest practice of all. It can be challenging at times to offer ourselves compassion, and it is important to be aware of when we need it most. Mindfulness skills and techniques can help us open, lean into, and acknowledge our challenges, and through that opening deepen our potential for greater freedom, humility, and a deeper connection with humanity. We are more capable of showing up for another human being's suffering when we can trust that we can be in wise, compassionate relationship to our own.

The primary formal practices taught in mindfulness-based stress reduction curriculum are the body scan, the breath awareness practice, the sitting awareness practice, mindful lying yoga, mindful standing yoga, walking meditation, and loving kindness. Each of these practices is unique to its intended focus, yet they all share significant commonalities, such as intentionally attuning nonjudgmentally to our experience in the present moment.[67] (See the Apply it Now section of this chapter for examples of formal mindfulness practices.)

Practicing mindfulness over time reveals and develops the basic human qualities of wisdom and compassion, the main values of the skills of mindfulness. Wisdom means seeing clearly into the nature of reality. Through mindfulness practices, we can begin to recognize the impermanent nature of all phenomena and see the unsatisfactory nature of ordinary human experience that arises from the illusion that the self is an existence separate from the rest of reality.[26,76] We begin to sense our interconnectedness within the full spectrum of our shared human experience. We have a greater capacity to meet grief and loss without fear or aversion. We are more capable of behaving with wisdom and compassion while maintaining inner and outer peace, regardless of the situation.[118] We begin to recognize what is most essential for our well-being and to tune into our experience and the experience of others with greater degrees of insight and understanding (Fig. 7.2).[85,92]

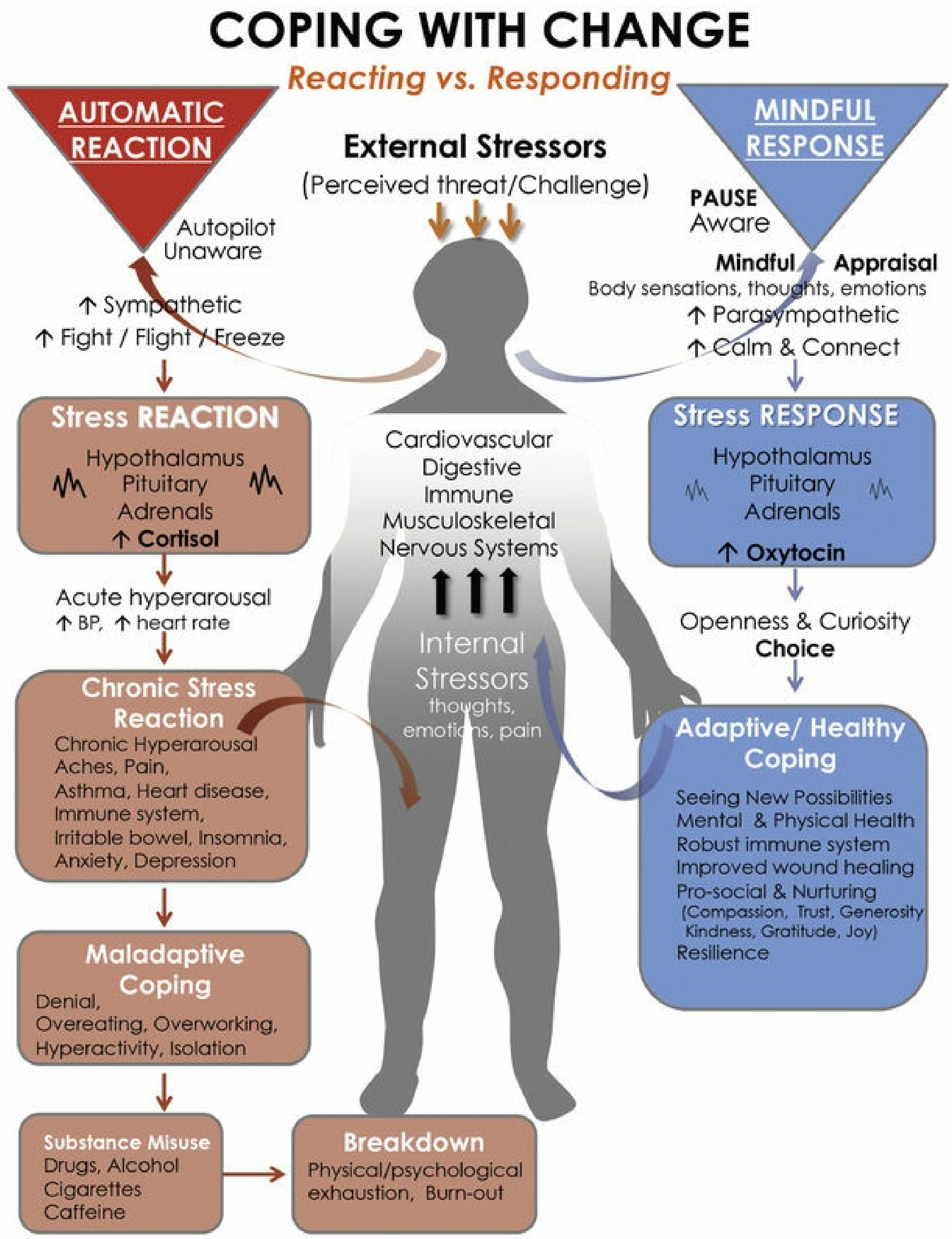

FIG 7.2 Coping with change. (©2015 Elizabeth Lin MD, MPH, ehblin@uw.edu. Adapted with permission from Kabat-Zinn J: *Full catastrophe living*, 2013; Bardacke N: *Mindful birthing*, 2012; Graphics courtesy R. Ryan.)

Mindfulness offers us an opportunity to realize the arising and passing away of all phenomena, the impermanence of all phenomena, including our thoughts and emotions, pain and discomfort, and life itself. Through this recognition, which arises out of our own subjective experiences with the practices, we are capable of learning to embrace life's transient nature and to understand the value of capturing each present moment as it arrives as fully as possible, with all our senses. This especially applies to preparing the OT self to work in the moment and value the moment, and to convey this to our clients, regardless of their loss or the severity of their circumstances. The presence of a practitioner can be a palpable anchoring presence in the midst of catastrophic life experiences. It may be imperceptible, but research has shown that these qualities are very much present and can be profoundly effective and healing.[68]

OT Practice Note

Extended Mindfulness Retreat Training

Participating in extended mindfulness training retreats are one of the best ways to deepen the skills of mindfulness in one's life and to experience the benefits more deeply and swiftly. It is necessary to cultivate a relationship to mindfulness with an attitude of nonstriving, of not needing anything to be “fixed”; to understand that we are already whole and complete just as we are as we engage with the mindfulness practices. To trust as we turn toward our own completeness and humanity while being held in the container of mindfulness that we will open to greater degrees of insight and well-being in a time frame that is unique to each individual (see resources for mindfulness-based retreat centers in the United States).

Mindfulness skills offer powerful means to work with pain and physical discomfort—by becoming aware of and experiencing for oneself the distinction between pain and suffering—as it pertains to our own perception of the experience.[43] These qualities are invaluable as we participate in the compelling and complex practice of occupational therapy, working on the front lines of incredible human suffering: our own, the world's, and that of the individuals with whom we work.

The shift for Irene was slow but palpable as she began to recognize the difference (perceptual shift) between “pain” and “suffering.” Her most valuable experiences at first were those that pertained to her own pain and experience of what it really means “to suffer.” As she built mindful awareness into her life, Irene began to recognize that the physical pain she experienced in her back fluctuated, depending on what she was doing, that it was impermanent and not present “all the time,” and that it did not spread throughout her whole body, as she had previously “thought.” Irene recognized that when she mentally resisted or ruminated about the pain in her back, it would get stronger and intensify. She recognized that the mental and emotional resistance and rumination were the root of her “suffering,” and the physical pain was something separate and was to be honored and acknowledged. The physical pain sensations were messages from her body that she could tune into, turn toward, and to which she could actually listen and skillfully respond. She recognized that steadfast personal self-care and self-compassion were particularly healing remedies for her physical pain. As she released the mental and emotional ruminations and resistance, she noticed she had much more energy to devote to her healing and she had greater mental clarity and curiosity, all of which reduced her experience of the mental and emotional “suffering” previously associated with the physical pain.

Irene sensed parallels between her reaction to her physical pain and her mental pain. She noticed that when she was ruminating about an event or situation, her thoughts would spin off and she would lose focus, become agitated, easily frustrated, and mentally unclear. She recognized rather quickly that when she did not feed into or resist the persistent and unhelpful thinking patterns, she could keep a distance, observe, not take it so personally, and actually find humor in her automatic habitual mental patterns that she could now let go of if she chose to. She sensed immediate and greater ease from this mindfulness skill, and each moment became a practice and a choice for how to respond to her physical, mental, or emotional pain. Every moment she chose, and each moment she chose ease rather than dis-ease, and this empowered her. She felt courageous and powerful. She was aligning her present moment experience with her living values of higher self, prefrontal cortex behaviors (rather than small egoic self), and her emotional and physical health.

This embodied experience of the difference between pain and suffering manifested in her work as Irene also came to recognize this in her clients. She noticed the difference between the physical pain her clients might be experiencing and the mental and emotional suffering they might be engaged in. She knew they didn't know any better, but she realized that mindfulness skills training (if the person chose to learn) could also bring reduced mental and emotional suffering, greater clarity and focus to truly heal, to move into a new normal, to freedom. She also recognized that this is a path each person must choose for himself or herself, and she was careful not to impose the skills of mindfulness on her clients. Her personal experience of pain as something separate from suffering was a powerful embodiment of the experience, which allowed Irene to meet her clients where they were and not need them to be “fixed” either. She could empathize viscerally with the experience of her clients and had a deeper and more authentic expression of compassion for her clients than she had ever had before. She described this empathic experience as one guided less by an intellectual understanding of empathy and more by an embodied, visceral experience or “knowing,” “insight,” and “understanding.” She described it with this statement: “Yes, life *is* like this.” There was a greater ease in her well-being as she met the needs of her clients as best she could. She knew her clients benefitted from her greater ease and understanding as she engaged with them in her OT practice.

Mindfulness in Western Medicine, Healthcare, and Society

Complementary and alternative medicine (CAM) and integrative medicine (IM) have been growing rapidly in the psychodynamic and humanistic traditions of psychotherapy to help meet the needs of our growing chronic public physical and mental health disease crisis. The current demand for highly qualified professionals who teach the skills of mindfulness has grown exponentially in recent years. The year 1990 was a watershed, after which "mindfulness" as a discrete term began to take hold in the discourse of academic medicine and psychology.[17] This was the year Jon Kabat-Zinn's book, *Full Catastrophe Living: Using the Wisdom of Your Body and Mind to Face Stress, Pain, and Illness,*[42] was published. In his book Kabat-Zinn describes the mindfulness-based stress reduction (MBSR) program that he developed in 1979 at the University of Massachusetts Medical Center. The curriculum started at the center has produced nearly 1000 certified MBSR instructors, who can be found in nearly every state in the United States and in more than 30 countries.[67]

Almost every major medical center in the United States currently has an IM center, and many include mindfulness and/or MBSR as an integral component of their programming. MBSR is now used as a therapeutic intervention in over 700 hospitals worldwide. Meditation and mindfulness have been featured in cover stories in the *Scientific American, New York Times, Time Magazine, The New Yorker,* and *Newsweek.* MBSR and other mindfulness-based approaches are now considered evidence-based treatment due to the extensive amount and quality of research with randomized, controlled clinical trials that has abounded over the past 10 years. In fact, 52 papers were published in 2003, rising to 477 by 2012. Nearly 100 randomized controlled trials had been published by early 2014.[67]

Clinical trials that are currently underway studying the efficacy of Mindfulness-based interventions (MBIs) include the following conditions: asthma, bone marrow transplant, breast cancer, chronic pain, chronic obstructive pulmonary disease (COPD), human immunodeficiency virus infection and acquired immunodeficiency syndrome (HIV/AIDS), hot flashes, hypertension, immune response to the human papillomavirus (HPV), irritable bowel syndrome (IBS), lupus, myocardial ischemia, obesity, cancer, arthritis, organ transplant, type 2 diabetes, and other medical conditions, including psychiatric disorders, such as anxiety disorders, eating disorders, personality disorders, post-traumatic stress disorder (PTSD), burnout, schizophrenia, and suicidality.[27,59] Grossman et al.[29] characterized the current research findings with this statement: "Thus far, the literature seems to clearly slant toward support for basic hypothesis concerning the effects of mindfulness on mental and physical well-being."[22,75]

Mindfulness and MBSR are not just in Western medicine. More than 2000 people from companies such as Google, Facebook, and Instagram showed up in San Francisco in 2016 for a mindfulness conference called Wisdom 2.0. Google now offers its 52,000 employees free lessons in mindfulness. Corporations such as General Mills have made it available to their employees and set aside rooms for meditation. In 2012, Representative Tim Ryan of Ohio published a book titled *A Mindful Nation,* and he has helped organize regular group meditation periods on Capitol Hill. An all-party parliamentary mindfulness group was developed in the UK for the House of Lords. In the UK, three universities offer master's level post-graduate professional training in mindfulness-based approaches: The University of Exeter and Oxford University Mindfulness Centre in England, and Bangor University Center for Mindfulness, Research, and Practice in Wales. The Department of Occupational Therapy at San Jose State University has offered a semester-long Mindfulness-Based Occupational Therapy (MBOT) course for their students for the past 6 years.

Mindfulness-Based Interventions (MBIs) are growing in number as well. Mindfulness-Based Cognitive Therapy (MBCT), Dialectical Behavioral Therapy (DBT), Acceptance and Commitment Therapy (ACT), Mindfulness-Based Relapse Prevention (MBRP), and Mindfulness-Based Therapeutic Community (MBTC) treatment are several MBIs that are drawing the most cultural attention at this moment.[67] The UC Berkeley Greater Good in Action (GGIA) program found at http://ggia.berkeley.edu highlights science-based practices for how to build qualities such as compassion, connection, empathy, forgiveness, appreciation, happiness, mindfulness, optimism, and resilience, to name a few. The Department of Occupational Therapy at San Jose State University is currently developing a Mindfulness-Based Healthcare Practitioner (MBHP) Post Graduate Certificate program to be offered to occupational therapists all over the world with the intention of continuing to deepen the skillfulness and effectiveness of the emerging Mindfulness-Based

Occupational Therapy (MBOT) and MBHP discourse and evidence-based interventions.[70]

Occupational therapists are currently using elements of these MBIs in a variety of ways as interventions within their practice and yet there is clearly an unmet need of applying mindfulness directly and explicitly into the complexities of occupational therapy practice, the use of self, and interventions. It is not clearly defined currently in OT literature as to how mindfulness and quality of participation in daily occupations is articulated and experienced or the impact of poor quality participation on an individual's health and well-being. This chapter is meant to begin the conversation and consider possibilities.

Threaded Case Study

Irene, Part 2

Occupational Therapists Embodying Mindfulness in Their Lives and Work

Irene began to realize that her ethical and moral duty to her work as an occupational therapist was not separate from her duty to her own mental, emotional, spiritual, and physical health, development, and self-care. She recognized that she deeply valued her ability to make sure she was not harming her clients and was not only practicing the ethical principles and standards of practice of nonmaleficence, but that she also wanted to make a meaningful contribution to her clients' lives. With this desire to improve her own well-being, quality of life, occupational participation, and therapeutic use of self, Irene pursued mindfulness practice in her own life, and this had beneficial side effects she could never have imagined. Although there was certainly “work to be done” and practices to engage in, the effects of building mindfulness into her life were so profound that her motivation to continue the path of mindfulness created palpable feedback loops that perpetuated her growth and development. Challenges became deep learning opportunities, and life's intensities became edges that actually propelled her into greater degrees of understanding and insight. She recognized that cultivating awareness, curiosity, and self-compassion during her darkest moments transformed those instances into moments of great courage, strength, growth, and learning.

Mindfulness of Self

Body Awareness

Through the cultivation of mindful awareness through the formal and informal practices of mindfulness, Irene became more aware of her body and the needs of her body. Initially Irene noticed a great deal of tension, discomfort, and pain in her body. It was surprisingly difficult to become aware of what specifically she was experiencing. She noticed how she wanted to numb and distract herself from the discomfort, and even boredom, and acknowledged this experience as a trigger for her to use all kinds of things to distract herself, as mentioned in her case example. The qualities of kindness and self-compassion were critical for her capacity to keep showing up for the discomfort in her daily formal practices, even when she succumbed to the impulse to distract herself. She simply noticed what she was choosing to numb herself to pain with, with nonjudgmental, open, curious awareness. She would come back to the formal practices and each time was more and more capable of showing up for whatever was there without needing it to go away and without needing to bolt.

As Irene developed greater degrees of body awareness, she moved through her daily routines and rounds of occupation with greater intention and ease. She slowed down her pace. As she slowed down during her ADL participation, she was able to recognize which activities exacerbated her pain, and she made adjustments over time that supported the needs of her body. Initially she took frequent mindful breaths, wherever possible, to release any unnecessary tension that she noticed. This increased blood flow, oxygenation, and healing fluids to these areas. The attention and expression of kindness toward her body that she developed over time helped her remain in a more parasympathetic nervous system response, which reduced stress hormone production and assimilation. At times she noticed herself expressing appreciation and gratitude toward her body, which felt healing and nourishing to her on all levels. She could sense even greater degrees of ease and well-being. Irene noticed that daily activities such as watching television and surfing social media sites increased ruminative thought patterns, which activated her sympathetic stress response. Fig. 7.3 is a visual representation of how Irene became empowered to choose how she was going to respond and to make empowered lifestyle choices that aligned with her intention for greater health, effectiveness, and well-being. She could sense the stress response in her body with participation in these activities, and she began to cut back on them. This, in turn, opened up more time and energy for her to be with and connect with her husband and daughter and for preparing healthy meals for her family, all of which activated her parasympathetic response and nourished her health and well-being.

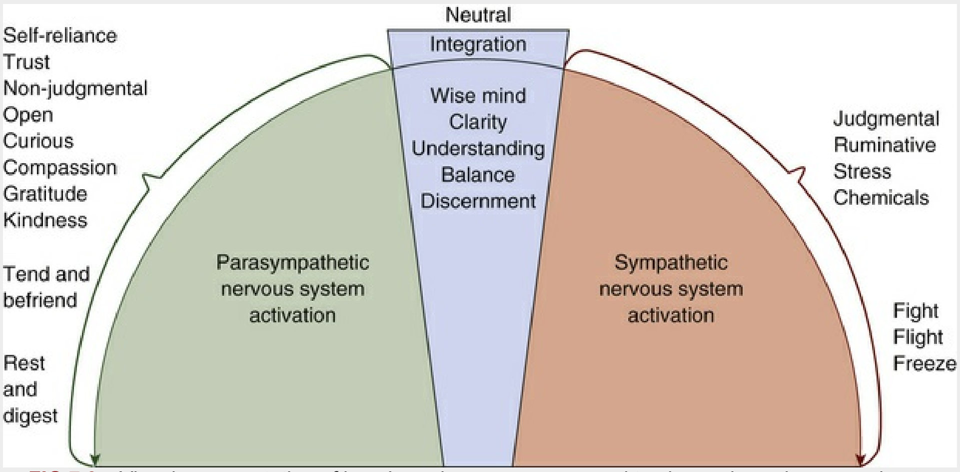

FIG 7.3 Visual representation of how Irene became empowered to choose how she was going to respond and to make empowered lifestyle choices that aligned with her intention to achieve greater health, effectiveness, and well-being.

Irene's digestion improved, allowing her to reap greater nutritional benefits from the foods she was eating. She began to eat foods that she recognized would nourish her body and noticed how her body felt after eating foods that were not nutrient dense, such as refined, processed foods. She made more dietary adjustments that supported the experience of greater health in her body. She slowly reduced her caffeine consumption until she was able to switch to herbal tea instead of drinking coffee. She significantly reduced her sugar consumption and switched to local honey as a sweetener. She was more aware of these health feedback loops, which motivated her further to continue to deepen the practices in her life and continue making healthy dietary adjustments for her family. She could physically sense the difference in her health and well-being with the body awareness practices infused with qualities of kindness and self-compassion and lifestyle adjustments. Her insomnia began to lessen, she had fewer headaches, and she felt more in control of her eating habits. She noticed that her daughter's behavior also responded positively to the dietary changes, and this continued to motivate her to make healthier choices over time by removing all manufactured foods that contained refined sugars, colorants, chemical additives, stabilizers, gums, and preservatives. Irene was ever more empowered by her and her family's healing journey at the hands of none other than herself.

Breath Awareness

Irene learned to frequently use the awareness of breath (AOB) practice to anchor her awareness in the present moment when she noticed that her mind was elsewhere. She noticed that her thoughts were often ruminating over situations that she had little control over, such as the health of her father, the overwhelming workload for which she was responsible, and her husband's lack of income. She would kindly and gently refocus her attention on the occupation at hand, and when she had time in the day, she would sit down and problem-solve with her husband about what adjustments needed to be made in their life to support greater ease, sense of control, and a sense of connectedness. They worked together over time to make necessary adjustments to their lifestyle, simplifying, reducing extraneous expenditures, getting support from community resources, and making small but meaningful problem-focused and emotion-focused adjustments that gave them a sense of self-efficacy and hope for a better situation in the future. Irene had a new and embodied sense of the true value of what occupational therapists often teach in their work, and these personal-life adjustments developed a deep sense of trust and self-efficacy in her capacity to help others make meaningful lifestyle changes that might enhance their life satisfaction and well-being.

Although Irene recognized that she could not alter the productivity, billability, or technological standards of her work environment, she now realized that she had complete control over how she responded to the work environment. She noticed that when she mentally resisted the situation in any way, this would activate her sympathetic stress response, she would get tension throughout her body, and release a storm of stress hormones and chemicals that affected every organ of her body. Over time and with practice, Irene noticed how she could allow the work environment to be as it is, come to greater degrees of acceptance over the reality of the situation, and not need to mentally or physically resist it. She could just notice it as it is, with the statement, "Yes, occupational therapy practice and Western medicine *are* this way sometimes"—with curiosity and openness—all the while acknowledging and honoring her own experience of the situation and bringing kindness and compassion toward herself, her team, and her clients, all of whom were participating in and managing the system in their own unique ways. She noticed how her usual mode of cynicism melted away over time and was replaced with wonder and awe about the complexities of a rehabilitation environment such as the one in which she worked. She was better able to recognize the simple yet deeply moving details of her workday, such as how a family dealt courageously with the suffering of their loved one. Furthermore she noted how, day in and day out, the staff members arrived and did the best they could with what they knew, or how society has developed such inspiring emergency medical care for its people. She recognized what a beautiful profession occupational therapy is, with its holistic view of each individual client and his or her situation. Irene noticed how differently her new way of being in relationship to her work environment activated her parasympathetic nervous system response; there was less tension in her body, and she sensed an overwhelming ease and equanimity even during some of the more intense moments in her day. She observed that she was more capable of responding skillfully to the complexities of patient and family care, and able to be more present and respond more rapidly and skillfully to the needs of her team. Similarly, she was less mentally and emotionally affected by the so-called "billability" and "productivity" standards and continued to do the best she could to meet them with integrity and ethical behavior without an overlay of self-condemning or system-condemning thought patterns.

Irene perceived that the deepening sense of self-compassion and appreciation for simple experiences in her life actually remotivated her to engage in occupations that she previously found nourishing and rejuvenating but had given up as life and work became more intense and less manageable. She made sure to take frequent "3-breath cycle breaks" while at work, usually while she washed her hands between clients and team meetings. She found this to be particularly grounding and restorative, and it gave her a pause to check in on how she was doing mentally, emotionally, and physically. Based upon this self-check-in she would make any necessary adjustments to gently bring herself back to the present and to a state of greater ease before she moved on to her next task of the day. She noticed that she felt more at ease and capable when she needed to have difficult conversations with her team or supervisors. She spoke with greater clarity and calm. She was able to stay on point and be an effective leader during difficult situations.

Irene reconnected with her family by planning regular activities that they all enjoyed participating in together, such as being in nature, camping, and going for walks. They incorporated more check-in time/connection during the week and ate at least one meal a day at the kitchen table together, enjoying healthy, whole, clean food and pleasant conversation. The greatest adjustment Irene made was to reduce her level of "busyness." She and her family took a fresh look at their deeply held family values and made adjustments and even removed tasks or activities that did not align with those values; this opened up more spaciousness in their lives. They all felt less hurried and harried. Over time and together, Irene's family developed a greater sense of connectedness, simplicity, ease, and well-being overall for the whole family. This experience and newly practiced behavior opened her up for more authentic and present interactions and relationships with her clients and colleagues. Irene became a source of ease for her team and was often approached for guidance about important matters and decisions that needed to be made for her team and her clients.

Awareness of Thoughts and Emotions

Over time, with her deepening experiences with the formal mindfulness practices, increased reflective observation, and open, curious, nonjudgmental active experimentation, Irene began to gradually notice how her *quality* of participation and engagement in her daily occupations affected the quality of her life and her mental, emotional, and physical well-being. She experienced how she was frequently on autopilot mode during basic self-care ADLs, often ruminating about unpleasant past events and experiences or fabricated fears about the future, which activated her sympathetic nervous system, released a storm of stress chemicals throughout her body, and increased tension in her body and affected her digestion. It was her habit to neglect her body's cues and sense of increased pain in her body when she participated in her ADLs in this unskillful way. With practice, however, Irene released her patterns of ruminative past and future thinking and was more capable of keeping her attention and awareness in the present moment. She became more capable of noticing when her mind was not in the present, and she noticed the thoughts and emotions with curiosity instead of condemnation. When she needed to plan for the future, she scheduled time in her day for this and focused her attention on the task at hand. She did her "planning" in the present moment. With the energy that previously had been spent on ruminations and stressful thinking, Irene shifted the focus of her energy on approaching her daily occupations with appreciation, awe, and wonder. Irene began recognizing things in her life that she was grateful for, such as how special it was to have running water and effective utilities. The appreciation for her ADL participation came in part due to her ability to be more and more present with the activities themselves. She no longer was stuck in the exhaustive, ruminative, unhelpful thought patterns about the past or future that used to run her moments and exhaust her energy. With practice she was developing new neural pathways in her brain that supported being present, and it became easier and easier to stay present over time.

Situational Awareness

As Irene developed a kind attunement to her present moment experience in basic ADLs, she knew that her "senses awakened." She was able to find enjoyment and appreciation for the simplest of daily life experiences, such as the warm sensations of the water while washing her hands, the smooth texture of her favorite pants as she put them on in the morning, the scent of her daughter's clean hair as she brushed it. She recognized that being present during her basic self-care in this way increased her appreciation for her ability to participate in these occupations; activated her parasympathetic nervous system, thereby releasing the healing "tend and befriend" hormones (e.g., oxytocin and endorphins), which helped her release tension; and reduced her mental, emotional, and physical pain (see Fig. 7.3).

During more instrumental daily activities, such as meal planning, preparation, and clean-up, Irene began to notice how her thoughts and emotions tended toward resentment for having "to do all this housework." She perceived anger and frustration in her body, which increased tension and pain in her body when she allowed herself to participate in this kind of dysfunctional thinking. Once again, she skillfully met these kinds of thoughts with self-compassion, recognition that "this will also pass," "this thought is impermanent," and that she could arrive in each present moment if she chose to, and she found that she actually did make that conscious choice to be present more and more. Irene consciously chose thoughts that aligned with her higher self and her core values of family and connection. She noticed that as she paid attention to the task at hand, such as preparing a healthy meal for her family, she developed appreciation for her strength and capacity to do these complex occupational tasks. Irene began to appreciate the simple yet complex sensory experiences of preparing a meal—the heaviness of the pan, the ease of turning on the burner to heat the meal, the running water, the smell of delicious aromas. She experienced how this level of attention she brought to the occupation would transform it from one of drudgery, resentment, and disconnection (from her own body and from her family) to an incredible sensory experience and an expression of love and connectedness for herself and her family. If she noticed her mind wandering into thought, she would anchor herself by becoming aware of the sensations of the breath in her body and then focus on the sensations and experience of the task at hand. She noticed that the more she did this, the easier it got. As with all the mindfulness awareness practices, she was developing new neural pathways in her brain that supported being present, and it became easier and easier to stay present over time. She expressed her appreciation to her family more, which felt to her like "a healing salve for our souls." Her family noticed it and also began to be more appreciative. The same daily occupations that were once drudgery became full of wonder and appreciation. This is the truest and most meaningful expression of alchemy in one's life (see the mindful listening exercise in Box 7.3).

Box 7.3

Mindful Listening/Mindfulness Communication Exercise

To keep the language of this guidance clear and uncomplicated, let's assume that your partner is a young woman. The process is the same, regardless of gender.

Sit about 3 to 4 feet away from your partner with nothing in between you. Lower your gaze or close your eyes. Begin by dropping your awareness into the sensations in your body, acknowledge whatever is here for you now without needing it to be any other way. Just noticing and recognizing the condition of your body in this moment. (pause) Bring awareness to what is the condition of your mind in this moment, again not trying to make any thoughts or emotions go away, just noticing them as they are in this moment with openness and curiosity. (pause)

Draw your awareness into your body. If you notice any unnecessary tension, see if you can allow those areas to release, and if not, just allow those sensations to go wherever they need to go… Now anchor your awareness into the sensation of your breath, so that as you breathe in you are aware that you are breathing in and as you breathe out you are aware that you are breathing out…

Become aware of what your intention is in communicating with your partner.

Before opening your eyes to share in this communication, see if you can keep some of your awareness anchored in your body and/or your breath sensations. Open your eyes and listen as best you can to your partner without any judgments, with openness and curiosity, without needing to have thoughts about what you are going to say next or without your own mental dialog distracting you from your partner's truth. Just listen as deeply as you are able.

When your partner is done sharing, you can ask if she has anything else to share and then pause. When she says she is done, you can both close your eyes. Drop your awareness back into your body sensations; notice any unnecessary tension and see if you can allow it to release. You can state as clearly as you can what you heard. Ask your partner if you heard her correctly.

Now take a few moments to formulate and articulate what is true for you/what it is you would like to share.

Before opening your eyes to share in this communication once again, see if you can keep some of your awareness anchored in your body and/or your breath sensations. Open your eyes and speak what is true for you. Notice any body sensations that may arise as you share. If you ever feel like you are getting off-center, just close your eyes, anchor your awareness back in your body sensations, and see if you can release tension. Connect back in with your truth and begin again when you are ready.

When you both feel that the communication is complete, thank each other for her presence and mindful listening. This is a deeply healing practice. Being deeply heard and listened to is a practice of compassion and is an incredible gift we can give to ourselves and others.

Irene also noticed how much more present she was able to stay when she was with clients. She recognized that she was much more capable of attuning to her client's mental, emotional, and physical states and responding appropriately as the moment required of her. She also experienced how she was better able to stay grounded in her own experience, not needing to be drawn into the suffering of her client and be taken away by it so readily. She was able to recognize and to be with the suffering and to stay present and honor her own experience, even when she was deeply moved by the client's suffering. She recognized when she was so moved by the suffering that she made a vow to herself to give herself space to grieve at an appropriate time, to acknowledge and validate her feelings with tenderness and gentleness, and to seek support and respite when needed.

As Irene became more aware of how she approached her clients and team members, she was also more aware of her intention, her body language, the verbal and/or tactile cues she used, her communication style, and her energy and presence and how these complexities affected others and whether they were effective. She had an embodied experience of what it truly means to be interconnected by how her response affected other people with whom she was in contact. She also recognized and honored that she was not perfect, she was still a human being with the potential to feel the full spectrum of human experiences. She was more likely to identify when she made mistakes, reflect upon the experiences, learn from them swiftly, make necessary and skillful adjustments, and move on when appropriate for the situation. She noticed how the practice of self-compassion and expression of kindness and gentleness was particularly healing during times when she felt like "she could have done better."

Interoccupational Awareness

The Quality of Engagement and Participation in Occupations (QPIO)

As occupational therapists integrate mindful awareness into their own daily personal and professional lives, they begin to become aware of their personal quality of participation in daily occupations. Through engaged participation in meaningful occupations, the therapist will gain insight into the significance of the healing nature of being more aware and present with one's unfolding experience in each given moment. Interoccupational awareness (IOA) is a state in which an individual intentionally establishes an awake, alert, nonjudgmental awareness during occupational participation. Establishing connection to our experience during daily occupations gives us the opportunity to develop deeper levels of understanding of the significance of daily occupations in our lives, of awareness of our own habitual patterns of thought and behavior, and of the effect of these patterns on our health and well-being.

As an example, Irene described that as she developed mindful awareness during her daily activities, she noticed that the occupation of washing the dishes was overlaid with her thoughts of resentment toward her family! She questioned "why she had to do the dishes, when she had other things to do that were a somehow better use of her time." She experienced how this quality of thought activated her sympathetic nervous system response, which in turn released powerful stress chemicals and hormones throughout her body, shut down her digestion, and ruined any capacity to appreciate the occupation in which she was participating. Over time, once she developed greater awareness and she made conscious choices about her relationship (in the form of thoughts, beliefs, and expectations) to washing the dishes, she was first able to cultivate a quality of neutrality, and eventually she was able to actually enjoy the activity. She noticed that it was her choice as to how she would relate to the activity. She noticed how she began to experience gratitude for having the strength to stand at the sink, to be able to use both of her arms, to have running water, hot water, to be able to afford and prepare healthy food for her family, to feel the sensory experience of washing the dishes. She noticed how her capacity to appreciate washing the dishes then became an activity that positively activated her parasympathetic "rest and digest, tend and befriend" nervous system (see Fig. 7.3). She felt at ease and almost as if the activity of washing dishes was a restorative activity, rather than her previous experience of dismay, resentment, and frustration.

Irene's example demonstrates that enhanced awareness allows us to notice our relationship to our daily occupations, and this awareness offers us information that can empower us and give us the opportunity and freedom to choose and establish deeper levels of wise relationship to the potential fullness of our occupations. Parasympathetic nervous system activation (PNSA mode) interoccupational experience can be experienced during *any* occupation we participate in. Not only those "special occupations" we choose, but *all* of our occupations hold the key to gladness and awe if we are open to the potential within the power of our choice as to how we relate to them. This is the ultimate in personal empowerment; choosing to experience all of our interoccupational relationships with a sense of awe, wonder, and gladness. Through this gained insight, the seeds of awareness are infused into all clinical interventions and also into personal and professional interactions.

"There's waking up—dragging yourself around—and then there's waking up," Kabat-Zinn said. Brushing your teeth, being in the bathroom—it's all part of developing awareness, and you can build mindful habits around those morning tasks. Kabat-Zinn's main advice is to rest in awareness, and drop in on yourself. "Drop in on yourself and rest for a stretch of time," he says. "And then as you go about your daily life, check in. Once an hour, once a minute. Once a day. You decide."[118a]

Why don't we "drop in on ourselves" during all our occupations and check in… What is the condition of my body in this moment, during this occupation?… What is the condition of my mind, during this occupation?" The implications of occupational participation within the context of our profession are addressed in the next section.

Employing Mindfulness in Occupational Therapy Practice

Occupational therapy is a beautiful and complex profession that grew up in the arms of Western medicine. The profession has a medical credibility and scientific groundedness in its value and at the same time is unique to other modern Western medical interventions in that the focus of intervention is on seeing the client and his or her situation holistically, considering mental, emotional, physical, cultural, societal, and contextual aspects. In some cases the occupational therapist may even consider spiritual aspects of an individual's functioning if he or she is so inclined and is skilled in doing so from his or her own “self-evident” experience.

Occupational therapy promotes health by enabling people to perform meaningful and purposeful occupations.[1] However, it is often the case that we (the clients, the therapist, anyone) may not be present or “conscious” while engaging in so-called meaningful and/or purposeful occupations. Not only are we not present, but we can often be lost in ruminative thoughts and unacknowledged judgments. We can often be lost in thoughts about the past or future. completely disengaged from what we are actually doing in any given moment and disconnected from the only moment in which we truly have to live in this lifetime—this one and only moment. Mental phenomena, such as plans, worries, anticipations, expectations, ruminations, imaginings, fantasies, and so on, can not only disengage us from our present-moment experience and occupational participation, but they also can often be dysfunctional or destructive to our emotional, mental, and physical health by activating our sympathetic stress response. These thoughts and ruminations are often not even our own. They have been passed on to us by family, teachers, communities, societies, religions, popular media, and other sources. We can be significantly limiting our experience of our lives by living only in the unacknowledged, often habitual, cognitive domain of experience. We can be drawn away and disconnected from our occupational experiences and our bodies for long periods of time and even life times. When we are disconnected from our lives, we are unable to fully experience our daily activities, even those that we might consider “meaningful,” and the quality of participation in occupations can suffer greatly, affecting every aspect of our lives.

Our “occupations” can even lose their “occupationess” when the participants are not engaged, not present, or are even “unconscious.” If we participate in our occupations in this way out of habit due to familial, social, cultural, or societal norms, are they really authentic occupations? Are they really meaningful or purposeful? Or do they become an end in and of the means and sheer drudgery? Can occupational participation really be considered a healing agent and skillful tool if we as therapists don't really know what it means to show up fully for our own occupations? These are questions to be lived, engaged in, embodied, and intellectualized as we explore and co-create the integration of mindfulness with the practice of occupational therapy.

It can be a profound realization to recognize that the capacity to build mindful awareness of one's body and mind can be assistive in the act of skillfully meeting many of the underlying problems of modern diseases. Mindfulness is the practice of purposefully attending to the present moment with an attitude of openness and curiosity. When we teach the heartfulness and skillfulness of mindfulness as occupational therapists, we become healing facilitators of our client's capacity to become a cohealer, using the wisdom of his or her own body and mind.[47,48,58,88] As we have coexperienced with Irene's case example, this can be incredibly empowering.

Mindfulness-based occupational therapy (MBOT) explores true healing as a journey of growing, learning, and connecting. It is not a model of fixing, correcting, or repairing. MBOT recognizes that we are already whole and complete just as we are, and our clients are whole and complete just as they are. And from that recognition, we realize that there is nothing we need to “fix.” We are in a place of meeting ourselves and our clients with radical acceptance of what is first and foremost; then we can authentically facilitate this journey of healing for ourselves and our clients if we are open to it and can hold the space for it.

The AOTA released the latest definition of occupational therapy as a practice that maximizes health, well-being, and quality of life for all people, populations, and communities through effective solutions that facilitate participation in everyday life. MBOT is an effective practice, a healing salve or “solution” steeped in a model of cultivating deeper levels of personal understanding and greater degrees of insight and freedom that can facilitate empowered participation in everyday life. This is emancipatory education because it is “really useful knowledge” that can empower people to get themselves out from under oppressive forces. These may be forces of our own mental perceptions handed to us, without our even knowing, through our industrialized cultural, societal, and familial lineage.

The skills of mindful awareness are tools that help us all engage in close connectivity in each moment with ourselves and our infinitely vast and complex human experience. The skills shed light on our present-moment experience and help us build trust in our capacity to make effective lifestyle shifts that resonate with what we each value most, to heal ourselves, our communities, and the world.

Occupational therapists work on the front lines of incredible human suffering. An occupational therapist who has his or her own personal mindfulness practice will be more able to remain present to his or her own internal mental and emotional experience and physical well-being from one moment to the next, thereby reducing potential for burnout and enhancing self-efficacy.[65] Dr. Dan Siegel, researcher, author, and director of The Mindsight Institute at UCLA, describes this process as neurologic "integration."[102–104,108] He invites us to "connect rather than correct." This process of integration involves learning to be in wise relationship to our experience in each moment, without needing it to be any other way, with a courageous degree of acceptance of what is. In this way we are capable of learning, growing, and healing ourselves and cultivating a wiser and more embodied relationship to our work as occupational therapists.

MBOT invites us to live the following questions as a journey of inquiry, healing, growth, and learning:

- What is my embodied experience of my *quality* of participation and engagement in my daily occupations?
- What is my relationship (beliefs, attitudes, expectations) to my occupations. and how can I cultivate a healthy, effective, and meaningful relationship to them?
- How might this higher quality occupation participation serve me and my higher self?
- How can I assist my client in cultivating and embodying a higher quality of participation, engagement, and relationship to his or her occupations? How might this affect the client's health and well-being?

To answer these questions the therapist must practice and develop an array of tools, skills, and practices that become a part of daily performance patterns (habits, routines, rituals, and roles). Mindful awareness tools and skills must be embodied in order to be modeled or shared authentically. If any mindfulness skills, tools, or practices do not ring true for you, don't use them. If you bring an awareness tool, practice, or skill as a therapeutic modality, bring it with the intention that you will also benefit and grow from the practice. The therapist becomes a part of the process of the authentic healing relationship. (See the Additional Resources section, at the end of the References, for suggested training pathways and a few simple mindfulness exercises with which to begin.)

Integrating Occupational Therapy and Mindfulness

Mindfulness-Based Occupational Therapy (MBOT) Competencies

When occupational therapy and mindfulness are skillfully integrated, mindfulness-based occupational therapy competencies have more fertile ground in which to grow and ultimately be embodied by the occupational therapist and be shared with the client in appropriate and profoundly meaningful ways. The following list presents the five interrelated sets of cognitive, affective, and behavioral competencies. The definitions of the five competency clusters for therapists are:

- ***Competency 1: Self-awareness.*** An occupational therapist's self-awareness deepens when it is enhanced by the mindfulness practices of focusing attention and cultivating self-compassion. It includes the capacity to recognize one's emotions, thoughts, attitudes, beliefs, and perceptions and their influence on behavior. This includes accurately assessing one's strengths and limitations and possessing a well-grounded sense of confidence and enthusiasm.
- ***Competency 2: Self-management.*** Mindfulness increases the occupational therapist's emotion, thought, and behavior regulation skills, which enhances his or her ability to meet the needs of our complex profession, resolve internal and situational conflict more creatively, recognize and honor how he or she is feeling in an emotionally balanced way, and learn and grow from his or her insights and deepening awareness. This includes managing stress responses skillfully, recognizing impulses that may be unskillful, motivating oneself, finding meaning, and setting and working toward achieving personal and professional goals that are guided by personal values.
- ***Competency 3: Social awareness.*** Mindfulness increases occupational therapists' empathic drives by helping them validate, acknowledge, and regulate their emotions rather than get emotionally

overwhelmed when faced with difficult situations. As a result, their capacity to notice and honor both their own suffering and another person's suffering and respond to it skillfully increases. In addition to this, he or she is able to take a broader contextual and anthropologic perspective and embrace others from diverse backgrounds and cultures, to understand social and ethical norms of behavior, and to recognize and offer appropriate resources and support.

- ***Competency 4: Relationship skills.*** Mindfulness increases compassion. Thus, when OTs practice mindfulness skills, such as nonstriving (*of being with things as they are and not needing them to be any other way if for no other reason than because this is the way it is in this moment*), they are doing so with more compassionate, open, curious, accepting, and nonjudgmental understanding. This manifests as communicating clearly, listening actively, and seeking and offering help when needed. This also includes recognizing the relationship therapists have with their own occupational participation, in addition to recognizing how their perceptions and thoughts about an occupation shape their experience and can make the occupational participation health enhancing or health degrading. The occupational therapist recognizes that the quality of participation is up to him or her, which is empowering, and can make effective, life-enhancing, and life-affirming adjustments over time.
- ***Competency 5: Decision making.*** Mindfulness increases cognitive flexibility and creativity, which gives occupational therapists a broader contextual perspective and a wider range of potential responses to challenging or complex situations. This includes being able to make constructive and respectful choices about personal behavior and social interactions based on consideration of ethical standards, safety concerns, social norms, the realistic evaluation of consequences of various actions, and the well-being of oneself and others.[71,117]

Ultimately, when taught and learned together, mindfulness and occupational therapy have the potential to transform our profession from one focused on what can feel more like encouraging our clients to be "occupational doers or doings" and instead foster and cultivate the qualities of what it really means to be "occupational beings." With the skills of mindfulness cultivating the tendencies for compassion and ethical ways of living and being, and MBOT teaching the skills that allow us to bypass the tendency to encourage a mode of "occupational doing," we can return to the true sense of the term "*human being*" by fostering and cultivating in our clients those qualities that mark what it truly means to be an "*occupational being.*"

As skilled mindfulness-based healthcare practitioners we will each become powerful co-creators of a new paradigm in Western medicine; one that highlights our tremendous power individually and collectively to harness newfound "self-evident" scientific knowledge and embodied clinical practice. Each of us has the opportunity to participate in this exciting stage of human evolution,[37] the development of lifestyle medicine,[10] and the movement toward a new model of care that is so deeply needed. In this way we become empowered healing agents for the bloodstream of humanity.[78]

Apply It Now: Practice Descriptions

This section describes modified versions of the core practices of mindfulness-based stress reduction. The traditional MBSR practices of body scan, sitting meditation, mindful yoga, and walking meditation have been adjusted to better fit the needs of the occupational therapist interested in integrating a practice into a treatment session. There are many ways of interpreting these practices authentically, as long as the therapist has integrated them into his or her own life first. The therapist who has had his or her own embodied experience of what it really means to participate in practices such as these will bring the practices into OT interventions in an empathic, understanding, and authentic way. It is not recommended to implant one of these practices into interventions if the therapist himself or herself is not already clear about its usefulness or effectiveness.[67]

Practice 1: Body Awareness Practice in Sitting or Lying Down

Approximate timing: introduction 3 minutes; practice 25 minutes.

Introduction. This is a body awareness practice designed for you (the occupational therapist) to use regularly to help assume an active and powerful role in your own health and well-being. It is best to use a guided body scan recording (see Additional Resources for links) and do what it says while in a comfortable place where you feel safe, secure, and free from interruption. Consider this practice time as an opportunity to be both by yourself and fully with yourself…an opportunity to nourish yourself, to open to and experience the potential of strength and insight within yourself.

This is a radical redefinition, suggesting a preference for embodiment over cognitive, verbal processes. You are choosing to show up for whatever is happening in this moment…making the choice to allow yourself to be exactly as you are in this moment. Completely as you are and complete as you are.

Our culture asks us to live so much in the cognitive and intellectual domain of experience. We often forget that the whole body feels and knows and that there is a wisdom beyond words.

The body awareness practice, as with all the others described here, provides ample opportunities to reinforce the powerful practice of cultivating nonjudgment and curiosity, in addition to kindness and compassion toward oneself.

Mindfulness Practice: The 3-Minute Breathing Space. The following instructions for the 3-minute breathing space are adapted from Segal, Williams, and Teasdale (2014).[93a] You may wish to take about 5 minutes right now to read the instructions and use them to guide you through the practice, spending about a minute practicing each step after you read it.

- **Step 1: Becoming aware of present-moment experience.** Begin by taking an intentional posture that is upright but not stiff, eyes gently closed, or holding a soft gaze on the floor or wall a few feet in front of you. Next, begin to bring your attention to your internal experience, perhaps by asking, "What is my experience right now?" "What thoughts are passing through my mind?" Acknowledge thoughts as mental events as best you can, perhaps putting thoughts into words: "What feeling tone is here?" "Is there a sense of pleasant, unpleasant, or neutral feeling present?" In particular, allow any unpleasant feelings to be known: "What body sensations or reactions are noticeable right now?" Acknowledge any sensations in your body, including any areas of tightness or tension.

- **Step 2: Gathering attention on the breath.** In this step redirect your attention to the physical sensations of the breath in your body. Focus on a particular area of the body where the breath sensations are most accessible, perhaps the abdomen rising and falling, or the air passing in and out through your nostrils. Follow the breath in your chosen area of the body from the very beginning of the in-breath, all the way to the pause when the breath turns and becomes the out-breath and follow the sensations all the way through the out-breath. Continuing in this way, allow your attention to rest on the breath sensations and gently return your attention to these sensations whenever you notice that it has wandered away.

- **Step 3: Expanding attention to whole body.** In the third step expand the spotlight of your attention once again, maintaining awareness of breathing while including a sense of whole body, perhaps a sense of the posture, and the internal sense of your facial expression.

If any sensations of discomfort, tension, or resistance are present, allow them to be acknowledged and breathe with them. Perhaps on the out-breath, see if any tension can be released.

As best you can, bring this expanded awareness to the next moments of your day.

Exploring the breath and its soothing and anchoring potential. Come to gently notice the breath. It's such a constant feature of life that we often ignore it…so take time with it now…actually feel the sensations as the breath enters the body and leaves the body of its own accord… allow it to move through its cycle of in-breath and out-breath without controlling or needing it to be any other way than it is… if it feels right to you, attend to the belly, the lower abdomen, noticing that it may be rising and falling with the cycle of the breath. If you care to, place your hands on your belly, feeling the movement of breath, the rhythm, the waves of the breath… simply ride the waves of your breath from moment to moment.

Offering a safe haven. As you listen to the body scan, if at any time sensations in the body become too uncomfortable, or emotions arrive that are too difficult, know that it is always possible to return to the breath as a safe place, as a haven, a retreat for you to rest in, until you are ready to venture again and into the body scan… wherever the recording is in its progress.

Body awareness practice—awareness of sensation and moving away from concepts toward direct experience. If you have placed your hands on your belly, allow your arms and hands to rest by your sides, and move your attention to the top of your head. Notice that sensations may arise when you bring attention to a particular part… maybe tingling, maybe pressure, maybe a feeling of breath. Or perhaps there's no sensation…that's OK, that is simply your experience at this moment. And when you're ready, move your attention to your forehead… observe sensation… perhaps sensations of tension, or tingling, or a sense of relaxation. Allow yourself to feel whatever you feel.

Now move your attention from the forehead to the eyes and eyelids… notice how you're holding them. How much or how little pressure does it take to keep them closed? Experience the eyes from the inside, from behind the eyelids. Are the eyeballs moving or still? Is there darkness? Light? Color? How does the breath affect this area?

When it feels right, begin to pay attention to the cheeks… sense the bones and the muscles coming to the skin of the cheeks… the air, sensations of coolness or warmth… note perhaps that some sensations stay for a while, whereas others pass quickly… and that intensity may change as you bring attention to them. Attend now to the nose, from the bridge to the edges of the nostrils… perhaps feeling the breath in the nostrils as it enters and leaves. Notice there is temperature, moisture, and sensations on the upper lip.

Moving the attention to the jaw… be aware of tightness or softness… allow the lower jaw to drop down slightly, and notice any changes in sensations in the muscles of the face and neck, or in other parts of the body, that that small movement may create. Expand your focus of attention to include the mouth and lips… inside the mouth, tongue against the teeth, sense the roof of the mouth, the gums… if you care to, breathe in through the nose and out through the lips, observing the sensations of dampness, dryness, warmth, or coolness.

Expanding the attention to encompass the entire face… don't just picture your face in your mind, but really feel the sensations in that area that we call the face. Where is that for you? Be aware of any thoughts and emotions as well… and if thoughts or emotions arise just allow them to simply come into awareness and then pass, like clouds in the sky.

Shifting the attention to your neck… notice how it is right now in the big muscles in the back of the neck, from the base of the skull to the shoulders… the throat… perhaps be aware of the sensation of air or the touch of clothing… be present in this experience.

Now to the shoulders; check into their condition in the moment…notice any tightness or softness, recognizing that this is the current condition…accept it, know that it does not need to be some other way. And know also that conditions change… notice if there is a sense of breath in the shoulders. How much of the body does breathing affect?

Allow attention to travel to the upper and midback… sense the muscles, tight or loose… perhaps be aware of sensations of the weight of the body here… pressure against the chair, feelings of the texture of clothing. Notice how the breath moves in this area.

Bring attention to the lower back…sense the contact or lack of contact with the chair…a sense of yielding to gravity or resisting…any tightness or softness. Notice any tendency to move away from or toward any sensations or thoughts, feelings, or judgments that may arise… remember this is simply how it is in the lower back at this moment.

Experience the whole back now, from the shoulders to the base of the spine… be aware of the subtle and not so subtle motions of the back as you breathe… dwell in the sensations in the back, not watching from your head, just knowing what the back knows.

Shift to the arms… to the upper arms and forearms… be aware of the pull of gravity, the weight of the arms… feel the muscles and joints…the touch and texture of clothing. Expand the attention to the wrists and hands… notice warmth or coolness, tingling, moisture, or dryness. How does the breath affect the arms and hands? Is it possible to feel the pulse here? Just be with what's here now.

And move, as you are ready, to the chest… to the lungs and heart in this space… maybe sensing inside, as the lungs fill and empty… perhaps noticing the heartbeat…the rhythm of the heart and the breath together. Be present to the sensations of life… what it feels like to be alive…and feel the surface, the touch of the clothing and any sense of movement.

Now extend attention to the abdomen, the belly, feeling inside first… this is the place where we have our gut feelings…there really are nerves here that sense and *know*…feel into the motion of the diaphragm, sense the breath in the belly.

When it seems right, move attention to the pelvic region, from hip to hip…be aware of the effects of gravity, the weight of the lower body… the buttocks pressed into the floor or chair, sensations in the joints… the groin, genitals… the lower abdomen… tune into the sense of the breath, or the pulse here. How far do they reach? And notice thoughts and feelings that may arise… be aware of any judgments and, as it's possible for you, let them go.

Shift the focus to the upper legs, the thighs… be aware of the sense of gravity, the pressure against the floor or chair, the feeling of clothing against the skin, and sense the quality of the muscles. Are the muscles tight or loose? Is it possible to feel the bone running through?

Extend the attention now to the lower legs, calves, and shins… notice points of contact or lack of contact with the floor or chair…be aware of gravity…be aware also that the legs are alive. How does the breath affect them? How does the pulse? Is there a sense of the blood flowing?

When you are ready, explore the feet… feel where they are…the floor…perhaps feel temperature sensations… warmth or coolness. Sense the heartbeat in the feet, perhaps?

Now, expand the attention to include the entire body, from the soles of the feet to the top of the head… be fully present to the totality of the experience of sitting or lying in this moment…sense perhaps the breath, the pulse, the heartbeat… feel a sense of gravity…a sense of being held gently, closely, without fail… dwell in what the body feels… and what it knows.

In the last moments of this body awareness practice, congratulate yourself for spending the time and energy to nourish yourself in this way… for continuing to make choices to live a more healthy, satisfying life… and know that you can carry this awareness of your body's deep wisdom beyond this practice session into each moment of your day, wherever you may find yourself.

Practice 2: Opening to and Expanding Awareness Practice

Approximate timing: introduction 3 minutes; practice 25 minutes.

Introduction. In your formal practice of sitting meditation, you are taking a seat right in the middle of your life. You are intentionally bringing yourself into a direct and intimate relationship with the present moment and what is arising in it for you—as much as possible, without judgment.

In this practice you have the opportunity to expand your attention to explore body sensations, sounds, thoughts, emotions and, when you are ready, to open to all of these—to the full range of events and phenomena, within and without as they move and change, appear and disappear in awareness. You're taking time to become more familiar—moment by moment—with who you are, beyond all the wanting and having and doing…

In a sense this practice is a perfect expression of your own unique presence in the world. It is helpful to come to this practice with a sense of kindness and care for yourself and bring a dignity and ability that resonates with your special status to the time, place, and posture of your sitting practice. Set aside a regular time when you won't be interrupted and can be in a quiet and comfortable place that can nurture your practice. When sitting, whether in a chair cushion or on the floor, maintain an attitude of confidence and stability—not leaning into or moving away from anything, simply be present with and open to what is happening now.

Opening to and expanding awareness practice. Sit in an upright position with your back straight and belly relaxed. Embody dignity and confidence… allow the sense of dignity to be both an expression and a reflection of your own innate integrity and wakefulness. Feel the floor or chair cushion beneath you, supporting you. Sense the pull of gravity holding you, receiving you. Find a point of balance where gravity is holding you comfortably upright, without strain. Allow the body to become still.

Bring your attention now to the sense of the body breathing, orient yourself to the breath entering and leaving the body… bring openness and curiosity to this moment. Notice where you feel the sensation of the breath most now… center your attention there.

Notice that there is a beginning, middle, and end of the in-breath and a beginning, middle, and end of the out-breath… (long pause).

Watch the entirety of the cycle of breath from beginning to the end. Notice the moment when the in-breath shifts to become an out-breath… and then notice the out-breath, from its beginning to when it shifts to become an in-breath… (long pause).

Realize that no matter how many times the attention leaves the breath, awareness of that does arise and there is an opportunity to choose and to bring the attention back… to this in-breath and/or the out-breath, now… (long pause).

Allow the breath to be at the center of your attention…to be center stage… allow any thoughts to come and go like clouds in the sky. If attention has wandered from the breath, gently but firmly escort it back, making the breath the focus of attention again… (long pause).

When you're ready, expand your attention beyond the breath to also include the entire body, sitting. Begin where there are distinct sensations in the body… perhaps in sensations of contact with the chair cushion… perhaps the touch of the clothes on your body or how your hands are feeling in the moment…perhaps sensations of temperature. Be present with any sensations as they rise.

Notice how sensations sometimes stay for just a short while, and how other times they linger… notice they may change in intensity, shift, and pass away as new sensations arise. Like the breath, they, too, have a beginning, middle, and end… (long pause)

Stay in touch with the sensations in the body as you sit… when attention wanders, notice you are making a choice to bring it back, with care and kindness, to the awareness of the body in the breath… (long pause)

We always have options and permission to explore our experience and notice the impermanence of all phenomena. If sensations arise in the body that are very intense, making it difficult to focus on the body or the breath, there are two ways to address this:

1. You may choose to mindfully change your posture, attending to the sensations of the movement as you shift.
2. You may choose to direct attention right into the intensity and sensation itself. Explore it with a gentle curiosity… notice nuances of sensation… perhaps notice thoughts and judgments… perhaps notice resistance or bracing… and, as much as possible, step back to observe, to open space in awareness, perhaps to soften the intensity of the sensation. Attend to duration…notice the duration and changes in sensations…notice they have a beginning, middle, and end… (long pause)

Now, allow your attention to shift from the breath and body to the sense of hearing…not seeking sound, rather, receiving whatever is available from within the body and from the environment near and far. Become particularly aware of hearing… notice how the awareness receives sounds without effort… (long pause).

Be aware of how sounds have a beginning, middle, and end… how some sounds are short and some are long… sounds are varied and textured… there is space between sounds. Notice how the mind labels sounds…has opinions about sounds…it likes and dislikes certain sounds. Notice any desire to move away from some sounds and toward others… as much as possible, make a space in which sounds can be experienced as they are… (long pause).

And when you're ready, allow your attention to shift from hearing and let it expand to thinking—the realm of thought. See thoughts not as distractions, but rather, bring your awareness to the thinking process itself. Notice how thoughts arise, stay briefly, or for a more extended period, and then dissolve… they, too, have a beginning, middle, and end. So as not to get lost in the content of the thoughts, allow thoughts to be in the foreground of awareness, with sound, body sensations, and breath in the background… (long pause).

Notice thoughts… they may be about anything—sleep, obligations, the past, the future… if you get carried away in the current of thinking, come back to observing thoughts as separate elements that come and go… thoughts moving through an open and spacious mind.

Emotions also arise in the body and mind… perhaps frustration, restlessness, peacefulness, sadness, joy, or fear…observe emotion…bring attention to emotion and to the mood state. What is here for you right now? Notice where in the body certain emotions seem to live… (long pause).

Explore emotions… notice how what is here may be wanted or unwanted… how there may be a tendency to cling to emotion judged as pleasant and to struggle with emotions judged negatively—such as sadness or fear… (long pause).

Notice whatever emotions arise in the moment… Know that they have a beginning, middle, and end… Perhaps simply observing them in the body—letting go of supporting thoughts, narratives, or stories… (long pause).

If at any time emotions or sensations become too uncomfortable, remember that you can always return to the breath… find a safe harbor and focus there until you are ready to venture out again… (long pause).

Move now, if you care to, into a choiceless awareness… not choosing to bring your attention to anything in particular. Simply sit, fully aware of whatever is presenting itself to you in each moment. If sound arises, allow sound to be the center of attention… If a body sensation arises, let that be the center of your attention until the next sensation arises, which may be another body sensation… or a thought about the body sensation… or an emotion… (long pause).

In one moment, the breath may be predominant and then, perhaps, sound might be most prominent… simply dwell with an open awareness, attending to whatever arises… (long pause).

Observe whatever presents itself to you in the moment… be spacious with whatever arises… (long pause).

Sit in stillness with whatever comes and goes… (pause) … be present with it all… (pause) … be here now… (pause) … open to the totality of your experience… (pause) … be fully human… (long pause).

Now return the attention to the body as you sit…feel the breath coming and going… stay fully present with body and breath… (long pause).

As this meditation practice comes to a close, realize that by practicing mindfulness you are intentionally deepening your ability to be fully present in your daily life. If it feels right, perhaps congratulate yourself for having taken this time and energy to nourish and care for yourself. Remember that practicing in this way helps create access to a wider, deeper, more open way of being in your life, in which you can see more clearly and make more conscious choices for health, well-being, and freedom.

Practice 3: Mindful Movement Practice During ADLs

Approximate timing: introduction 3 minutes; practice 20 minutes.

Introduction. This guiding of gentle movement during an ADL is an invitation to enter more deeply into the life of the body… experience the mind and body as one, as a unit while moving the body… to bring them together. And as with all mindfulness practices, this movement practice is about paying attention, moment to moment, to sensations, thoughts, and feelings that arise in your awareness. The movements in this guided meditation are designed to be done during a basic and routine ADL, such as washing your hands or face or folding the laundry.

As you go through this guided practice, you will be entering into the experience of the body as deeply as you can, without judgment. This is not about performing, about doing the mindful movements in some ideal way for a critical audience… rather, it's about doing them to help connect more closely to, and better understand, the body while you move and participate in ADLs. Not forcing any movement, but rather, relaxing into it… using discernment and knowledge of your own body and its limits to guide you and to override the instructions, adapting the practice in a way that works for you. Or perhaps imagining yourself doing the movements in a mindful way, feeling them in stillness as you visualize participating in the ADL in a mindful way, which is a valuable practice in itself.

Mindful Movement Practice During ADLs. For this mindful ADL practice let's begin in an alert, dignified, seated posture…notice the how the chair or other support accepts you…how gravity works so you don't have to… sense the areas of your body that touch the seat or chair…sense your feet on the floor. Bring your attention to the sensations of the breath in the body… be aware of sensations of rising and falling, expanding and contracting, on the in-breath and out-breath…

and with each breath, allow the chair or support to receive more of your weight… working less, trusting and accepting more…breathing in and out.

When you're ready, breathe in and imagine yourself preparing to wash your hands as you stand at your sink…notice your body sensations as you stand at your sink, notice any thoughts or emotions that may arise in the moment and let them be, and guide your attention, with kindness and firmness, back to sensations of your body. Then actually walk mindfully to your sink…bring a sense of curiosity and freshness to the movement… feel the pressure of the soles of the feet as you take each step…feel the lifting, swinging, placing phase of each step you take. Stand still with your arms and hands at your side as you reach the sink and just feel the sensations of standing… sense the pull of gravity and the support of the surface you are standing on. Notice any unnecessary tension in your muscles and see if you might be able to release any tension… and if not, just allow the sensations to go wherever they need to go.

Notice any thoughts or feelings that may enter your awareness, and as much as possible, allow them to simply come and go like clouds in the sky… keeping attention centered on the sensations of the body.

Now, bring your hands to the soap dispenser or bar of soap, hold the soap in your hand and experience the sensations of the force of gravity on the soap in your hand, the weight of the soap, the coolness or warmth, the texture… you may notice there is a scent to the soap, just notice it without judgment, without narrative…then slowly, aware of the sensations of movement but without anticipating the next movement, begin to wash your hands. Allow an element of freshness of experience as you move the soap around in your hands. Now sense into the body as you move your hands to turn on the faucet and feel the sensation of the water as you rinse your hands, the warmth or coolness, the weight and texture, the sounds as just sounds. Notice how much of the body is involved in this activity, how the breath may change as you move. Now mindfully reach to dry your hands off with a towel, sensing the texture of the towel on your hands and wrists, and return to standing with your hands at your sides. As you stand still, notice how you feel in your body after having experienced the ADL of washing your hands in this way—with open, curious awareness.

In your own time, mindfully walk and return to a tall, dignified seated position and become aware of how you feel… aware of thoughts and emotions, and as much as possible, let them go as you focus on bodily sensations in this moment… allowing them to pass as clouds in the sky as you focus on the sensations in the body after experiencing this ADL in this way. If it feels right, perhaps congratulate yourself for having taken this time and energy to nourish and care for yourself…remembering that practicing in this way helps create access to a wider, deeper, more open and healthy way of being and doing in your life, in which you can see more clearly and make more conscious choices for your health, well-being, and freedom.

Section 2 Summary

Over the years the AOTA's Commission on Practice has become increasingly explicit in its courageous attempts to interweave the significance of the development of the therapeutic use of self into the OTPF. Now we must be courageous in our efforts to articulate and embody what that actually means and to do more than just attend to the intellectual understanding or "concept," especially since the development of the therapeutic use of self cannot only be explained as an intellectual concept. It must be embodied and experienced individually.

How fortunate we are as a profession, in these efforts, in this time, to be able to draw upon an exquisite body of research that identifies practical and reasonable ways for us as individuals and as a profession to be able to articulate specific skills, qualities, characteristics, and practices that can, like a magic carpet, take us on a journey of compassionate self-exploration and enhanced insight and understanding, and ultimately bring us closer to an embodied experience of what it really means to use ourselves in a therapeutic way and to find for ourselves a meaningful balance between what it means to "be" and "do." Mindfulness must be embodied, just as the use of the self as a therapeutic modality must be embodied. These practices are inextricably interconnected and inseparable, with an infinite depth. Developing one does not happen without developing the other, and when working on one, we work also on deepening the other. It is a true journey of exploration and one that is just emerging for our beautiful and complex healing profession.

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Review Questions

1. What is the difference between acquisition, retention, and transfer of learning? Apply these terms to describe the learning stages in a client you have observed.
2. When are declarative learning and procedural learning processes used? How will teaching methods differ when declarative or procedural processes are required?
3. What are the reasons therapists teach activities? Give an example of desired teaching outcomes for each of the reasons presented in the chapter.
4. In which situations is extrinsic feedback valuable to the therapeutic process? What are some advantages and disadvantages of providing extrinsic feedback to clients?
5. Why does contextual interference contribute to transfer of learning? Think of an example of how contextual interference can be incorporated into an OT session.
6. Differentiate between random and blocked practice schedules. In which situations would each of these practice schedules be chosen?
7. Provide examples of how a therapist might structure whole practice versus part practice. In which situations might each of these types of practice be appropriate?
8. In which ways can occupational therapists enhance the variability of practice contexts? Give practical examples of how occupational therapists working in inpatient settings can provide treatment in natural contexts.
9. How can occupational therapists help clients develop metacognitive skills? Why are these skills important in the learning process?
10. Define mindfulness and the therapeutic use of self.
11. Explain ways in which the therapeutic use of self can be cultivated and fostered.
12. Describe ways in which the Western medical culture and Western societal and cultural norms in general can undermine our capacity to cultivate and foster the therapeutic use of self.
13. Identify ways in which mindfulness is currently embedded within the Western medical system.
14. Describe three or four ways in which the art and practice of embodying mindfulness as an occupational therapist can enhance the cultivation and development of the therapeutic use of self.
15. What is the significance of learning to turn toward one's own present-moment experience with openness and curiosity? How might occupational therapists skilled in this particular characteristic be able to benefit their client and/or the therapist-client relationship?
16. How might an occupational therapist who takes tender care of himself or herself behave in a way that would benefit his or her professional and personal relationships? What does it mean to truly care for oneself? How might that work for you?
17. What is the potential impact of the current Western medical environment on the development of the therapeutic use of self? How might you mitigate these modern-day challenges?
18. Who is mindfulness appropriate for? What are the major practices of mindfulness? Why is self-compassion such an integral part of developing mindfulness in one's life?
19. What is the distinction between pain and suffering?
20. List a few of the mindfulness-based interventions in which an occupational therapist could be trained.
21. In what ways did developing breath and body awareness empower Irene to make meaningful and lasting lifestyle changes that enhanced her health and well-being?
22. What is the point of cultivating interoccupational awareness?
23. Can occupational participation really be considered a healing agent and skillful tool if we as occupational therapists don't really know what it means to show up fully for our own occupations?

24. What is the significance of the word “being” in the term “occupational being”? What is an MBOT's role in cultivating “being” over “doing” for one's clients?

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Additional Resources

Mindfulness Recording Resources

Kabat-Zinn J: *Mindfulness meditation practices*. http://www.mindfulnesscds.com

Stahl B: Mindful healing recordings. http://www.mindfulnessprograms.com

Sounds True Audio. http://www.Soundstrue.com

Parallax Press: Books and recordings of Thich Nhat Hanh. http://www.parallax.org

Professional Training in MBSR

OASIS Institute: An International Learning Center for MBSR Teacher training: Center for Mindfulness in Medicine, Health Care and Society at the University of Massachusetts, Worcester, MA. http://www.umassmed.edu/cfm/oasis

Jefferson-Myrna Brind Center for Integrative Medicine—Stress Reduction Program, Philadelphia, PA. http://www.jeffersonhospital.org/cim

El Camino Hospital Mindfulness Stress Reduction Program, Mountain View, CA. http://www.mindfulnessprograms.com/teacher-training.html

Duke Integrative Medicine, Durham, NC. http://www.dukeintegrativemedicine.org/educational/mindfulness_training.aspx

Academic Education in Teaching Mindfulness-Based Interventions

Center for Mindfulness Research and Practice, School of Psychology, Bangor University, UK. http://www.bangor.ac.uk/imscar/mindfulness

Postgraduate Master of Science in MBCT at Oxford University. http://www.oxfordmindfulness.org

Centre for Mindfulness Studies affiliated with the University of Toronto, in Toronto, ON, Canada, offers a certificate program in MBCT facilitation. http://www.mindfulnessstudies.com/pro-training/

In development, to begin 2016: Mindfulness-Based Occupational Therapy Postgraduate Certificate Program at San Jose State University. http://www.sjsu.edu/occupationaltherapy/Programs/

DBT Training Resource: Marsha Linehan Behavioral Tech Research, Inc. http://www.behavioraltech.org

ACT Training Resource: Steven Hayes Association for Contextual Behavioral Science. http://www.contextualpsychology.org

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[a]References 9, 18, 24, 25, 39, 40, 49, 57, 61-63, 72, 73, 82, 94, 95, and 114.

[b]References 7, 11, 14, 19-21, 34, 38, 42, 46, 51, 76, and 81.

[c]References 28, 32, 34, 91, 97-100, 102, and 109.

[d]References 28, 32, 34, 91, 97-100, 105, and 109.

[a]References 9, 18, 24, 25, 39, 40, 49, 57, 61-63, 72-74, 82, 87, 94, 95, and 114.

[a]References 28, 32, 34, 91, 97-100, 102, and 109.

Documentation of Occupational Therapy Services

Jerilyn (Gigi) Smith

CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Identify five purposes of documentation.
2. Describe the basic technical points that should be adhered to when writing in the medical record.
3. Explain why only approved abbreviations should be used in occupational therapy (OT) documentation.
4. Describe the acceptable method of correcting an error in the medical record.
5. Explain why occupational therapy documentation should reflect the terminology outlined in the Occupational Therapy Practice Framework (OTPF).
6. Describe the components of a well-written progress note.
7. Identify the different places where documentation is required.

8. Briefly summarize the content of the initial evaluation.
9. Define assessments as they apply to the OT process.
0. Describe the purpose of the intervention plan.
1. Explain why establishment of goals should be a collaborative effort between the client and the therapist.
2. Explain the meaning of "client-centered goal."
3. Describe the purpose of progress reports.
4. Explain what is meant by a skilled intervention.
5. List the components of a SOAP note and give an example of each component of the note.
6. Identify the purpose of the discharge report.
7. List the primary reimbursement systems of OT services in the physical disabilities setting.
8. Describe two ways to ensure that confidentiality in documentation is maintained (refer to the AOTA Code of Ethics and the regulations established by the Health Insurance Portability and Accountability Act [HIPAA]).

KEY TERMS

Assessments
Checklist notes
Client record
Clinical reasoning
Confidentiality
Discharge report
Documentation
Ethical practice
Evaluation
Evaluation report
Health Insurance Portability and Accountability Act (HIPAA)
Initial evaluation report
Intervention plan
Legal document
Long-term goal
Medical record
Medicare guidelines
Narrative notes
Occupational profile
***Occupational Therapy Practice Framework*, third edition (OTPF-3)**
Privacy
Problem-oriented medical record (POMR)

Professional reasoning
Progress report
Reimbursement
Short-term goal
Skilled interventions
Skilled services
SOAP notes

Threaded Case Study

Jane, Part 1

Jane just started her first job as an occupational therapist at a skilled nursing facility. This week she completed two initial evaluations, and she has seen four clients for therapy each day. Jane knows the importance of accurate documentation, and she wants to make sure she includes data that will communicate the necessary information for reimbursement. She also knows that documentation is essential to demonstrate the value of occupational therapy. However, she has never worked in this practice setting and is worried about what terminology to use and how to document effectively to guarantee reimbursement.

Critical Thinking Questions

As you read this chapter, reflect on the following questions as they pertain to the case study.

1. What specific skills must Jane use in deciding how she will document the evaluation process?
2. What information is important to include in the SOAP note for reimbursement? Will the practice setting have an influence on what is included in the note?
3. How might federal regulations (HIPAA) and the principles put forth in the Occupational Therapy Code of Ethics influence how Jane communicates the results of the OT evaluation and the intervention program?

Documentation is an essential component of OT practice. It is the primary method of communication that is used to convey what was done with the client. Documentation supplements the practitioner's memory and creates a longitudinal record to enhance the continuity of care for the client. It demonstrates to others the value of OT intervention, and it provides validation of services to substantiate reimbursement. Documentation also serves as a means for collecting data that can later be used to support evidence-based clinical research.

Purposes of Documentation

Documentation is a permanent record of what occurred with the client. It is also a **legal document** and as such must follow the guidelines that will enable it to withstand a legal investigation. **Reimbursement** depends upon accurate, well-written documentation that provides the necessary information to justify the need for and value of OT services.

The American Occupational Therapy Association (AOTA) has identified these purposes of documentation:

- To communicate information about the client from the OT perspective
- To articulate the rationale for provision of OT services and the relationship of those services to the client's outcomes
- To reflect the OT practitioner's **clinical reasoning** and professional judgment
- To create a chronological record of the client's status, the OT services provided to the client, the client's response to OT interventions, and client outcomes[1]

Clear, concise, accurate, and objective information is essential to communicate the OT process to others. The clinical record should provide sufficient data to support the need for OT intervention.

Documentation is required whenever OT services are performed. This includes a record of what occurred during direct client care, in addition to supportive documentation required to justify the need for OT intervention.

OT Practice Notes

Examples of Documentation

Documentation is an ongoing process that continues throughout the client's therapy program. For example, the OT will document screening reports, **initial evaluation reports**, reevaluation reports, progress notes, discharge summaries, other medical record entries (eg, interdisciplinary care plans, provider telephone orders), intervention and equipment authorization requests, letters and reports to families and other healthcare professionals, and outcomes data.

Best Practices

Regardless of where documentation takes place, several basic technical points are important to adhere to when writing in a **medical record**. Box 8.1 lists the fundamental elements of documentation as set forth by the AOTA.[1] Proper grammar, correct spelling and syntax, and well-written sentences are essential components of any professional correspondence. Keeping lists of commonly used terms and using a handheld spell-check device are two strategies that can help the practitioner with spelling difficulties. Poor grammar or inaccurate spelling can lead the reader to question the skills of the therapist. Legibility is important to ensure that misinterpretation does not occur.

Box 8.1

AOTA's Fundamental Elements of Documentation

The following elements should be present in all documentation.

1. Client's full name and case number on each page.

2. Date

3. Identification of type of documentation (eg, evaluation report, progress note)

4. OT practitioner's signature with a minimum of first name or initial, last name, and professional designation.

5. When applicable on notes or reports, the signature of the recorder directly at the end of the note and the signature.

6. Countersignature by an OT on documentation written by students and OTAs as required by the payer source, state regulations, or the employer.

7. Acceptable terminology defined within the boundaries of the setting.

8. Abbreviation usage as acceptable within the boundaries of the setting.

9. All errors corrected by drawing a single line through an error and initialing the correction.

. Adherence to professional standards of technology when OT services are documented with electronic claims or records.

. Disposal of records (electronic and traditionally written) within law or agency requirements.

. Compliance with confidentiality standards.

. Compliance with agency or legal requirements of storage of records.

. Documentation should reflect the professional clinical reasoning and expertise of an OT practitioner and the nature of OT services delivered in a safe and effective manner. The client's diagnosis or prognosis should not be the sole rationale for OT services.

Modified from the American Occupational Therapy Association: Guidelines for documentation of occupational therapy, *Am J Occup Ther* 67:S32–S38, 2013.

Only approved abbreviations are to be used in the medical record. All clinical sites should have a printed list of acceptable abbreviations that can be used at the site. It is important to obtain this list and to use it as a reference when documenting. Examples of abbreviations commonly used in clinical practice are listed in Box 8.2. Misinterpretation of the intended meaning can occur when unfamiliar abbreviations or casual language unsuitable for therapeutic context is used. Language particular to a profession (slang or jargon) should never be used in the **client record**.

Box 8.2

Abbreviations Commonly Used in Clinical Documentation

abd	abduction
Add	adduction
ADLs	activities of daily living
Ⓐ	assistance
AE	above elbow
AFO	ankle-foot orthosis
AK	above knee
AM	morning
ant	anterior
A/P	anterior-posterior
AROM	active range of motion
Assist	Assistance, assistive
Ⓑ	bilateral
BE	below elbow
BM	bowel movement
BP	blood pressure
$\bar{c}$	with
CHF	congestive heart failure
CHI	closed head injury
C/O	complains of
D/C	discontinue or discharge
dept	department
DNR	do not resuscitate
DOB	date of birth
DOE	dyspnea on exertion
Dx	diagnosis
ECF	extended care facility
eval	evaluation
ext	extension
F/U	follow up
flex	flexion
FWB	full weight bearing
fx	fracture
HOB	head of bed
HOH	hand over hand
LE	lower extremity
LOS	length of stay
NWB	non–weight bearing
OOB	out of bed
po	by mouth
PMH	past medical history
PM	afternoon
prn	as needed
PWB	partial weight bearing
PMH	past medical history
post	posterior
Pt, pt	patient
PTA	prior to admission
PWB	partial weight bearing
q	every
qd	every day
qh	every hour
qid	four times a day
qn	every night
Ⓡ	right
re:	regarding
rehab	rehabilitation
reps	repetitions
R/O	rule out
ROM	range of motion
RR	respiratory rate
RROM	resistive range of motion
Rx	prescription
$\bar{s}$	without
SLR	straight leg raise
SNF	skilled nursing facility
SOB	short of breath
S/P	status post
S/S	signs and symptoms
STM	short term memory
Sx	symptoms
TDWB	touch down weight bearing
TTWB	toe touch weight bearing
t.o.	telephone order
Tx	treatment
UE	upper extremity

VC	vital capacity
v.o.	verbal orders
WBAT	weight bearing as tolerated
w/c	wheelchair
WFL	within functional limits
WNL	within normal limits
y.o.	year old
<->	to and from
->	to; progressing toward
@	at
1°	primary
2°	secondary; due to

From Gateley C, Borcherding S: *Documentation manual for occupational therapy: writing SOAP notes,* ed 4, Thorofare, NJ, 2016, Slack.

All entries made in the medical record must be signed with the therapist's legal name. Your professional credentials should follow your signature. Do not leave blank spaces at the end of an intervention note. Instead, draw a single line that extends from the last word to the signature. This prevents additional information from being added after the entry has been completed.

One of the greatest challenges for students and new therapists is writing notes that are concise yet comprehensive and include all the relevant information necessary to meet the goals of documentation as described earlier. Most third-party payers do not reimburse for time spent on documentation, so efficiency becomes essential. Although it is very important to accurately describe what occurred in the therapy session, care must be taken to keep this information to the point, relevant, and specific to established goals identified in the intervention plan. A common error is to describe each event that occurred in the intervention session in a step-by-step format. This is far too time-consuming and in fact does not meet the objectives of good documentation. Rather, short statements should be used that clearly and objectively convey necessary information to the reader. Abbreviations that have been approved by and are appropriate for the practice setting can be used to save time and space. Customized forms and checklists that include information relevant to the practice setting help streamline documentation and reduce time spent on narrative writing.

OT practitioners have an obligation to present information (verbally, in writing, or electronically) that is clear and at a level of linguistic clarity that the client can understand.[14]

Ethical Considerations

Principle 5 of the AOTA's Code of Ethics and Ethical Standards[3] addresses the OT practitioner's duty to provide comprehensive, accurate, and objective information when representing the profession. Principle 5B states that OT personnel shall "refrain from using or participating in the use of any form of communication that contains false, fraudulent, deceptive, misleading, or unfair statements or claims."[3] This pertains to OT documentation. To maintain ethical standards when documenting, therapists must be truthful and accurate in all that they report about the client.

Documentation must be written by the therapist providing the intervention. It is never acceptable to write a note for another therapist; in fact it is considered fraudulent to do so. It is best practice to complete documentation as soon after the therapy session as possible. The longer the interval between evaluation or intervention and completion of the written record, the greater the chance that details or other important information will be forgotten. Although documenting at the time of service delivery is ideal, it is not always possible. At these times, it may be beneficial for the therapist to carry a notepad or clipboard to record data that can later be included in the official write-up.

Altering, substituting, or deleting information from the client's record should never take place. Changes made to the original documentation could be used to support allegations of tampering with the medical record, even when this was not the intent of the writer. However, at times, corrections must be made. These might include errors in spelling, mistakenly writing in the wrong medical record, or inadvertently omitting information or assessment results. Several principles should be followed to avoid questioning of the validity of the corrected information. Nothing should be deleted from the record. Never use correction fluid when correcting an entry in the client's record. An acceptable method of correcting an error in the documentation is to draw a single line through the word or words, initial and date the entry, and indicate that this was an "error." Do not try to obliterate the sentence or word because this may appear to be an attempt to prevent others from knowing what was originally written. Late entries to the medical record cannot be backdated. If it is necessary to enter information that is out of sequence (eg, a note that the therapist forgot to write), it must be entered into the medical record as a "late entry" and must be identified as such. Words or sentences cannot be squeezed into existing text "after the fact." Attempts to do this may be interpreted as adding missing information to support something that occurred after the original documentation was completed. Although it is acceptable to make immediate corrections in the medical record, the medical record itself should never be altered.[8]

Corrections in an electronic medical record (EMR) are managed differently from paper-based documentation corrections. Each facility or organization has its own protocol for correcting errors in the medical record. Therapists must take the initiative to learn the site-specific guidelines for making corrections in the medical chart.

Ethical Considerations

OT notes can be the best defense against a denial of reimbursement of services or a lawsuit. Although no fraudulent intent may be present, it could be suspected if the content of a claim is ever called into question.

Do not leave blank spaces on evaluation and preprinted forms. If it is not appropriate to complete a section, N/A can be inserted to indicate that the particular area was not addressed. If sections are left blank, others reading the chart may think these areas were overlooked.

Documentation should incorporate the terminology outlined in the ***Occupational Therapy Practice Framework*, third edition (OTPF-3)**.[4] One of the purposes of the OTPF-3 is to assist therapists in communicating to other professionals, consumers of services, and third-party payers the unique focus of occupational therapy on occupation and daily life activities. Documentation should reflect the impact of occupational therapy on supporting function and performance in daily life activities and those factors that support engagement, participation, and health (performance skills, performance patterns, client factors, context and environment) during the evaluation and intervention process.[4] Many practice settings that follow the medical model, such as hospitals, use the term *patient* to describe the recipient of services. Other settings may prefer the term *resident.* Although these are acceptable, the OTPF-3 advocates use of the term *client*. *Client* encompasses not only the individual receiving therapy, but also others who are involved in the person's life (eg, a spouse, parent, child, caregiver, employer), in addition to larger groups, such as organizations or communities. The OTPF-3 provides terminology that can be used at each stage of the therapy process. This is explained in further detail when the various parts of the therapy evaluation, intervention, and discharge processes are described.

Clinical/Professional Reasoning Skills

Occupational therapists must use clinical or professional reasoning throughout the OT process. The more contemporary term **professional reasoning** is used by some authors to more closely align with language used in OT practices outside of medical settings, such as educational and community settings.[15] However, the term **clinical reasoning** is still widely used by occupational therapists, especially those working in physical disability practice settings. Clinical reasoning is also defined in the OTPF-3. For the purpose of this chapter, the term *clinical reasoning* will be used to refer to the comprehensive types of thinking and judgment used by occupational therapists in making client-related decision. Clinical reasoning also includes determining how to appropriately document information obtained during the evaluation, intervention, and discharge process. Clinical/professional reasoning is used to plan, direct, perform, and reflect upon client care.[15] Documentation must demonstrate that clinical reasoning was used in the decision-making process during all aspects of the client's therapy program.

Clinical/professional reasoning comprises many different aspects of reasoning: scientific, diagnostic, procedural, narrative, pragmatic, ethical, interactive, and conditional.[15] Scientific reasoning is used to help the therapist understand the client's impairments, disabilities, and performance contexts and to determine how these might influence occupational performance. Scientific reasoning guides the therapist's choice of interventions that will most benefit the client. Diagnostic reasoning is specifically concerned with clinical problem identification related to the client diagnosis. Procedural reasoning is used when the therapist thinks about the disability or disease and decides upon intervention to remediate identified problems. Narrative reasoning guides the therapist in evaluating the meaning that occupational performance limitations might have for the client. Pragmatic reasoning is used when the therapist addresses the practical realities associated with delivery of therapy services while looking at the context or contexts within which the client must perform his or her desired occupations. The therapist's personal situation, such as clinical competencies, preferences for particular therapy techniques, commitment to the profession, and comfort level in working with certain clients or diagnoses, is a part of the pragmatic reasoning process. Ethical reasoning is the process by which the therapist considers what should be done, taking into consideration all interested parties' needs and wishes when he or she develops the intervention plan.[15] For OT practitioners, keeping these points in mind and using clinical reasoning skills in determining what and how to document will facilitate client care and reimbursement for therapy services.

Clinical Reasoning in Documentation

Choosing appropriate assessments based on an understanding of the client's diagnosis and the occupations that might be affected involves clinical reasoning. Skilled observations, theoretical knowledge, and clinical reasoning are used to identify, analyze, interpret, and document components of occupational performance that may contribute to the client's engagement in occupation. Occupational therapists demonstrate clinical reasoning when they include information in their documentation that demonstrates synthesis of information from the occupational profile, interpretation of assessment data to identify facilitators and barriers to client performance, collaboration with the client to establish goals, and a clear understanding of the demands, skills, and meaning of the activities used in intervention.[4] Terminology used in documentation should reflect the unique **skilled services** that the occupational therapist uses to address client factors, performance skills, performance patterns, context and environment, and activity demands as they relate to the client's performance. Box 8.3 provides some examples of clinical reasoning.

OT Practice Notes

Concise, clear, accurate documentation that keeps the target audience in mind will ensure that the appropriate information is conveyed to other healthcare professionals and will meet the criteria for reimbursement.

Box 8.3

Examples of Clinical Reasoning

- Because of Mr. Page's change in affect after his total hip replacement, the Geriatric Depression Scale will be administered and his primary physician will be contacted.
- Using neurodevelopmental techniques (NDT), including facilitation at the hips, the client is now able to independently stand at the sink with good balance for 2 minutes to brush his teeth.
- A home assessment is recommended to determine what adaptive equipment is necessary to allow the client to independently and safely complete ADL tasks.
- Mr. Page's difficulty with problem solving, task initiation, and task progression impedes his ability to independently prepare a simple meal.
- A resting hand splint was fabricated for the client because of the emergence of spasticity, poor passive positioning of the upper extremity, and a high risk for development of contractures.
- Mrs. Rogers requires maximal assistance to complete upper/lower body dressing because of poor sitting balance, right neglect, and apraxia.

Legal Liability

The medical record is a legal document. All written and computerized therapy documentation must be able to pass a legal review. The medical record may be the most important document in a malpractice suit because it outlines the type and amount of care or services that were given.[8] The therapist must know what information is necessary to include in the client record to reduce the risk of malpractice in a legal proceeding. All information must be accurate and based on first-hand knowledge of care. Deductions and assumptions are to be avoided; judgmental statements do not belong in the therapy notes. The therapist instead should describe the action, behavior, or signs and symptoms that are observed. As described earlier, it is considered fraudulent to alter the medical record in any way.

Initial Evaluation

The **initial evaluation report** is a very important document in the OT process. It is the foundation upon which all other components of the client's program are based. including long- and short-term goals, the intervention plan, progress notes, and therapy recommendations. **Evaluation** is the process of obtaining and interpreting data necessary for understanding the individual, system, or situation. It includes planning for and documenting the evaluation process, results, and recommendations, including the need for intervention.[5] The OTPF-3 stresses that the evaluation process should focus on identifying what the client wants and needs to do, in addition to identifying factors that act as supports for or barriers to performance. The client's involvement in this process is essential for guiding the therapist in choosing the appropriate tools to assess these areas. The occupational therapist takes into account the performance skills, performance patterns, context and environment, activity and occupational demands, in addition to the client factors required for the client to successfully engage in occupation. This information must be articulated in the initial evaluation write-up.

A clear, accurately written account of the client's current status, in addition to a description of his or her prior status, is essential to justify the need for OT services. This initial report also provides necessary information to establish a baseline against which reevaluation data and progress notes can be compared to demonstrate the efficacy of therapy intervention. The evaluation must clearly "paint a clinical picture" of the client's current functional status, strengths, impairments, and need for occupational therapy.

The occupational profile is an important part of the evaluation. The **occupational profile** includes information about the client's occupational history and experiences, patterns of daily living, interests, values, and needs.[4] Information obtained from the occupational profile is essential in guiding the therapist to make clinically sound decisions about appropriate assessments, interventions, and goals.

Assessments are the tools, instruments, and interactions used during the evaluation process.[5] Assessments comprise standardized and nonstandardized tests and can include written tests or performance checklists. Interviews and skilled observations are examples of assessments frequently used in the evaluation process. The specific assessments used are determined by the needs of the client and the practice setting in which the client is being seen. Assessments should be chosen that evaluate the client's occupational needs, problems, and concerns. Clinical reasoning skills are used to decide which assessments are appropriate and which areas should be evaluated. It is not necessary to evaluate every occupation and all performance skills for every individual. For example, it is not appropriate to assess a client's ability to cook a meal if he or she lives in a setting in which meals are provided. Results of the assessment should be clearly identifiable and stated in measurable terminology that is standardized to the practice setting. Table 8.1 shows an example of terminology that can be used to describe the level of assistance required during the performance of a functional task.

TABLE 8.1

Levels of Assistance

Assistance Level	Description
Independent	• Client is completely independent. • No physical or verbal assistance is required to complete the task. • Task is completed safely.
Modified independence	• Client is completely independent with task but may require additional time or adaptive equipment.
Supervised	• Client requires supervision to safely complete task. • A verbal cue may be required for safety.
Contact guard/standby assistance	• Hands-on contact guard assistance is necessary for client to safely complete the task, or caregiver must be within arm's length for safety.
Minimum assistance	• Client requires up to 25% physical or verbal assistance from one person to safely complete the task.
Moderate assistance	• Client requires 26% to 50% physical or verbal assistance from one person to safely complete the task.
Maximal assistance	• Client requires 51% to 75% physical or verbal assistance from one person to safely complete the task.
Dependent	• Client requires more than 75% assistance to complete the task. **Note:** It is important to state whether the assistance provided is physical or verbal assistance.

The AOTA has outlined the recommended components of professional documentation used in occupational therapy in the text *Guidelines for Documentation of Occupational Therapy,*[1] which provides suggestions for what information should be included in screening reports, evaluation and reevaluation reports, intervention plans, progress reports, transition plans, and discharge reports.

Screening Report

The **screening report** is an initial brief assessment to determine the client's need for further OT evaluation or for referral to another service. Suggested content includes:

1. *Client information:* Name/agency; date of birth; gender; applicable medical, educational, and developmental diagnosis; precautions; and contraindications

2. *Referral information:* Date and source of referral; services requested; reason for referral; funding source; and anticipated length of service

3. *Brief occupational profile:* Client's reason for seeking OT services; current areas of occupation that are successful and areas that are problematic; contexts that support or hinder occupations; medical, educational, and work history; occupational history; client's priorities; and targeted outcomes

4. *Assessments used and results:* Types of assessments used and results (eg, interviews, record reviews, observations)

5. *Recommendations:* Professional judgments regarding appropriateness of need for complete OT evaluation

Evaluation Report

The **evaluation report** should contain the following information:

1. *Client information:* Name/agency; date of birth; gender; applicable medical, educational, and developmental diagnosis; precautions; and contraindications

2. *Referral information:* Date and source of referral; services requested; reason for referral; funding source; and anticipated length of service

3. *Occupational profile:* Client's reason for seeking OT services; current areas of occupation that are successful and areas that are problematic; contexts that support or hinder occupations; medical, educational, and work history; occupational history; client's priorities; and targeted outcomes

4. *Assessments:* Types of assessments used and results (eg, interviews, record reviews, observations, standardized or nonstandardized assessments)

5. *Analysis of occupational performance:* Description and judgment about performance skills; performance patterns; contextual or environmental aspects or features of activities; client factors that facilitate or inhibit performance; and confidence in test results

6. *Summary and analysis:* Interpretation and summary of data as they relate to the occupational profile and referring concerns

7. *Recommendation:* Judgment regarding appropriateness of OT services or other services

Intervention Plan

Upon completion of the assessment, the **intervention plan** is established. Information obtained from the occupational profile and the various tools used to assess the client is analyzed, and a problem list is generated. Problem statements should include a description of the underlying factor (performance skill, performance pattern, client factor, contextual or environmental limitation, activity demand) and its impact on the related area of occupation.[9] Based on the client's specific problems, the intervention plan is developed. The therapist must use theoretical knowledge and clinical reasoning skills to develop long- and short-term goals, to decide upon intervention approaches, and to determine the interventions to be used to achieve stated goals. Recommendations and referrals to other professionals or agencies are also included in the plan.[1] The intervention plan is formulated on the basis of selected theories, frames of reference, practice models, and best available evidence. It is directed by the client's goals, values, beliefs, and occupational needs.[4]

Establishment of the intervention plan is a collaborative effort between the therapist and the client or, if the client is unable, the client's family or caregivers. Although the occupational therapist (OT) has primary responsibility for development of the intervention plan and goal setting, the occupational therapy assistant (OTA) may contribute to the process. The OTA collaborates with the OT to select, implement, and make modifications to the interventions and provides documentation in the client's record.[2]

Intervention Goals

Intervention goals are written based on identified problems. Goals must be measurable and directly related to the client's ability to engage in desired occupations. The overarching goal of OT intervention is "achieving health, well-being, and participation in life through engagement in occupation"[4] (OTPF-3, p. S2). This must be kept in mind at all times when long- and short-term goals are developed. The OTPF-3 further identifies the outcome of OT intervention to be "the method that assists the client to reach a state of physical, mental, and social well-being; to identify and attain aspirations; to satisfy needs; and to change or cope with the environment"[4] (OTPF-3, p. S14). Documentation that uses this terminology will support the unique focus that occupational therapy contributes to the client's care plan and the rehabilitation process.

The AOTA defines intervention goals as "measurable and meaningful occupation-based long-term and short-term goals directly related to the client's ability and need to engage in desired occupations."[1] Writing goals that are clear, realistic, measurable, and appropriate for the client is an essential part of the therapeutic process that will lead to desired outcomes. Goals are written as a part of the evaluation and are critical factors in justifying the need for therapeutic intervention. As the client's status changes throughout the course of treatment, goals are upgraded or downgraded to guide further intervention. Reimbursement requirements and the setting in which the therapist works often direct the wording of the goal.

The client's intervention plan contains both short- and long-term goals. Some therapists prefer to use the term *objective* in place of *short-term goal.* **Short-term goals**, or objectives, are written for specific time periods (eg, 1 or 2 weeks) within the overall course of the client's therapy program. They are periodically updated as the client progresses or in accordance with the guidelines of the practice setting or payer requirements. Short-term goals are the steps that lead to accomplishment of the long-term goal, which is also called the *discharge goal* in some settings. The **long-term goal** is generally considered to be the overall goal of the intervention and is broader in nature than the short-term goal. For example, the client's long-term goal may be to become independent with dressing. One short-term goal to accomplish this might be that the client will be able to independently put on and take off a simple pullover shirt without fasteners. When this short-term goal has been achieved, a subsequent goal might be for the client to be able to dress independently in a shirt with buttons. Eventually, lower extremity dressing would be added as an objective, then socks, shoes, and outerwear, until the long-term goal of independent dressing is achieved.

Establishing objective, occupation-based, client-centered goals that focus on engagement in occupations and activities to support participation in life is central to the philosophy of occupational therapy.[4] Skillful goal writing requires practice and careful consideration of the desired outcome of therapy intervention. Client-centered goals are written to reflect what the client will accomplish or do, *not* what the therapist will do, and are written in collaboration with the client. The goal must reflect the outcome, not the technique or intervention used to achieve the outcome. *The client will be taught energy conservation techniques to use during dressing* is an example of a poorly written goal that focuses on the process, rather than the outcome, of therapy. The correct way to write the goal would be: *The client will independently use three energy conservation techniques during dressing.*

Goals must be objective and *measurable* and must include a *time frame.* The time frame may be written in a separate section of the evaluation form. A well-written goal clearly identifies the **expected outcome behavior** using concrete terms that describe a specific functional task, action, behavior, or activity (eg, The client will put on pants); a **measurable expectation of performance** (eg, independently); and the conditions or circumstances that support the outcome listed (eg, using a dressing stick). Examples of measurable expectations of performance include levels of assistance, degrees of motion, number of repetitions, and length of time. Examples of conditions include use of assistive devices, adaptive aids, the location where performance takes place (eg, edge of the bed), and additional time necessary to complete the activity. The following goal has all the necessary components: *Mr. B will feed himself* (expected outcome behavior) *with moderate verbal cues* (measurable expectation of performance) *while sitting in a quiet environment* (condition). Table 8.2 shows examples of short- and long-term goals.

TABLE 8.2

Examples of Short- and Long-Term Goals

Short-Term Goal[a]	Long-Term Goal[b]
Client will transfer w/c <-> (from wheelchair onto and off of) toilet with a raised seat and handrails with minimal physical assistance.	Client will independently transfer to a nonmodified toilet using a walker.
Client will brush teeth with moderate physical and verbal assistance while seated at the sink.	Client will complete morning hygiene and grooming independently after task setup using assistive devices while seated at the sink.
Client will put on socks with minimal assistance using a sock aid while seated in a wheelchair.	Client will independently complete lower body dressing without assistive devices while seated at the edge of the bed.

[a]Short-term goals are to be completed in 2 weeks.

[b]Long-term goals are to be completed in 4 weeks.

RUMBA

According to Perinchief,[12] a tool such as the RUMBA (also called RHUMBA) can be beneficial in organizing the therapist's thought processes for writing goals. RUMBA and RHUMBA are acronyms; each letter identifies something that the therapist should keep in mind when writing goals and documenting the therapeutic process. The therapist should review documentation to determine whether these questions have been answered, all the while keeping the target audience in mind.[13]

- Is the information **r**elevant (the outcome must be relevant)? *The goal/outcome must relate to an area of occupation (keep it functional). The long- and short-term goals must relate to each other and to what was identified in the evaluation as being in need of intervention.*
- **H**ow long will it take? *Indicate when the goal/outcome will be met.*
- Is the information **u**nderstandable? *Anyone reading it must know what it means. Avoid jargon, use correct grammar and acceptable abbreviations. Use an active voice rather than a passive voice (eg,* The client will brush her teeth, *rather than* Teeth will be brushed by the client*).*
- Is the information **m**easurable? *There must be a way to know when the goal has been met. This is written as a quantitative statement.*
- Is the information **b**ehavioral (describe behaviors)? *The goal/outcome must be something that is seen or heard and is described using an action verb.*
- Is the outcome **a**chievable (realistic*)? The goal/outcome must be doable and realistically able to be met in the established time frame.*

SMART

Another method that may assist the therapist in writing goals is the SMART goals system. SMART stands for **s**ignificant (and **s**imple), **m**easurable, **a**chievable, **r**elated, and **t**ime limited.[13]

- Achieving this goal will make a **s**ignificant difference in the client's life.
- You have a clear, **m**easurable target to aim for, and you will know when the client has reached the goal.
- It is reasonable that the client could **a**chieve this goal in the time allotted.
- Long- and short-term goals **r**elate to each other, and the goal has a clear connection to the client's occupational needs.
- The goal is **t**ime limited: short- and long-term goals have a designated chronological end point.[7]

Once the short- and long-term goals have been established, the therapist, in collaboration with the client, chooses appropriate interventions that will lead to goal attainment. The plan consists of **skilled interventions** that the therapist will provide throughout the client's therapy program. Interventions are chosen that involve the therapeutic use of occupations or activities (occupation-based activity, purposeful activity, preparatory methods); and consultation and client/caregiver education and advocacy.[4] Examples of OT interventions are activities of daily living (ADL) training; instrumental activities of daily living (IADL) training; therapeutic activities; therapeutic exercises; splint/orthotic fabrication, modification, and application; neuromuscular retraining; cognitive-perceptual training, community reintegration training, client/caregiver training; and discharge planning. The OTPF-3 outlines various approaches that may guide the intervention process (Table 8.3). These approaches are based on theory and best practice evidence. It is expected that the intervention plan will be modified according to the client's needs, priorities, and responses to the interventions. Modifications to the intervention plan must be documented in the client's record in the weekly or monthly progress reports.

TABLE 8.3

OT Intervention Approaches

Intervention Approach	Designed to …
Create, promote (health promotion)	Provide enriched contextual and activity experiences to enhance performance for persons in the natural contexts of life. It does not assume that a disability is present or that there is anything specific that would interfere with performance.
Establish, restore (remediation, restoration)	Change client variables to develop a skill or ability that has not yet been developed or to restore a skill or ability that has been impaired.
Maintain	Provide the supports that will allow the client to maintain performance capabilities. Without continued maintenance intervention, client performance would decline and/or occupational needs would not be met, affecting the individual's health and quality of life.
Modify (compensation, adaptation)	Find ways to revise the current context or activity demands to support performance. This includes using compensatory techniques, enhancing some features to provide cues, or reducing features to reduce distractibility.
Prevent (disability prevention)	Prevent the occurrence or development of barriers to performance in context. This approach is directed toward clients with or without a disability who are at risk for occupational performance problems.

Adapted from the American Occupational Therapy Association: Occupational therapy practice framework: domain and process, third edition, *Am J Occup Ther* 68(Suppl 1):S1–S51, 2014.

Progress Reports

Progress toward goal attainment is an expected criterion for reimbursement of OT services in most practice settings. Documentation that demonstrates progression toward goal achievement is critical to support the need for ongoing therapy. The purposes of the **progress report** are to document the client's improvement, describe the skilled interventions provided, and update goals. Progress reports may be written daily or weekly, depending on the requirements of the work site and the payer source. Various reporting formats are used to document client progress. The most prevalent formats used in physical disabilities settings are SOAP notes, **checklist notes**, and narrative notes.

Regardless of the format used, progress reports should identify the following key elements of the intervention session: the client outcome (using measurable terminology from the OTPF-3); the skilled interventions provided by the occupational therapist; and progress that resulted from the OT intervention. Skilled interventions are those that require the expertise, knowledge, clinical judgment, decision making, and abilities of an occupational therapist. Skilled therapy services have a level of inherent complexity such that they can be performed safely and/or effectively only by or under the general supervision of a qualified therapist.[11] Skilled services include evaluation; determination of effective goals and services in collaboration with the client and the client's caregivers and other medical professionals; analysis and modification of functional activities and tasks; determination that the modified task obtains optimum performance through tests and measurements; client/caregiver training; and periodic reevaluation of the client's status, with corresponding adjustment of the OT program. Box 8.4 shows examples of terminology that reflects the provision of skilled services.

Box 8.4

Terminology Used in the Provision of OT Services

Skilled Terminology

Assess

Analyze

Interpret

Modify

Facilitate

Inhibit

Instruct in:

- compensatory strategies
- hemiplegic dressing
- techniques
- safety
- adaptive equipment

Fabricate

Design

Adapt

Environmental modifications

Determine

Establish

Unskilled Terminology

Maintain

Help

Watch

Observe

Practice

Monitor

Documentation of skilled services includes a description of the type and complexity of the skilled intervention and reflects the therapeutic rationale underlying the choice of the intervention. Reimbursement for clinical services provided depends on documentation that demonstrates the clinical reasoning that underlies the intervention. The progress note must identify the skilled intervention provided and indicate the progress made toward established goals. Comparison statements are an excellent way to convey this information. Current status information is compared with baseline evaluation findings to clearly identify progress: *Client now requires minimal assistance to regain sitting posture during lower body dressing (last week required moderate assistance)*. Documentation that includes functional assessment scores from validated tests and measurements to demonstrate client progress provides strong justification for reimbursement of therapy services. A statement explaining why additional therapy services are needed substantiates the need for ongoing therapy: *Occupational therapy services are required for facilitation of balance and postural corrections to improve independence and safety with lower body dressing.* Goals are modified and updated on the basis of the client's progress: *Client will put on pants independently, without loss of balance, while seated on the edge of the bed.* Upgrading of the client's goals can consist of reducing the amount of assistance required to complete the task, increasing the complexity of the task, or introducing a new component to the activity. This is an ongoing process, and meticulous documentation is necessary to demonstrate the need for continued OT services. If a client is not making progress toward stated goals, a clear explanation of the reasons for this must be included in the progress note, with a modification of the existing goal and intervention approach.

SOAP Progress Note

The format for the **SOAP note** was introduced by Dr. Lawrence Weed in 1970 as a method of charting in the **problem-oriented medical record (POMR)**.[16] In the POMR, which focuses on a client's problems instead of on his or her diagnosis, a numbered problem list is developed that becomes an important part of the medical record. Each member of the healthcare team writes a SOAP note to address problems on the list that are specific to his or her area of expertise. The POMR is constantly modified and updated throughout the client's stay. The SOAP progress note is one of the most frequently used formats for documenting a patient's status. Each letter in the acronym SOAP stands for the name of a section of the note:

S—Subjective

O—Objective

A—Assessment

P—Plan

- The *Subjective* **(S)** part of the note is the section in which the therapist includes information reported by the client. Information provided by the family or caregivers can also be included here. Many different types of statements can be included in the subjective section of the SOAP note. Any information the client gives the therapist about his or her current condition that is relevant to treatment (eg, complaints of pain or fatigue; statements about feelings, attitudes, or concerns; and goals or plans) is appropriate to include in this section.[9] A client's subjective response to treatment is recorded in this section. Direct quotes can be used when appropriate. Family, caregivers, and others involved in the client's care can also provide valuable information. For example, nursing may report that the client was unable to feed himself or herself at breakfast, or a family member may supply information on the client's normal routine before hospitalization. If the client is nonverbal, gestures, facial expressions, and other types of nonverbal responses are appropriate to include. This information can be used to demonstrate improvement, support the benefit of chosen interventions, document the client's response, and show client compliance. However, discretion must be used when deciding what information to include. Using careful, effective communication skills during client treatment sessions will enhance the therapist's ability to gather relevant subjective information about the client's attitudes and concerns that can be used to ensure proper intervention and appropriate documentation.[9]
  The *Subjective* section should include only relevant information that will support the therapist's decision regarding which assessments should be used and which goals are appropriate for this client. The therapist should avoid statements that can be misinterpreted or that can jeopardize reimbursement. Subjective statements that do not relate to information in the other parts of the note are not useful. Negative quotes from the client that do not relate to the intervention session are not necessary or beneficial to include. If there is nothing relevant to report in the *Subjective* section, it is permissible to not include a statement. In this case, write a circle with a line through it (∅) to indicate that you have intentionally left the section blank.
- In the *Objective* **(O)** section of the SOAP note, the therapist documents the results of assessments, tests, and measurements performed, in addition to objective observations.[6] Data that are recorded in the *Objective* section are measurable, quantifiable, or observable. Only factual information may be included. Results of standardized and nonstandardized tests are documented in this part of the note. Measurable performance of functional tasks (ADLs, IADLs), range-of-motion (ROM) measurements, muscle grades, results of sensory evaluations, and tone assessments are examples of appropriate information for this section of the SOAP note. It is important that the therapist not interpret or analyze data in the *Objective* section. Rather, statements should include only concise, specific, objective recordings of the client's performance. Simply listing the activities that the client engaged in is not sufficient. The emphasis is on the results of the interventions, not on the interventions themselves. Information in the *Objective* section can be organized chronologically, discussing the results of each treatment event in the order it occurred during the session, or categorically.[6,9] Information that is organized categorically should follow the categories outlined in the OTPF-3: performance skills, performance patterns, context, and client factors.[4] Table 8.4 presents examples of documentation that can be used in the *Objective* section.

TABLE 8.4

Examples of Categories and Documentation for Objective Section of SOAP Note

Category	Objective Documentation
Activities of daily living (ADL) task performance	Note how each of the performance skills and client factors affects completion of ADL tasks. Include assist levels and setup needed, adaptive equipment required, or techniques used. Include client response to treatment.
Posture and balance	Note whether balance was static or dynamic. Note whether the client leans in one direction, has rotated posture, or has even or uneven weight distribution. Note the position of the head and what cues or feedback was necessary to maintain or restore balance.
Coordination	Include hand dominance, type of prehension used, ability to grasp and maintain grasp, reach and purposeful release, object manipulation, and gross versus fine motor ability.
Swelling or edema	Give volumetric measurements if possible, pitting or nonpitting type.
Movement patterns in affected upper extremities	Note tone, tremors, synergy pattern, facilitation required, and stabilization.
Ability to follow directions	Note type and amount of instruction required and ability to follow one-, two-, or three-step directions.
Cognitive status	Report on initiation of task, verbal responses, approach to the task, ability to stay on task, sequencing, orientation, and judgment.
Neurological factors	Note perseveration, sensory losses (specific), motor deficits, praxis, spasticity, flaccidity, rigidity, neglect, bilateral integration, and tremors.
Functional mobility	Note type of assistance required for the client to complete all types of mobility.
Psychosocial factors	Note client's overall mood, affect, and ability to engage with others. Also note family support, response to changes in body image, and ability to make realistic discharge decisions.

From Borcherding S: *Documentation manual for writing SOAP notes in occupational therapy*, ed 2, Thorofare, NJ, 2005, Slack.

- In the *Assessment* **(A)** section of the SOAP note, the therapist draws from the subjective and objective findings and interprets the data to establish the most appropriate therapy program. In this section, impairments and functional deficits are analyzed and prioritized to determine what impact they have on the client's occupational performance and ability to engage in meaningful occupation. Only information that was included in the *Subjective* or *Objective* section is discussed in the *Assessment* section. Clinical reasoning is required to analyze the information and develop the intervention plan. The *Assessment* portion of the SOAP note is where the therapist demonstrates his or her ability to summarize relevant assessment findings, synthesize the information, analyze its impact on occupational performance, and use it to formulate the intervention plan. It requires keen observation, clinical reasoning, and judgment skills, in addition to an ability to identify relevant factors that inhibit or facilitate performance. The *Assessment* section should end with a statement justifying the need for continued therapy services: *Client would benefit from activities that encourage trunk rotation and forward lean to facilitate transfers and lower body dressing.*[9] Insight and skill in completing the *Assessment* section improve with clinical experience.
- In the *Plan* **(P)** section of the SOAP note, the OT practitioner outlines the intervention plan. As the client achieves the short-term goals, the plan is revised and new short-term goals are established. Documentation reflects the client's updated goals, in addition to any modifications to the frequency of therapy. Suggestions for additional interventions are also included in this section. This information will guide subsequent treatment sessions. Fig. 8.1 shows an example of a progress note using the SOAP format.

S: Client states that "it takes too much energy to dress each day and my hands are too stiff to manage buttons and ties anyways." Client's family reports that client no longer seems interested in self-care activities.

O: Client became SOB with seated self-care task (dressing) after 5 minutes of activity. Client required minimal assistance for upper body dressing, moderate assistance to don pants and maximal assistance to don shoes (last week she required maximal assistance with all tasks). Client had moderate difficulty with buttons (last week she was unable to button blouse). Client was unable to tie shoes. BUE shoulder strength is 3+/5 (was 3/5).

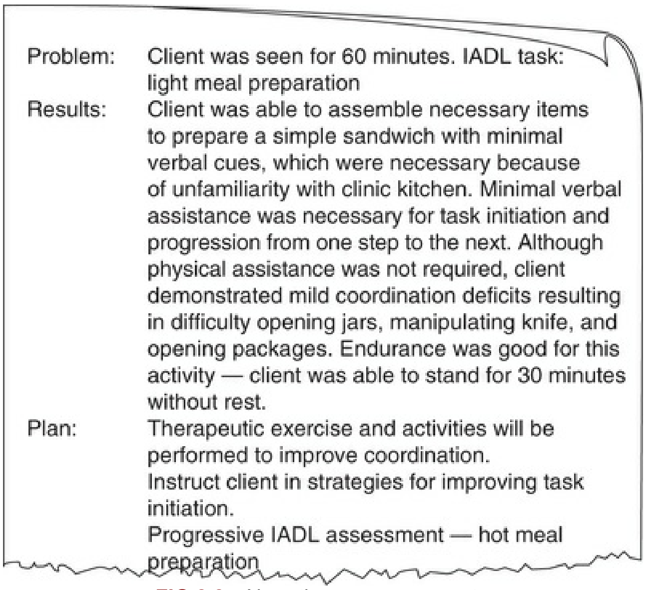
A: Client is improving in her ability to complete her self-care tasks. COPD still interferes with ADL independence. She may benefit from adaptive equipment for lower body dressing.

P: Continue ADL training: assess for independence with adaptive equipment (dressing stick, long-handled shoe horn, and elastic shoe laces). Instruct client in energy-conservation techniques during ADL task completion. Instruct client in AROM exercises before beginning morning ADL tasks.

FIG 8.1 SOAP (**s**ubjective, **o**bjective, **a**ssessment, **p**lan) note.

Narrative Notes

The **narrative note** is another format used to document daily client performance. One way to organize the narrative note is to categorize the information into the following subsections: problem, program, results/progress, and plan. The *problem* being addressed in the treatment intervention should be clearly identified. The impact on occupational performance and the underlying impairment are stated (eg, *Unable to put on socks due to poor sitting balance and postural instability)*. The intervention or intervention modality is identified in the *program* section. The *results,* including progress, are documented in measurable, objective terminology. Barriers to progress are included in this section. The plan for future intervention is outlined in the *plan* section. The need to modify goals and the rationale for this would be included here. In some practice settings, the narrative note is written directly in the medical chart. Occupational therapy may have a designated area in the medical chart in which the therapist can write notes, or all clinicians involved with the client may document in a single comprehensive interdisciplinary note. The date and often the beginning and ending times of the therapy session must be included in the note. The therapist's signature follows the last word of the note. Fig. 8.2 shows an example of a narrative note using this format.


Problem: Client was seen for 60 minutes. IADL task: light meal preparation

Results: Client was able to assemble necessary items to prepare a simple sandwich with minimal verbal cues, which were necessary because of unfamiliarity with clinic kitchen. Minimal verbal assistance was necessary for task initiation and progression from one step to the next. Although physical assistance was not required, client demonstrated mild coordination deficits resulting in difficulty opening jars, manipulating knife, and opening packages. Endurance was good for this activity — client was able to stand for 30 minutes without rest.

Plan: Therapeutic exercise and activities will be performed to improve coordination.
Instruct client in strategies for improving task initiation.
Progressive IADL assessment — hot meal preparation

FIG 8.2 Narrative progress report.

A narrative format may also be used to write any type of information the therapist wishes to convey to the other team members. For example, the therapist may document that the evaluation was initiated or that the client was unable to attend therapy because of illness. Documentation of communication between team members regarding the client's program may be expressed in a narrative format.

Descriptive Notes

At times a short descriptive note is useful to relay important information about the client. Although it is preferable to keep notes as objective as possible, it is sometimes appropriate to include subjective information. Judgmental comments, negative statements, comments about other staff members, and information not directly related to the client's intervention program do not belong in the official medical record. Unobserved behaviors that are included in the client record should be recorded as such and a clear explanation provided as to who provided the information to the therapist.

Progress Checklists or Flow Sheets

Checklists or flow sheets can be used to document daily performance in a concise, efficient manner. High productivity demands in many settings, in addition to lack of reimbursement for documentation, have made this type of documentation a useful option. Flow sheets typically have a table or graph format, which the therapist uses to record measurements at regular intervals, usually after each session. Advantages of using a flow sheet or a checklist to document daily performance on specific tasks include improved clarity and organization of data; reduction in the quantity of data that need to be recorded after each session; improved focus on interventions that are specific to the client's goals; and ease in clearly identifying the client's functional status and progress.[13] A disadvantage of using this format for documentation is that often there is not sufficient space for the therapist to include subjective statements to explain client performance, document the therapist's interpretation of the objective information, or describe the client's response to the intervention. The checklist provides a description of what the client did based on a level of assistance or an objective measurement, but it does not provide information on the quality of how the task was accomplished or modifications that were made to facilitate successful completion of the task. Whenever possible, this information should be included in a narrative format on a separate note sheet. Information from the daily checklist or flow sheet is used to write a weekly progress note.

Discharge Reports

Discharge reports are written at the conclusion of the therapy program. A comparison statement of occupational performance from initial evaluation to discharge is documented to demonstrate progress. Emphasis should be placed on the progress the client has made in engaging in occupations. A summary of the skilled interventions provided to the client is also included. Discharge recommendations (eg, home programs, therapy follow-up, and referral to other programs) are made to facilitate a smooth transition from therapy. Clients are discharged from therapy when they have achieved established goals, have received maximal benefit from OT services, do not desire to continue services,[5] or have exceeded reimbursement allowances. The discharge summary should clearly demonstrate the efficacy of OT services; it is often used to obtain information for outcome studies.

Electronic and Paper-Based Documentation

Documentation can be paper based (written record) or computer generated. Many healthcare facilities and other healthcare providers have adopted EMRs to standardize the collection of client data, improve coordination of care, improve productivity, and facilitate reporting of quality measures. Computerized documentation can be used to record all aspects of the OT process, from the evaluation report to the discharge report. Reporting forms can be accessed on the computer, and the results of the initial evaluation and the discharge report can be typed directly onto the forms. This guarantees legibility and ensures that no areas are left uncompleted.

Electronic evaluation forms and progress notes are formatted to meet the needs of the facility and include information required for reimbursement (Fig. 8.3). Therapists often are able to choose responses from a pull-down menu, thereby reducing the time spent in deciding on the appropriate terminology to use (Table 8.5). Space also is usually available to include narrative information. Because all healthcare providers enter information on a common database, members of the team are able to quickly access information about the patient by reviewing relevant sections on the computerized medical chart. One of the problems or inconveniences that may occur with electronic documentation is the accessibility of computers. Therapists must allow time to locate a computer that is not in use so that they can enter data. However, many clinical sites are now using handheld devices, which alleviates this obstacle. Additionally, some electronic forms are very restrictive in terms of what information the therapist may enter. This may make it difficult for the therapist to adequately document the session. Information entered solely from a pull-down menu may not give a clear picture of what occurred with the client. The use of electronic clinical documentation should not compromise the quality of the content in documentation. Software that allows for ease of use, ability to customize the documentation record to meet the individual needs of the practice setting, and the ability to allow for custom entries in narrative form to clarify information enhances the quality of electronic documentation.[10] In general, electronic documentation and billing can be an asset in the therapy setting.

DATE:
TIME:

PAGE 1

NURSING ASSESSMENT
O.T. PROGRESS REPORT

Client :
Account :
Admit Date :
Status : ADM IN
Attending :

Age/Sex :
Unit # :
Location :
Room/Bed :

Diagnosis :
Precautions :
Onset Date : Equipment :

FUNCTIONAL SKILLS	INITIAL STATUS Date :	STATUS WEEK From : To :
Eating :	.	:
Grooming :	.	:
Sponge Bathing UB/LB :	.	:
Showering :	.	:
Toileting :	.	:
Dressing UB :	.	:
Dressing LB :	.	:
Kitchen/Homemaking :	.	:
Bed/Chair Transfers :	.	:
Toilet Transfer :	.	:
Tub/Shower Transfer :	.	:

Pain : Pain Scale : (1-10) /10
Pain Location : Quality of Pain:
Effects of pain on ADLs :
Pain Comment :

CURRENT SHORT-TERM GOALS

1 : MET :
2 : :
3 : :

Current Problems :

1 : 4 :
2 : 5 :
3 : 6 :

NEW SHORT-TERM GOALS

1 :
2 :
3 :

COMMENTS : Conferred with OT for Treatment Plan Adjustment:

:
:
:
:
:

EDUCATED

Client Instructed : Parent/Significant Other Instructed : Translator Used :
Instruction Given On :
:

DATE:
TIME:

PAGE 2

NURSING ASSESSMENT
O.T. PROGRESS REPORT

Client :
Account :
Admit Date :
Status : ADM IN
Attending :

Age/Sex :
Unit # :
Location :
Room/Bed :

:

Mode of Instruction :

Fact Sheet/Handout Title :

Instruction comment :
Understanding Validated By :
MD aware of current status via conference notes (SNU)

Occurred Date :
Monogram : Initials : Name :

Occurred Time :
Nurse Type :

FIG 8.3 Computerized documentation form.

TABLE 8.5
Definitions of Level of Assistance Based on the Functional Independence Measure (FIM)[a]

	FIM Levels
No Helper	
7	Complete independence (timely, safety)
6	Modified independence (device)
Helper—Modified Dependence	
5	Supervision (subject = 100%)
4	Minimal assistance (subject = 75% or more)
3	Moderate assistance (subject = 50% or more)
Helper—Complete Dependence	
2	Maximal assistance (subject = 25% or more)
1	Total assistance or not testable (subject less than 25%)

[a]The FIM measures level of assistance in various domains on a 7-point scale.

Many different written formats can be used to document OT services. The content of the form used is usually determined by the requirements of the third-party payer reimbursing the service and the unique needs of the practice setting. As stated before, documentation must contain the information necessary to justify the need for OT services, must demonstrate the provision of skilled therapeutic interventions, and must show client progress toward identified goals. OT documentation should address all these components to ensure reimbursement and to convey accurate information about the client's performance.

Primary reimbursement systems for OT services in the physical disabilities setting include Medicare, Medicaid, various health maintenance organizations (HMOs), and preferred provider organizations (PPOs). Each of these organizations requires specific information that must be included in the documentation for reimbursement to occur. Individual facilities (eg, hospitals, clinics, home health agencies, skilled nursing facilities) design documentation forms to meet their specific needs and to ensure that the information necessary for reimbursement is included. Billing systems may also influence the type of documentation format that is used in a particular setting.

Medicare is a major payer source in the geriatric physical disability setting. Medicare is a national insurance program and as such has set national standards for documentation. This government agency has put forth detailed guidelines stating expectations for what information must be included in the medical record to justify the need for OT services. Intermediaries will reimburse OT services only if all of the requirements established by the **Medicare guidelines** and regulations have been met. The 2016 Medicare Benefit Policy Manual[11] describes the key words and phrases medical reviewers are looking for when they review a claim for payment. Medicare requires that specific information be clearly documented for each part of the therapy process for therapy services to be reimbursed. Many other payers of therapy services in adult rehabilitation follow Medicare's guidelines when establishing documentation policies for reimbursement.[13] A thorough and up-to-date understanding of these requirements is critical for ensuring reimbursement for services provided. The therapist working with Medicare clients must become familiar with these guidelines and regulations to prevent denial of services. Detailed information can be found at the Medicare website. It is important to keep up to date on current Medicare regulations to ensure that documentation is sufficient and includes all the components required for reimbursement. The AOTA (*http://www.aota.org*) maintains current information on Medicare reimbursement coverage on its website.

The Centers for Medicare and Medicaid Services (CMS) has designed a specific form for outpatient evaluations: CMS-700, Plan of Treatment for Outpatient Rehabilitation (commonly known as the Medicare 700 form). Although Medicare no longer requires its exclusive use, the form specifies the information that must be supplied for reimbursement. Documentation on the initial evaluation must demonstrate that it is reasonable and necessary for the therapist to complete the evaluation to determine whether restorative or maintenance services are appropriate. It is important to fill in all spaces on the Medicare 700 form (Fig. 8.4). Failure to complete a section of the form could result in a technical denial. It also is important to include a statement of the client's prior level of function and the change in function that precipitated the OT referral. Results from assessments that support the need for therapeutic intervention are recorded in this section. Objective tests and measurements are used to establish baseline data. This information serves as the basis for short- and long-term goals.

DEPARTMENT OF HEALTH AND HUMAN SERVICES
CENTERS FOR MEDICARE & MEDICAID SERVICES

PLAN OF TREATMENT FOR OUTPATIENT REHABILITATION

(COMPLETE FOR INITIAL CLAIMS ONLY)

1. PATIENT'S LAST NAME	FIRST NAME M.I.	2. PROVIDER NO.	3. HICN
4. PROVIDER NAME	5. MEDICAL RECORD NO. *(Optional)*	6. ONSET DATE	7. SOC. DATE
8. TYPE ☐ PT ☐ OT ☐ SLP ☐ CR ☐ RT ☐ PS ☐ SN ☐ SW	9. PRIMARY DIAGNOSIS *(Pertinent Medical D.X.)*	10. TREATMENT DIAGNOSIS	11. VISITS FROM SOC.

12. PLAN OF TREATMENT FUNCTIONAL GOALS GOALS *(Short Term)* OUTCOME *(Long Term)*	PLAN
13. SIGNATURE *(professional establishing POC including prof. designation)*	14. FREQ/DURATION *(e.g., 3/Wk. x 4 Wk.)*
I CERTIFY THE NEED FOR THESE SERVICES FURNISHED UNDER THIS PLAN OF TREATMENT AND WHILE UNDER MY CARE ☐ N/A 15. PHYSICIAN SIGNATURE / 16. DATE	17. CERTIFICATION FROM THROUGH N/A 18. ON FILE *(Print/type physician's name)* ☐
20. INITIAL ASSESSMENT *(History, medical complications, level of function at start of care. Reason for referral.)*	19. PRIOR HOSPITALIZATION FROM TO N/A

21. FUNCTIONAL LEVEL *(End of billing period)* PROGRESS REPORT	☐ CONTINUE SERVICES **OR** ☐ DC SERVICES
	22. SERVICE DATES FROM THROUGH

Form CMS-700-(11-91)

INSTRUCTIONS FOR COMPLETION OF FORM CMS-700

(Enter dates as 6 digits, month, day, year)

1. **Patient's Name** - Enter the patient's last name, first name and middle initial as shown on the health insurance Medicare card.

2. **Provider Number** - Enter the number issued by Medicare to the billing provider *(i.e., 00–7000)*.

3. **HICN** - Enter the patient's health insurance number as shown on the health insurance Medicare card, certification award, utilization notice, temporary eligibility notice, or as reported by SSO.

4. **Provider Name** - Enter the name of the Medicare billing provider.

5. **Medical Record No.** - *(optional)* Enter the patient's medical/clinical record number used by the billing provider.

6. **Onset Date** - Enter the date of onset for the patient's primary medical diagnosis, if it is a new diagnosis, or the date of the most recent exacerbation of a previous diagnosis. If the exact date is not known enter 01 for the day *(i.e., 120191)*. The date matches occurrence code 11 on the UB-92.

7. **SOC *(start of care)* Date** - Enter the date services began at the billing provider (the date of the first Medicare billable visit which **remains the same on subsequent claims** until discharge or denial corresponds to occurrence code 35 for PT, 44 for OT, 45 for SLP and 46 for CR on the UB-92).

8. **Type** - Check the type therapy billed; i.e., physical therapy (PT), occupational therapy (OT), speech-language pathology (SLP), cardiac rehabilitation (CR), respiratory therapy (RT), psychological services (PS), skilled nursing services (SN), or social services (SW).

9. **Primary Diagnosis** - Enter the pertinent written medical diagnosis resulting in the therapy disorder and relating to 50% or more of effort in the plan of treatment.

10. **Treatment Diagnosis** - Enter the written treatment diagnosis for which services are rendered. For example, for PT the primary medical diagnosis might be Degeneration of Cervical Intervertebral Disc while the PT treatment DX might be Frozen R Shoulder or, for SLP, while CVA might be the primary medical DX, the treatment DX might be Aphasia. If the same as the primary DX enter SAME.

11. **Visits From Start of Care** - Enter the **cumulative total** visits *(sessions)* completed since services were started at the billing provider for the diagnosis treated, through the last visit on this bill. *(Corresponds to UB-92 value code 50 for PT, 51 for OT, 52 for SLP, or 53 for cardiac rehab.)*

12. **Plan of Treatment/Functional Goals** - Enter brief current plan of treatment goals for the patient for this billing period. Enter the major short-term goals to reach overall long-term outcome. Enter the major plan of treatment to reach stated goals and outcome. Estimate time-frames to reach goals, when possible.

13. **Signature** - Enter the signature *(or name)* and the professional designation of the professional establishing the plan of treatment.

14. **Frequency/Duration** - Enter the current frequency and duration of your treatment; e.g., 3 times per week for 4 weeks is entered 3/Wk x 4Wk.

15. **Physician's Signature** - If the form CMS-700 is used for certification, the physician enters his/her signature. **If certification is required and the form is not being used for certification, check the ON FILE box in item 18.** If the certification is not required for the type service rendered, check the N/A box.

16. **Date** - Enter the date of the physician's signature only if the form is used for certification.

17. **Certification** - Enter the inclusive dates of the certification, **even if the ON FILE box is checked in item 18.** Check the N/A box if certification is not required.

18. **ON FILE** (Means certification signature and date) - Enter the **typed/printed name of the physician** who certified the plan of treatment that is on file at the billing provider. If certification is not required for the type of service checked in item 8, type/print the name of the physician who referred or ordered the service, **but do not check the ON FILE box.**

19. **Prior Hospitalization** - Enter the inclusive dates of recent hospitalization *(1st to DC day)* **pertinent** to the patient's current plan of treatment. Enter N/A if the hospital stay does not relate to the rehabilitation being rendered.

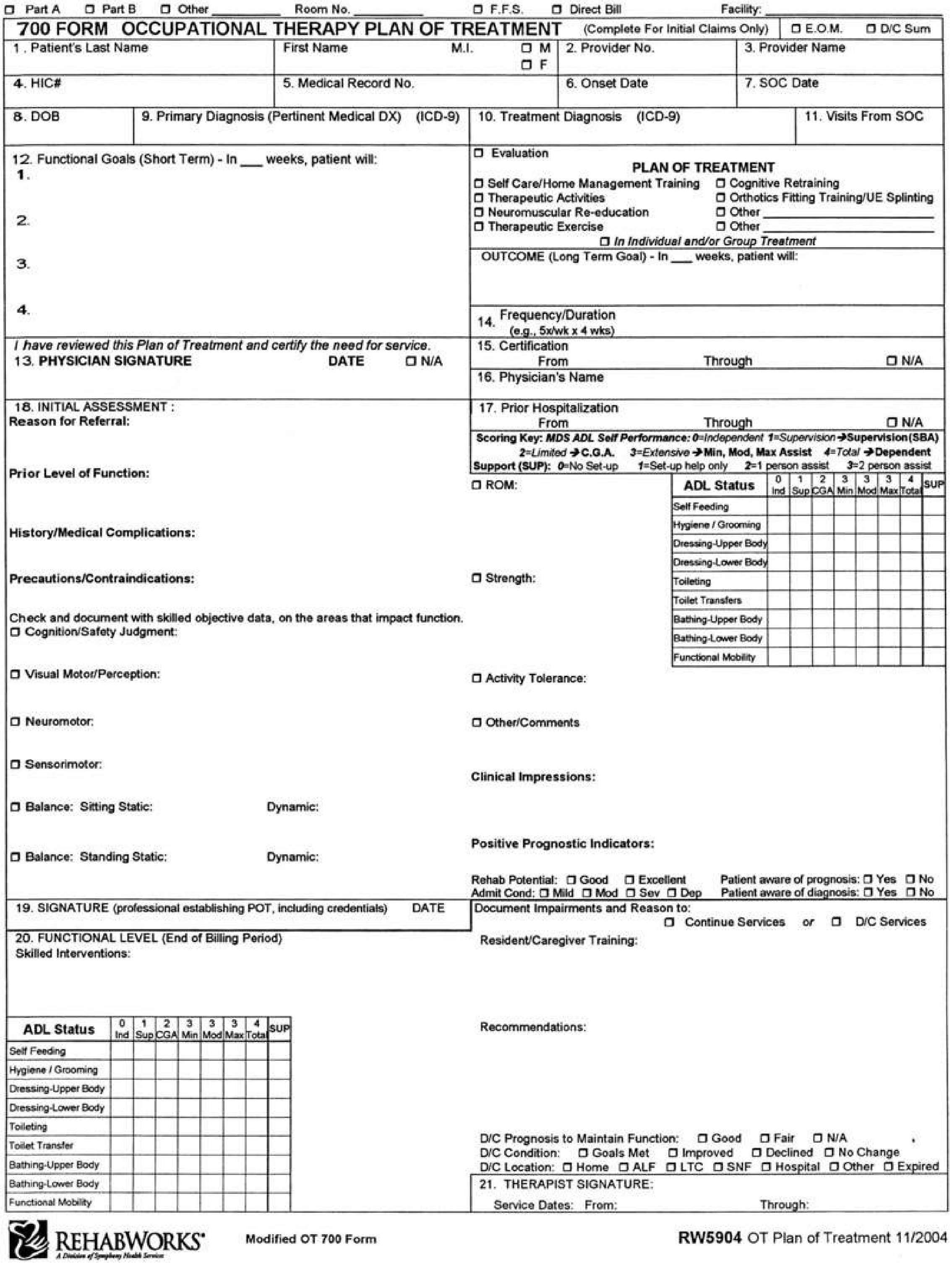
20. **Initial Assessment** - Enter only **current relevant history** from records or patient interview. Enter the major functional limitations stated, if possible, in objective measurable terms. Include only relevant surgical procedures, prior hospitalization and/or therapy for the same condition. Include only pertinent baseline tests and measurements from which to judge future progress or lack of progress.

21. **Functional Level** (end of billing period) - Enter the pertinent progress made and functional levels obtained at the end of the billing period compared to levels shown on initial assessment. Use objective terminology. Date progress when function can be consistently performed. When only a few visits have been made, enter a note indicating the training/treatment rendered and the patient's response if there is no change in function.

22. **Service Dates** - Enter the From and Through dates which represent this billing period *(should be monthly)*. Match the From and Through dates in field 6 on the UB-92. DO NOT use 00 in the date. Example: 01 08 91 for January 8, 1991.

FIG 8.4 Medicare evaluation form and instructions. (Courtesy Medicare, http://www.medicare.org.)

Many rehabilitation companies and hospitals have modified the Medicare 700 form with headings and checklists to assist the therapist in providing the type of information that will support the need for therapy services (Fig. 8.5). Space on the form is limited, and the therapist must be able to concisely present data that will clearly demonstrate the need for occupational therapy. A recent change in function (a decline or an improvement) is required to justify therapy. The plan of treatment (Section 12) includes functional, measurable goals based on assessment results as described in Section 18 of the Modified Medicare 700 form (sections may differ on Fig. 8.4 of the Medicare evaluation form). Goals cannot address issues that do not have supporting baseline data in the Assessment (Section 18) section. Goals cannot address issues that do not have supporting baseline data in the Assessment section (Section 18). The plan of treatment is the skilled intervention that the therapist will provide. The Medicare 700 form also functions as the end-of-month progress report and/or as the discharge form. Section 20 is completed at the end of the billing period. Progress, current functional status, and skilled interventions provided during the previous month are included in this section.



☐ Part A ☐ Part B ☐ Other ________ Room No. ________ ☐ F.F.S. ☐ Direct Bill Facility: ________

700 FORM OCCUPATIONAL THERAPY PLAN OF TREATMENT (Complete For Initial Claims Only) ☐ E.O.M. ☐ D/C Sum

1. Patient's Last Name | First Name | M.I. | ☐ M ☐ F | 2. Provider No. | 3. Provider Name

4. HIC# | 5. Medical Record No. | 6. Onset Date | 7. SOC Date

8. DOB | 9. Primary Diagnosis (Pertinent Medical DX) (ICD-9) | 10. Treatment Diagnosis (ICD-9) | 11. Visits From SOC

12. Functional Goals (Short Term) - In ___ weeks, patient will:
1.
2.
3.
4.

☐ Evaluation

PLAN OF TREATMENT

☐ Self Care/Home Management Training ☐ Cognitive Retraining
☐ Therapeutic Activities ☐ Orthotics Fitting Training/UE Splinting
☐ Neuromuscular Re-education ☐ Other ________
☐ Therapeutic Exercise ☐ Other ________
☐ *In Individual and/or Group Treatment*

OUTCOME (Long Term Goal) - In ___ weeks, patient will:

14. Frequency/Duration (e.g., 5x/wk x 4 wks)

I have reviewed this Plan of Treatment and certify the need for service.
13. **PHYSICIAN SIGNATURE** **DATE** ☐ N/A

15. Certification From Through ☐ N/A

16. Physician's Name

18. INITIAL ASSESSMENT :
Reason for Referral:

17. Prior Hospitalization From Through ☐ N/A

Scoring Key: *MDS ADL Self Performance:* *0=Independent 1=Supervision* → **Supervision (SBA)** *2=Limited* → **C.G.A.** *3=Extensive* → **Min, Mod, Max Assist** *4=Total* → **Dependent**
Support (SUP): 0=No Set-up 1=Set-up help only 2=1 person assist 3=2 person assist

Prior Level of Function:

☐ ROM:

ADL Status	0 Ind	1 Sup	2 CGA	3 Min	3 Mod	3 Max	4 Total	SUP
Self Feeding								
Hygiene / Grooming								
Dressing-Upper Body								
Dressing-Lower Body								
Toileting								
Toilet Transfers								
Bathing-Upper Body								
Bathing-Lower Body								
Functional Mobility								

History/Medical Complications:

Precautions/Contraindications:

☐ Strength:

Check and document with skilled objective data, on the areas that impact function.
☐ Cognition/Safety Judgment:

☐ Visual Motor/Perception:

☐ Activity Tolerance:

☐ Neuromotor:

☐ Other/Comments

☐ Sensorimotor:

Clinical Impressions:

☐ Balance: Sitting Static: Dynamic:

Positive Prognostic Indicators:

☐ Balance: Standing Static: Dynamic:

Rehab Potential: ☐ Good ☐ Excellent Patient aware of prognosis: ☐ Yes ☐ No
Admit Cond: ☐ Mild ☐ Mod ☐ Sev ☐ Dep Patient aware of diagnosis: ☐ Yes ☐ No

19. SIGNATURE (professional establishing POT, including credentials) DATE

Document Impairments and Reason to: ☐ Continue Services or ☐ D/C Services

20. FUNCTIONAL LEVEL (End of Billing Period)
Skilled Interventions:

Resident/Caregiver Training:

Recommendations:

ADL Status	0 Ind	1 Sup	2 CGA	3 Min	3 Mod	3 Max	4 Total	SUP
Self Feeding								
Hygiene / Grooming								
Dressing-Upper Body								
Dressing-Lower Body								
Toileting								
Toilet Transfer								
Bathing-Upper Body								
Bathing-Lower Body								
Functional Mobility								

D/C Prognosis to Maintain Function: ☐ Good ☐ Fair ☐ N/A
D/C Condition: ☐ Goals Met ☐ Improved ☐ Declined ☐ No Change
D/C Location: ☐ Home ☐ ALF ☐ LTC ☐ SNF ☐ Hospital ☐ Other ☐ Expired

21. THERAPIST SIGNATURE:
Service Dates: From: Through:

REHABWORKS A Division of Symphony Health Services — Modified OT 700 Form — **RW5904** OT Plan of Treatment 11/2004

FIG 8.5 Modified Medicare 700 form—occupational therapy plan of treatment. (Courtesy RehabWorks, a Division of Symphony Rehabilitation, Hunt Valley, MD.)

Fig. 8.6 shows an example of an initial evaluation form used in a rehabilitation center. It has been modified to meet the specific needs of the practice setting. Fig. 8.7 shows an example of an OT evaluation report and initial intervention plan that incorporates the OTPF language and process. As facilities update evaluation forms, the OTPF language should be incorporated.

County of Los Angeles — RANCHO LOS AMIGOS NATIONAL REHABILITATION CENTER — Department of Health Services

DIAGNOSIS:	ONSET DATE:	ADMIT DATE:

LIVING SITUATION / LIFE ROLES:

DISCHARGE PLAN:

MAJOR PROBLEMS / INTERFERING FACTORS:

BEHAVIOR / COGNITION / COMMUNICATION:

ADL STATUS	INITIAL	GOAL	CURRENT
SELF FEEDING			
HYGIENE GROOMING			
BATHING			
WET TUB / SHOWER TRANSFER			
UPPER BODY DRESSING			
LOWER BODY DRESSING			
TOILET ACTIVITIES			
WRITING / TYPING			
TELEPHONE			
DIRECTING (OWN) CARE			
MEAL PREPARATION			
SHOPPING			
LAUNDRY			
DRIVING			
PUBLIC TRANSPORTATION			
LIGHT HOUSEKEEPING			
HEAVY HOUSEKEEPING			
AVOCATIONAL			
VOCATIONAL			
OTHER			

KEY (Status): 7 = Complete independence/no helper, 6 = Modified independence/device, 5 = Supervision or set up, 4 = Minimum assist (patient does 75-100%), 3 = Moderate assist (patient does 50-74%), 2 = Maximum assist (patient does 25-49%), 1 = Total assist (patient does <25%), 0 = Not tested

Precautions:

Self-care:

Upper Extremity Status:

Motor Control:
RUE:
LUE:

Sensation:
RUE:
LUE:

Occupational History:

PATIENT / FAMILY GOALS:

O.T. PROGRAM:

ANTICIPATED FREQUENCY AND DURATION:

FOLLOW UP PLAN:

760193E (R 11/97)

☐ ADMISSION
☐ INTERIM
☐ DISCHARGE

THERAPIST'S SIGNATURE ____________ Date ________

PHYSICIAN'S SIGNATURE ____________ Date ________

NAME

RLANRC #

B.D. SEX

UNIT

OCCUPATIONAL THERAPY NOTE

FIG 8.6 OT initial evaluation form. (Courtesy Rancho Los Amigos National Rehabilitation Center, Downey, CA.)

Occupational Therapy Initial Assessment

Name: ______________________________ DOB: _____________ Start of Service Date: ____________________

HICN: ___________________________ Onset: _______________

Medical Dx/ICD-9 # ___________________________________Treatment Dx/ICD-9# ________________________

Past Medical History:____

Occupational Profile:

Areas of Occupation:

ADL Status	dep	max	mod	min	sup	indep	comments:
Self-feeding							
Hygiene/grooming							
UB bathing							
UB dressing							
LB dressing							
Wet tub/shower							
Toilet transfer							
Toileting skills							
Functional mobility:							
Personal device care							

IADL Status

Kitchen survival skills							
Meal preparation							
Shopping							
Laundry							
Light housekeeping							
Community mobility							
Financial mgmt							
Care of others							

Work/Leisure/social participation

Vocational:
Avocational:
Leisure participation:
Social participation:

Client Factors:

Functional cognition	
Perceptual status	
Memory	
Vision/hearing	
Pain	
ROM: RUE: LUE:	
Motor control: RUE: LUE:	
Strength: RUE: LUE:	
Muscle tone	
Coordination/bilateral integration	
Body system function	

Performance Skills:

Posture Sit: Stand:	
Mobility	
Endurance/effort	

Patient/family goals:

Short-term goals:	Long-term goals:
OT intervention plan:	Frequency/duration:

Therapist's Signature

Date

FIG 8.7 OT evaluation report and initial intervention plan.

Confidentiality and Documentation

Maintaining **confidentiality** in documentation is the responsibility of the occupational therapist. Confidentiality, which is principle 3H of the AOTA Code of Ethics, addresses the issue of **privacy** and confidentiality in all forms of communication, including documentation:

Occupational therapy personnel shall maintain the confidentiality of all verbal, written, electronic, augmentative, and nonverbal communications, in compliance with applicable laws, including all aspects of privacy laws and exceptions thereto (eg, HIPAA and the Family Educational Rights and Privacy Act).[3]

Similarly, Fremgen,[8] addressing the rules of medical law and ethics, explained that patients "have the right to have their personal privacy respected and their medical records handled with confidentiality. No information, test results, patient histories, or even the fact that the person is a patient, can be transmitted to another person without the patient's consent."

The AOTA's "Guidelines to the Code of Ethics" provides additional guidance regarding confidentiality issues[2]:

Information that is confidential must remain confidential. This information cannot be shared verbally, electronically, or in writing without appropriate consent. Information must be shared on a need-to-know basis only with those having primary responsibilities for decision making.

5.1 All occupational therapy personnel shall respect the confidential nature of information gained in any occupational therapy interaction.

5.2 Occupational therapy personnel shall respect the individual's right to privacy.

5.3 Occupational therapy personnel shall take all due precautions to maintain the confidentiality of all verbal, written, and electronic, augmentative, and nonverbal communications (as required by HIPAA.)[3] **Ethical practice** demands that the therapist understand what is meant by confidential information and is knowledgeable about how to maintain client confidentiality. Information about clients, including their names, diagnoses, and intervention programs, cannot be discussed outside of the treatment environment. Client charts should not be removed from the facility. Reports containing personal information (name, Social Security number, medical diagnosis) cannot be left out in plain view, where others can read the information. Therapists, students, and staff cannot discuss clients in public areas where others may overhear the conversation.

Federal laws have been enacted to protect the consumer against breaches of confidentiality. The privacy sections of the **Health Insurance Portability and Accountability Act (HIPAA)** clearly outline the expectations of healthcare professionals in issues of confidentiality. HIPAA was enacted in 1996 and consisted of a series of provisions that required the Department of Health and Human Services to adhere to national standards for electronic transmission of healthcare information. The law also required that healthcare providers adopt privacy and security standards by which to protect confidential medical information of patients. Beginning in April, 2003, healthcare providers were required to adhere to the privacy standards mandated by HIPAA**.** Individually identifiable health information, also known as protected health information (PHI), is federally protected under HIPAA regulations. PHI is health information that relates to a past, present, or future physical or mental health condition. The HIPAA rule limits the use and disclosure of PHI to the minimum necessary to carry out the intended purpose. It also gives patients the right to access their medical records. This regulation protects the medical records of clients, whether the information is written or electronic (computer) or is verbally communicated. Violations of the HIPAA rules are subject to criminal or civil sanctions.[8]

The law requires that all staff members be trained in HIPAA policies and procedures and that they understand the implications specific to their work setting. In addition to the client confidentiality procedures explained earlier, safeguards must now be adhered to for compliance with HIPAA regulations. The therapist has a responsibility to protect confidential information from unauthorized access, use, or disclosure. This includes information documented in the medical record. Papers, reports, and forms containing PHI should not be disposed of in the regular trash. Instead they must be shredded. Never leave medical records or portions of records (ie, therapy notes) unattended in public view. Information (written, verbal, or electronic) cannot be shared with the client's family members unless permission has been provided in writing by the client.

If documentation is done electronically, special care must be taken to prevent unauthorized individuals from accessing client information. Log-in pass codes cannot be shared among staff members, and therapists must take care to ensure privacy when entering information.

Ethical Considerations

Special safety measures, such as personal identification and user verification codes for access to records, should be established to prevent unauthorized individuals from accessing clients' records.[8]

Threaded Case Study

Jane, Part 2

Reflect on the questions posed in Part 1 of this case study. Jane, the OT beginning her first job at the skilled nursing facility, must use clinical reasoning skills at all stages of the therapy process, including the documentation of services delivered. The evaluation, the intervention plan, and short-term and long-term goals are written using sound clinical reasoning to decide which assessments are appropriate to administer, how to use best practice evidence to develop interventions, and how to best collaborate with the client (taking into account the client's goals, priorities, and desires) throughout the process. Evidence of this comprehensive approach must be reflected in the documentation provided by Jane. It is essential that OT notes also indicate the skilled service or skilled intervention that was provided for reimbursement purposes. The format used for recording this information, and also the terminology used, may be specific to the practice setting. Federal (ie, HIPAA) privacy mandates and the Occupational Therapy Code of Ethics must be adhered to at all times during all methods of documentation, whether written, verbal, or electronically generated.

Summary

Documentation is a necessary part of the OT process. The occupational therapist has a responsibility to the client, to the employer, and to the profession to develop the skills that will allow him or her to accurately document the therapy process. Well-written documentation promotes the profession by providing proof of the value of OT intervention. It can provide valuable information for outcome research and evidence-based practice. It is a professional expectation that the OT will keep current on documentation requirements for his or her practice area and will acquire the skills necessary to accurately document the OT process.

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Infection Control and Safety Issues in the Clinic

Alison Hewitt George

CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:
1. Recognize the role of occupational therapy personnel in preventing accidents.
2. Identify recommendations for safety in the clinic.
3. Describe the purposes of special medical equipment.
4. Identify precautions that should be taken when treating clients who require special equipment.
5. Identify Standard Precautions for infection control and explain the importance of following them with all clients.
6. Describe proper techniques of hand hygiene.
7. Recognize the importance for all healthcare workers of understanding and following standard procedures used in client care to prevent the transmission of infectious agents.
8. Identify proper procedures for handling client injuries.

9. Describe the guidelines for handling various emergency situations.

KEY TERMS

Antiseptic
Arterial monitoring line
Autoclave
Cardiopulmonary resuscitation (CPR)
Catheter
Centers for Disease Control and Prevention (CDC)
Dyspnea control postures
Endotracheal tube (ET)
Feeding pump
Fowler's position
Healthcare-associated infection (HIA)
Hyperalimentation
Intravenous (IV) feeding
Intravenous (IV) lines
Isolation systems
Nasogastric (NG) tube
Nosocomial infection
Occupational Safety and Health Administration (OSHA)
Pathogens
Standard Precautions
Total parenteral nutrition (TPN)
Transmission-Based Precautions
Universal Precautions (UP)

Threaded Case Study

Donna, Part 1

Donna is a registered occupational therapist hired as director of Occupational Therapy (OT) Services in a recently opened community hospital. This 300-bed general acute care hospital provides inpatient and outpatient services for individuals with a wide range of medical needs, including cardiac problems, brain injury, neurological and orthopedic problems, and needs in oncology, obstetrics, and gynecology. OT services are provided in acute care, skilled nursing, acute rehabilitation, and outpatient units.

As director of OT Services, Donna must establish policies and procedures pertaining to client safety, infection control, medical emergencies, and precautions with special equipment. Donna must develop written guidelines and must identify and/or develop training requirements to ensure adequate orientation and preparation of OT personnel.

Critical Thinking Questions

In preparing these policies and procedures, Donna must consider the following:

1. What general safety procedures and infection control standards should be followed to maintain a safe clinic environment?

2. What items of specialized medical equipment are OT personnel likely to encounter in their interventions with clients, and what precautions should be taken when treating a client who requires special equipment?

3. What are the basic guidelines and/or procedures to be applied in emergency situations?

4. What resources are available to healthcare providers that offer up-to-date information pertaining to safety procedures and infection control?

As you read through the chapter, keep in mind these questions and any other concerns confronting Donna in developing protocols, policies, and procedures for the safety of clients and OT personnel.

Ethical Considerations

Occupational therapists have an ethical obligation to refrain from actions that cause harm (p. 3) to recipients of OT services. To meet these ethical obligations to clients and to provide a physical context that supports clients' engagement in meaningful occupations, occupational therapists need to be educated in proper safety procedures, infection control standards, and emergency interventions.

The current (2014) version of the OT Framework, the "Occupational Therapy Practice Framework: Domain and Process," third edition[2] (OTPF-3), describes OT service delivery as a collaborative process between the client and the OT practitioner. This collaboration can occur in a variety of settings (eg, hospitals, schools, community settings, and home). The physical environment is an aspect of the domain of occupational therapy that can influence a client's engagement in occupations. The physical environment refers to the "natural (eg, geographic terrain, plants) and built (eg, buildings, furniture) surroundings in which daily life occupations occur"[2] (OTPF-3, p. S8). Therefore, the setting, or physical context, in which OT intervention occurs plays a significant role in the delivery of services in terms of supporting or inhibiting the client's performance.

Medical technology and cost control pressures have made it necessary for rehabilitation professionals to treat seriously ill clients early in their illness and for shorter periods. In the hospital setting it is not unusual for occupational therapists to work with clients using interventions that include specialized medical equipment, such as **catheters**, intravenous (IV) lines, monitoring devices, and ventilators. These circumstances increase the potential for injuries to clients. In addition to ethical obligations to provide safe and proper intervention, OT personnel can be held legally liable for negligence if a client is injured because staff failed to follow proper procedures or standards of care.

This chapter reviews specific safety precautions for use with a variety of clients. It identifies precautions to consider when encountering equipment commonly used with clients. Guidelines for handling various emergency situations are reviewed. It is important to note that the chapter is only an overview and cannot substitute for training in specific procedures used in many facilities. In addition to following these procedures, it is incumbent upon the occupational therapist to teach clients and their families applicable techniques that can be followed at home.

Safety Recommendations for the Clinic

Prevention of accidents and subsequent injuries begins with consistent application of basic safety precautions for the clinic:

1. Hand hygiene (hand washing or the use of alcohol-based hand rubs) should be performed before and after treating each client to reduce cross-contamination.

2. Make sure space is adequate to maneuver equipment. Avoid placing clients where equipment or passing personnel may bump them. Keep the area free from clutter.

3. Do not attempt to transfer clients in congested areas or in areas where your view or movement is blocked.

4. Routinely check equipment to ensure that it is working properly.

5. Make sure that the furniture and equipment in the clinic are stable. When not using items, store them out of the way of the treatment area.

6. Keep the floor free of cords, scatter rugs, litter, and spills. Ensure that the floors are not highly polished because polished floors may be very slippery.

7. Do not leave clients unattended. Follow federal guidelines for the proper use of restraint equipment (eg, bed rails, belts, vests) to protect clients when they are not closely observed.

8. Have the treatment area and supplies ready before the client arrives.

9. Allow only properly trained personnel to provide client care.

10. Follow the manufacturer's and the facility's procedures for handling and storing potentially hazardous material. Make sure that such materials are marked and stored in a place that is in clear view. Do not store such items above shoulder height.

11. Clearly label emergency exits and evacuation routes.

12. Have emergency equipment, such as fire extinguishers and first aid kits, readily available.

Precautions With Special Equipment

Newly hired OT personnel need orientation and education regarding the types of medical equipment they are likely to encounter when treating clients. Before providing any intervention to a client at bedside, the OT should carefully review the medical chart to determine whether any specific instructions regarding movement precautions, positioning, or handling should be followed. For example, a client may need to follow a turning schedule and may be limited in the length of time allowed to remain in one position. Certain joint movements may be contraindicated, or special bed and wheelchair positioning requirements may need to be followed, such as with clients recovering from a burn injury, spinal cord injury, stroke, hip replacement surgery, and so forth. Special handling techniques may be required when working with clients who have catheters, feeding tubes, IV lines, or special monitors. The various chapters throughout this book that address specific diagnoses will identify necessary precautions and handling recommendations.

Hospital Beds

OT personnel must be educated in the proper use of hospital beds to ensure client safety. The most commonly used hospital bed is electrically powered, but some are adjusted manually (cranked) or by hydraulic methods. All hospital beds are designed to make it easier to support the client and to change a client's position. Other, more specialized beds are needed for management of more complicated or more traumatic cases. Whatever type is used, the bed should be positioned so that the client is easily accessed and the therapist can use good body mechanics during mobility activities (see Chapter 11).

Most standard electrically adjustable beds are adjusted by means of electrical controls attached to the head or the foot of the bed or to a special cord that allows the client to operate the controls. The controls are marked according to their function and can be operated with the hand or foot. The entire bed can be raised and lowered, or upper and lower sections of the bed can be elevated or lowered to meet the client's needs. When the upper portion is raised 45 to 60 degrees, the client's position is referred to as **Fowler's position**. This commonly used position facilitates lung expansion, improves breathing, and decreases cardiac workload (as compared with supine lying). However, an important precaution for the OT to observe and address is that in this position, the client may slide down in the bed, which increases shearing forces on tissues of the back.

Side rails are attached to most beds as a protective measure. Some rails are lifted upward to engage the locking mechanism, whereas others are moved toward the upper portion of the bed until the locking mechanism is engaged. If a side rail is used for client security, the OT should be sure the rail is locked securely before leaving the client. The rail should be checked to ensure that it does not compress, stretch, or otherwise interfere with any IV or other tubing.

Ventilators

Ventilators (respirators) move gas or air into the client's lungs and are used to maintain adequate air exchange when normal respiration is decreased. Two frequently used types of ventilators are volume-cycled ventilators and pressure-cycled ventilators. Both ventilators deliver a predetermined volume of gas (air) during inspiration and allow for passive expiration. The gas delivered by the ventilator usually will be introduced into the client through an **endotracheal tube (ET)**, which is a catheter inserted through the nose or mouth into the trachea. When the tube is in place, the client is intubated. Insertion of the ET will prevent the client from talking. When the ET is removed, the client may complain of a sore throat and may have a distorted voice for a short period. It is important to avoid disturbing, bending, kinking, or occluding the tubing or accidentally disconnecting the ventilator tube from the ET. The client who uses a ventilator may participate in various bedside activities, including sitting and ambulation. Make sure the tubing is sufficiently long to allow the activity to be performed. Because the client will have difficulty talking, ask questions that can be answered with head nods or by other nonverbal means. A client using a ventilator may have a lower tolerance for activities and should be monitored for signs of respiratory distress, such as a change in the respiration pattern, fainting, or blue lips.

Monitors

Various monitors are used to observe the physiological state of clients who need special care. Therapeutic activities can be performed by clients who are being monitored, provided that care is taken to prevent disruption of the equipment. Many of the units have auditory and visual signals that are activated by a change in the client's condition or position or by a change in the function of the equipment. It may be necessary for a nurse to evaluate and correct the cause of the alarm unless the OT has received special instruction.

The cardiac monitor provides a continuous check on the function of the client's heart, including electrical activity (electrocardiogram [ECG]), heart rate, blood pressure, and respiration rate. Acceptable or safe ranges for the three physiological indicators can be set in the unit. An alarm is activated when the upper or lower limits of the ranges are exceeded or if the unit malfunctions. A monitoring screen provides a graphic and digital display of the values so that healthcare staff can observe the client's responses to treatment.

The pulmonary artery catheter (PAC) (eg, Swan-Ganz catheter) is a long, plastic IV tube that is inserted into a large vein (eg, subclavian, femoral, or jugular) and then threaded through the right side of the heart into the pulmonary artery. It provides accurate and continuous measurements of pulmonary artery pressures and will detect subtle changes in the client's cardiovascular system, including responses to medications, stress, and activity. Activities, including OT interventions, can be performed with the PAC in place, providing they do not interfere with the location of insertion of the catheter. For example, if the catheter was inserted into the subclavian vein, elbow flexion should be avoided and shoulder motions restricted.

The intracranial pressure (ICP) monitor measures pressure exerted against the skull by brain tissue, blood, or cerebrospinal fluid (CSF). It is used to monitor ICP in clients with a closed head injury, cerebral hemorrhage, brain tumor, or overproduction of CSF. Some of the complications associated with this device are infection, hemorrhage, and seizures. Two of the more commonly used ICP monitoring devices are the ventricular catheter and the subarachnoid screw. Both are inserted in a hole drilled in the skull. Physical activities should be limited when these devices are in place. Activities that would cause a rapid increase in ICP, such as isometric exercises, should be avoided. Positions to avoid include neck flexion, hip flexion greater than 90 degrees, and the prone position. The client's head should not be lowered more than 15 degrees below horizontal. Care must be taken to avoid disturbing the plastic tube.

The **arterial monitoring line** (A line) is a catheter that is inserted into an artery to continuously and accurately measure blood pressure or to obtain blood samples without repeated needle punctures. OT intervention can be provided with an A line in place, but care should be taken to avoid disturbing the catheter and inserted needle.

Feeding Devices

Special feeding devices may be necessary to provide nutrition for clients who are unable to ingest, chew, or swallow food. Some of the more commonly seen devices are the **nasogastric (NG) tube**, the gastric tube, and **intravenous (IV) feedings**.

The NG tube is a plastic tube that is inserted through a nostril and terminates in the client's stomach. The tube may cause the client to have a sore throat or an increased gag reflex. Feeding training can be initiated while the NG tube is in place. However, care should be taken because the tube may desensitize the swallow mechanism. Caution should be used when moving the client's head and neck, especially in forward flexion, to avoid dislodging the tube.

The gastric tube (G tube) is a plastic tube inserted through an incision in the client's abdomen directly into the stomach. Care should be taken so that the tube is not disturbed or removed during intervention activities.

Intravenous feeding, **total parenteral nutrition (TPN)**, or **hyperalimentation**, devices permit infusion of the large amounts of nutrients needed to promote tissue growth. A hyperalimentation device is used when a client is unable to eat or absorb nutrients through the gastrointestinal tract. A catheter is passed into a large vein (typically the subclavian vein) that empties directly into the heart. The catheter may be connected to a semipermanently fixed cannula or sutured at the point of insertion. The OT should carefully observe the various connections to be certain they are secure before and after intervention. A disrupted or loose connection may result in the development of an air embolus, which could be life-threatening.

The system usually includes a specialized **feeding pump**, which will administer fluids and nutrients at a preselected, constant flow rate. An audible alarm will be activated if the system becomes imbalanced or when the fluid source is empty. Intervention activities can be performed as long as the tubing is not disrupted, disconnected, or occluded and as long as undue stress to the infusion site is prevented. Motions of the shoulder on the side of the infusion site may be restricted, especially abduction and flexion.

Most **intravenous (IV) lines** are inserted into superficial veins. Various sizes and types of needles or catheters are used, depending on the purpose of the IV therapy, the infusion site, the need for prolonged therapy, and site availability. Care should be taken during intervention to prevent any disruption, disconnection, or occlusion of the tubing. The infusion site should remain dry, the needle should remain secure and immobile in the vein, and no restraint should be placed above the infusion site. For example, a blood pressure cuff should not be applied above the infusion site. The total system should be observed to ensure that it is functioning properly when intervention begins and ends. If the infusion site is in the antecubital area, the elbow should not be flexed. The client who ambulates with an IV line in place should be instructed to grasp the IV support pole so that the infusion site will be at heart level. If the infusion site is allowed to hang lower, blood flow may be affected. Similar procedures to maintain the infusion site in proper position should be followed when the client is treated while in bed or at a treatment table. Activities involving elevation of the infusion site above the level of the heart for a prolonged period should be avoided. Problems related to the IV system should be reported to nursing personnel. Simple procedures, such as straightening the tubing or removing an object that is occluding the tubing, may be performed by the properly trained therapist.

Catheters

A urinary catheter is used to remove urine from the bladder when the client is unable to satisfactorily control retention or release. Urine is drained through plastic tubing into a collection bag, bottle, or urinal. Any form of trauma, disease, condition, or disorder affecting neuromuscular control of the bladder sphincter may necessitate the use of a urinary catheter. The catheter may be used temporarily or for the remainder of the client's life.

A urinary catheter can be applied internally (indwelling catheter) or externally. Female clients require an indwelling catheter inserted through the urethra and into the bladder. Males may use an external catheter. A condom catheter is applied over the shaft of the penis and is held in place by an adhesive applied to the skin or by a padded strap or tape encircling the proximal shaft of the penis. The condom is connected to a drainage tube and a urine collection bag.

When clients with urinary catheters are receiving OT intervention, several precautions are important. Disruption or stretching of the drainage tube should be prevented, and no tension should be placed on the tubing or the catheter. The urine collection bag must not be placed above the level of the bladder for longer than a few minutes to avoid backflow of urine into the bladder or kidneys (with an indwelling catheter) or soiling of the client (with an external catheter). The bag should not be placed in the client's lap when the client is being transported. The production, color, and odor of the urine should be observed. The following observations should be reported to a physician or nurse: foul-smelling, cloudy, dark, or bloody urine or a reduction in the flow or production of urine. The collection bag must be emptied when it is full.

Infection is a major complication for persons using catheters, especially for those using indwelling catheters. Everyone involved with the client should maintain cleanliness during treatment. The tubing should be replaced or reconnected only by those properly trained. Treatment settings in which clients with catheters are routinely treated have specific protocols for catheter care.

Two types of internal catheters that are frequently used are the Foley catheter and the suprapubic catheter. The Foley catheter is a type of indwelling catheter that is held in place in the bladder by a small balloon inflated with air, water, or sterile saline solution. For removal of the catheter, the balloon is deflated and the catheter is withdrawn. The suprapubic catheter is inserted directly into the bladder through incisions in the lower abdomen and the bladder. The catheter may be held in place by adhesive tape, but care should be taken to avoid its removal, especially during self-care activities. Catheter application and bladder management are activities of daily living (ADLs) that are frequently taught to clients as part of a comprehensive OT intervention program (see Chapters 10 and 36 for examples).

Infection Control

Infection control procedures are used to prevent the spread of disease and infection among clients, healthcare workers, and others. They are designed to interrupt or establish barriers to the infection cycle. In 1996 the **Centers for Disease Control and Prevention (CDC)** published "Guidelines for Isolation Precautions in Hospitals." This document described **Universal Precautions (UP)**, which were established to protect healthcare workers and the clients they served from infectious agents, such as the human immunodeficiency virus (HIV), and diseases, such as acquired immunodeficiency syndrome (AIDS), hepatitis B, and hepatitis C. UP placed an emphasis on preventing the transmission of **pathogens** (infectious microorganisms) through contact with blood and bodily fluids. The CDC revised and developed additional guidelines for a system of isolation, called body substance isolation (BSI), which focused on isolating moist and potentially infectious body substances (blood, feces, urine, sputum, saliva, wound drainage, and other body fluids) from all patients. These guidelines recommended the use of **Standard Precautions**, which synthesized the primary features of BSI and UP. Standard Precautions apply to blood, all bodily secretions and fluids, mucous membranes, and nonintact skin (Box 9.1 and Fig. 9.1).

Box 9.1

Summary of Standard Precautions

1. Use extreme care to prevent injuries caused by sharp instruments.
2. Cover minor, nondraining, noninfected skin lesions with an adhesive bandage.
3. Report infected or draining lesions and weeping dermatitis to your supervisor.
4. Avoid personal habits (eg, nail biting) that increase the potential for oral mucous membrane contact with body surfaces.
5. Perform procedures involving body substances carefully to minimize splatters.
6. Cover environmental surfaces with moisture-proof barriers whenever splattering with body substances is possible.
7. Wash hands regularly, whether or not gloves are worn.
8. Avoid unnecessary use of protective clothing. Use alternate barriers whenever possible.
9. Wear gloves to touch the mucous membranes or the nonintact skin of any client, and whenever direct contact with body substances is anticipated.

. Wear protective clothing (eg, gown, mask, and goggles) when splashing of body substances is anticipated.

. Ensure that the hospital has procedures for care, cleaning, and disinfection of environmental surfaces and equipment.

. Handle and process soiled linens in a manner that minimizes the transfer of microorganisms to other patients and environments.

. Handle used patient care equipment appropriately to prevent transfer of infectious microorganisms. Ensure that reusable equipment is thoroughly and appropriately cleaned.

FIG 9.1 Universal blood and body fluid precautions. (Courtesy Brevis, Salt Lake City, UT.)

The most recent revision by the CDC, the "2007 Guideline for Isolation Precautions Preventing Transmission of Infectious Agents in Healthcare Settings,"[16] recommends the use of two tiers of precautions to prevent transmission of infectious agents: Standard Precautions and **Transmission-Based Precautions**. The document states:

Standard Precautions are intended to be applied to the care of all patients in all healthcare settings, regardless of the suspected or confirmed presence of an infectious agent. Implementation of Standard Precautions constitutes the primary strategy for the prevention of healthcare-associated transmission of infectious agents among patients and healthcare personnel.

Standard Precautions include hand hygiene, use of protective clothing (eg, gloves, gowns, masks, or eye protection, depending on anticipated exposure), and safe injection practices. Specific recommendations for each area of the Standard Precautions are detailed in the CDC guidelines. Key features of these recommendations are summarized in Box 9.1 and Table 9.1. Transmission-Based Precautions are additional standards that are implemented with clients who are known to be infected with infectious agents and require additional control measures to effectively prevent transmission. The most recent standards of the CDC also reflect current trends in the transition of healthcare delivery from primarily acute hospital settings to other settings (eg, long-term care, home care). These recommendations "can be applied in all healthcare settings using common principles of infection control practice, yet can be modified to reflect setting-specific needs."[16] Additionally, the term **nosocomial infection** (ie, hospital-acquired infection) has been replaced by **healthcare-associated infection (HIA)** "to reflect the changing patterns in healthcare delivery and difficulty in determining the geographic site of exposure to an infectious agent and/or acquisition of infection."[16]

TABLE 9.1

Recommendations for Application of Standard Precautions in All Healthcare Settings

Component	Recommendations
Hand hygiene	After touching blood, body fluids, secretions, excretions, contaminated items; immediately after removing gloves; between patient contacts
Personal Protective Equipment (PPE)	

Gloves	For touching blood, body fluids, secretions, excretions, contaminated items; for touching mucous membranes and nonintact skin
Gown	During procedures and patient care activities when contact of clothing/exposed skin with blood/body fluids, secretions, and excretions is anticipated
Mask, eye protection (goggles), face shield	During procedures and patient care activities likely to generate splashes or sprays of blood, body fluids, secretions, especially suctioning, endotracheal intubation
Soiled patient care equipment	Handle in a manner that prevents transfer of microorganisms to others and to the environment; wear gloves if visibly contaminated; perform hand hygiene
Environmental control	Develop procedures for routine care, cleaning, and disinfection of environmental surfaces, especially frequently touched surfaces in patient care areas
Textiles and laundry	Handle in a manner that prevents transfer of microorganisms to others and to the environment
Needles and other sharps	Do not recap, bend, break, or hand-manipulate used needles; if recapping is required, use a one-handed scoop technique only; use safety features when available; place used sharps in puncture-resistant container
Patient resuscitation	Use mouthpiece, resuscitation bag, or other ventilation devices to prevent contact with mouth and oral secretions
Patient placement	Prioritize for single-patient room if patient is at increased risk of transmission, is likely to contaminate the environment, does not maintain appropriate hygiene, or is at increased risk for acquiring infection or developing adverse outcomes following infection
Respiratory hygiene/cough etiquette (source containment of infectious respiratory secretions in symptomatic patients, beginning at initial point of encounter [eg, triage and reception areas in emergency departments and physician offices])	Instruct symptomatic persons to cover mouth/nose when sneezing/coughing; use tissues and dispose of in no-touch receptacle; perform hand hygiene after soiling of hands with respiratory secretions; wear surgical mask if tolerated or maintain spatial separation greater than 3 feet if possible

From Healthcare Infection Control Practices Advisory Committee: 2007 guideline for isolation precautions: preventing transmission of infectious agents in healthcare settings. http://www.cdc.gov/hicpac/pdf/isolation2007.pdf.

The **Occupational Safety and Health Administration (OSHA)** issues regulations to protect the employees of healthcare facilities. All healthcare settings must do the following to comply with federal regulations:

1. Educate employees on methods of transmission and on prevention of hepatitis B, HIV, and other infections.

2. Provide safe and adequate protective equipment and teach employees where the equipment is located and how to use it.

3. Teach employees about work practices used to prevent occupational transmission of disease, including, but not limited to, Standard Precautions, proper handling of client specimens and linens, proper cleaning of body fluid spills (Fig. 9.2), and proper waste disposal.

FIG 9.2 Spills of body fluids must be cleaned up by a gloved employee using paper towels, which should then be placed in an infectious waste container. Afterward a solution of 5.25% sodium hypochlorite (household bleach) diluted 1 : 10 should be used to disinfect the area. (From Young AP: *Kinn's the medical assistant*, ed 12, St Louis, 2013, Elsevier.)

4. Provide proper containers for the disposal of waste and sharp items and teach employees the color-coding system used to distinguish infectious waste.

5. Post warning labels and biohazard signs (Fig. 9.3).

FIG 9.3 Biohazard label. (From Young AP: *Kinn's the medical assistant,* ed 12, St Louis, 2013, Elsevier.)

6. Offer the hepatitis B vaccine to employees who are at substantial risk of occupational exposure to the hepatitis B virus.

7. Provide education and follow-up care to employees who are exposed to communicable disease.

OSHA has also outlined the responsibilities of healthcare employees. These responsibilities include the following:

1. Use protective equipment and clothing provided by the facility whenever the employee contacts or anticipates contact with body fluids.

2. Dispose of waste in proper containers, applying knowledge and understanding of the handling of infectious waste and using color-coded bags or containers.

3. Dispose of sharp instruments and needles in proper containers without attempting to recap, bend, break, or otherwise manipulate them before disposal.

4. Keep the work environment and the client care area clean.

5. Wash hands immediately after removing gloves and at any other times mandated by the hospital or agency policy.

6. Immediately report any exposures, such as needle sticks or blood splashes, or any personal illnesses to the immediate supervisor and receive instruction about any further follow-up action.

Although it is impossible to eliminate all pathogens from an area or object, the likelihood of infection can be greatly reduced. The largest source of preventable client infection is contamination from the hands of healthcare workers. Hand hygiene (Fig. 9.4) and the use of gloves are the most effective barriers to the infection cycle. The use of gloves does not eliminate the need for hand hygiene, and vice versa. Latex gloves provide the best protection from infectious materials. However, many individuals have latex allergies, so nonlatex gloves can be used as an alternative. The World Health Organization (WHO) also recommends the use of alcohol-based hand rubs as an acceptable alternative to hand washing.[19] Alcohol-based hand rubs are fast acting, cause minimal skin irritation, and significantly reduce the presence of microorganisms on the skin.

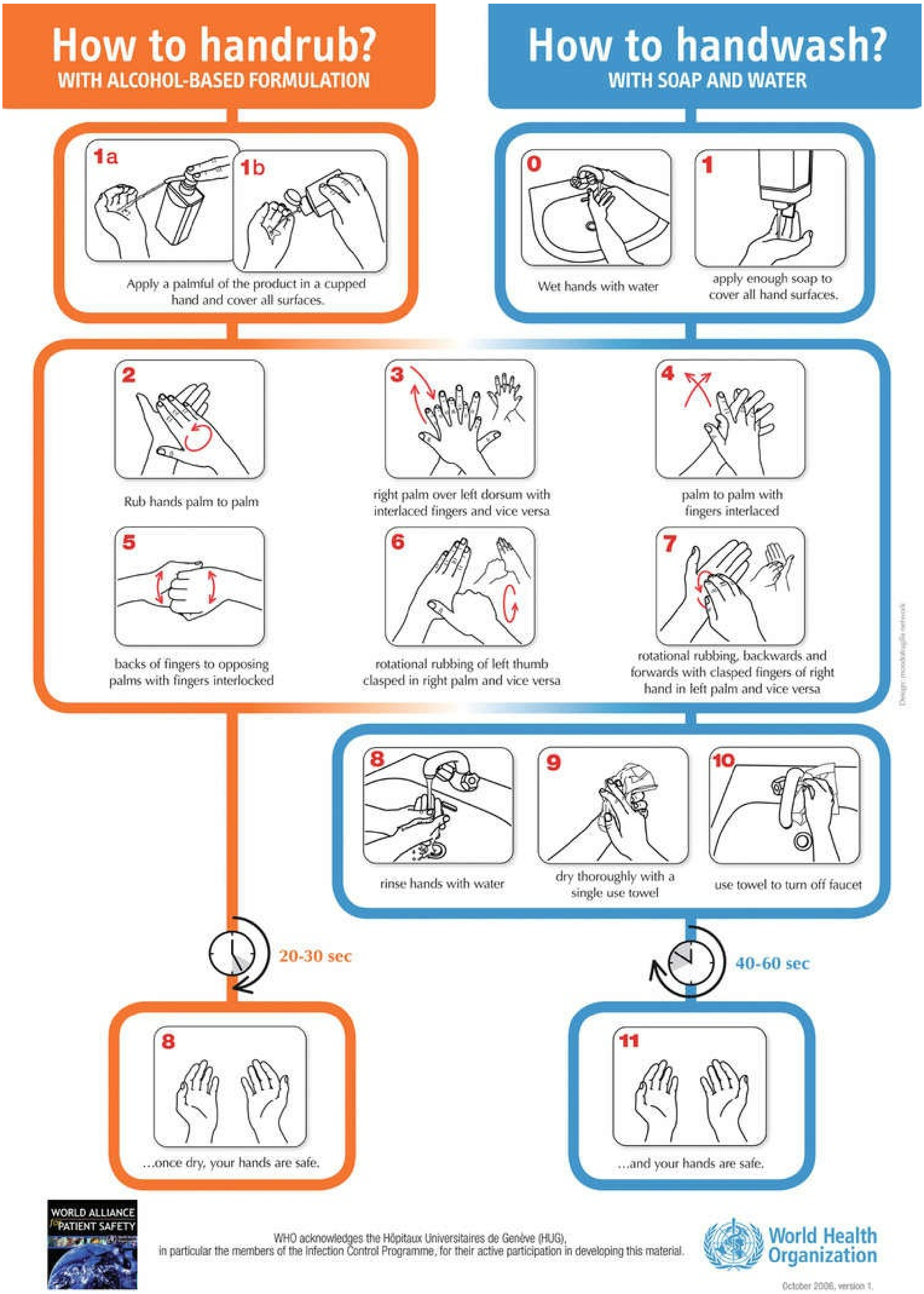

FIG 9.4 Guidelines on hand hygiene with hand rubs or hand washing. (From the World Health Organization (WHO), 2006.)

In the clinic, general cleanliness and proper control of heat, light, and air are important for infection control. Spills should be cleaned up promptly. Work areas and equipment should be kept free from contamination.

To decontaminate is to "remove, inactivate, or destroy blood-borne pathogens on a surface or item to the point where they are no longer capable of transmitting infectious particles and the surface or item is rendered safe for handling, use, or disposal."[15] Items to be sterilized or decontaminated should first be cleaned thoroughly to remove any residual matter. Sterilization is used to destroy all forms of microbial life, including highly resistant bacterial spores. An **autoclave** is used to sterilize items by steam under pressure. Ethylene oxide, dry heat, and immersion in chemical disinfectants are other methods of sterilization.

A variety of disinfectants may be used to clean environmental surfaces and reusable instruments. When liquid disinfectants and cleaning agents are used, gloves should be worn to protect the skin from repeated or prolonged contact. The CDC, local Health Department, or hospital infection control department can provide information about the best product and method to use.

Instruments and equipment used to treat a client should be cleaned or disposed of according to institutional or agency policies and procedures. Contaminated reusable equipment should be placed carefully in a container, labeled, and returned to the appropriate department for sterilization. Contaminated disposable items should be placed carefully in a container, labeled, and discarded.

Contaminated or soiled linen should be disposed of with minimal handling, sorting, and movement. It can be bagged in an appropriate bag and labeled before transport to the laundry, or the bag can be color coded to indicate the type or condition of linen it contains. Other contaminated items, such as toys, magazines, personal hygiene articles, dishes, and eating utensils, should be disposed of or disinfected. They should not be used by others until they have been disinfected.

OT Practice Notes

Therapists should routinely clean and disinfect personal items such as pens, keys, and clipboards because these objects are touched frequently and may become contaminated. If white coats or scrubs are worn, these should be cleaned regularly as well.

Isolation Systems

Isolation systems are designed to protect a person or an object from becoming contaminated or infected by transmissible pathogens. Various isolation procedures are used in different institutions. It is important for all healthcare workers to understand and follow the isolation approach used in their facilities so protection can be ensured. As mentioned, the CDC established Transmission-Based Precautions to be used for patients documented to have or suspected of being infected with highly transmissible or epidemiologically important pathogens: "Transmission-Based Precautions are used when the route(s) of transmission is (are) not completely interrupted using Standard Precautions alone." Three types of Transmission-Based Precautions may be used, singly or in combination, to control infectious transmission: contact precautions, droplet precautions, and airborne precautions. The CDC provides specific recommendations for each infection control measure. In addition, Appendix A of the 2007 guidelines provides a comprehensive list of the types of precautions (eg, standard, contact, airborne, droplet) recommended for selected infections and conditions.[16]

When Transmission-Based Precautions are needed, a client is usually isolated from other clients and the hospital environment because he or she has a transmissible disease. Isolation involves placing the client in a room alone or with one or more clients with the same disease to reduce the possibility of transmitting the disease to others. Specific infection control techniques must be followed by all who enter the client's room. These requirements are based on the type of infectious organism and common routes of transmission (ie, airborne, direct or indirect physical contact, and droplets). Specific instructions are listed on a color-coded card and are placed on or next to the door of the client's room. Strict isolation and respiratory isolation procedures are shown in Fig. 9.5. Protective clothing, including gown, mask, cap, and gloves, may be needed. When leaving the client, the caregiver must dispose of the protective clothing before leaving the room and must dispose of it in an appropriately designated area or container for storage, washing, decontamination, or disposal. Examples of diseases that require Transmission-Based Precautions are tuberculosis, severe acute respiratory syndrome (SARS), *Clostridium difficile* infection, chickenpox, measles, and meningitis.

STRICT ISOLATION

VISITORS: REPORT TO NURSES' STATION BEFORE ENTERING ROOM

1. Masks are indicated for all persons entering the room.
2. Gowns are indicated for all persons entering the room.
3. Gloves are indicated for all persons entering the room.
4. HANDS MUST BE WASHED AFTER TOUCHING THE PATIENT OR POTENTIALLY CONTAMINATED ARTICLES AND BEFORE TAKING CARE OF ANOTHER PATIENT.
5. Articles contaminated with infective material should be discarded or bagged and labeled before being sent for decontamination and reprocessing.

A

RESPIRATORY ISOLATION

VISITORS: REPORT TO NURSES' STATION BEFORE ENTERING ROOM

1. Masks are indicated for those who come close to the patient.
2. Gowns are not indicated.
3. Gloves are not indicated.
4. HANDS MUST BE WASHED AFTER TOUCHING THE PATIENT OR POTENTIALLY CONTAMINATED ARTICLES AND BEFORE TAKING CARE OF ANOTHER PATIENT.
5. Articles contaminated with infective material should be discarded or bagged and labeled before being sent for decontamination and reprocessing.

B

FIG 9.5 A, Strict isolation procedures sign. The card will be color-coded yellow and will be placed on or next to the door of the client's room. B, Respiratory isolation procedures sign. The card will be color-coded blue and will be placed on or next to the door of the client's room.

Occasionally a client's condition (eg, burns, systemic infection) makes him or her more susceptible to infection. This client may be placed in protective isolation. In this approach persons entering the client's room may have to wear protective clothing to prevent the transmission of pathogens to the client. The sequence and method of donning the protective garments are more important than the sequence used to remove them.

Healthcare-associated infections continue to be a significant problem in a variety of healthcare delivery settings. It is critical that OT personnel be given proper education and training in infection control standards to prevent the spread of unnecessary infections.

Incidents and Emergencies

Occupational therapists should be able to respond to a variety of medical emergencies and to recognize when it is better to get assistance from the most qualified individual available, such as a physician, emergency medical technician, or nurse. Securing such assistance should be relatively easy in a hospital but may require an extended period before response if the OT intervention is conducted in a client's home or an outpatient clinic. It is a good idea to keep emergency telephone numbers readily available.

Ethical Considerations

In most cases it is best to call for assistance before initiating emergency care unless delay is life-threatening to the client.

All OTs should be certified in **cardiopulmonary resuscitation (CPR)** and should have received basic first aid training. Training and certification can be obtained through organizations such as the American Heart Association (*http://www.americanheart.org*) and the American Red Cross (*http://www.redcross.org*).

Consistently following safety measures will prevent many accidents. However, the therapist should always be alert to the possibility of an injury and should expect the unexpected to happen. Most institutions have specific policies and procedures to follow. In general, the therapist should do the following when an injury to a client occurs:

1. Ask for help. Do not leave the client alone. Prevent further injury to the client and provide emergency care.

2. When the emergency is over, document the incident according to the institution's policy. Do not discuss the incident with the client or significant others or express information to anyone that might indicate negligence.

3. Notify the supervisor of the incident and file the incident report with the appropriate person within the organization.

Falls

The risk of falling is always present when functional mobility is addressed with clients. The OT can reduce the risk of falling by carefully preparing the environment before initiating intervention. This includes use of a gait belt, as needed, during mobility activities; clearing the environment of potential hazards; and having a wheelchair or chair nearby to pull into position for clients who might be prone to falling. The therapist can prevent injuries from falls by remaining alert and reacting quickly when clients lose their balance. Proper guarding techniques must be practiced. In many instances it is wise to resist the natural impulse to keep the client upright. Instead, the therapist can carefully assist the client to the floor or onto a firm object.

If a client begins to fall forward, the following procedure should be used: Restrain the client by firmly holding the gait belt. Push forward against the pelvis and pull back on the shoulder or anterior chest. Help the client stand erect once it is determined that no injury has occurred. The client may briefly lean against you for support. If the client is falling too far forward to be kept upright, guide the client to reach for the floor slowly. Slow the momentum by gently pulling back on the gait belt and the client's shoulder. Step forward as the client moves toward the floor. Tell the client to bend the elbows when the hands contact the floor to help cushion the fall. The client's head should be turned to one side to avoid injury to the face.

If the client begins to fall backward, the following procedure should be used: Rotate your body so one side is turned toward the client's back and widen your stance. Push forward on the client's pelvis and allow the client to lean against your body. Then, assist the client to stand erect. If the client falls too far backward, to stay upright, continue to rotate your body until it is turned toward the client's back and widen your stance. Instruct the client to briefly lean against your body or to sit on your thigh. You may need to lower the client into a sitting position on the floor using the gait belt and good body mechanics.

Burns

Generally only minor, first-degree burns are likely to accidentally occur in occupational therapy. These can be treated with basic first aid procedures. Skilled personnel should be contacted for immediate care if the burn has any charred or missing skin or shows blistering. The following steps should be taken for first-degree burns in which the skin is only reddened:

1. Rinse or soak the burned area in cold (not iced) water.

2. Cover with a clean or sterile dressing.

3. Do not apply any cream, ointment, or butter to the burn because this will mask the appearance and may lead to infection or a delay in healing.

4. Report the incident so that the injury can be evaluated by a physician.

Bleeding

A laceration may result in minor or serious bleeding. The objectives of first aid treatment are to prevent contamination of the wound and to control bleeding. The following steps should be taken to stop the bleeding.

1. Wash your hands and put on protective gloves. Continue to wear protective gloves while treating the wound.

2. Place a clean towel or a sterile dressing over the wound and apply direct pressure to the wound. If no dressing is available, use your gloved hand.

3. Elevate the wound above the level of the client's heart to reduce blood flow to the area.

4. Encourage the client to remain quiet and to avoid using the extremity.

5. Do not apply a tourniquet unless you have been trained to do so.

Shock

Clients may experience shock as a result of excessive bleeding, sepsis, and respiratory distress; as a reaction to the change from a supine to an upright position; or as a response to excessive heat or anaphylaxis (severe allergic reaction). Shock causes a drop in blood pressure and inefficient cardiac output, resulting in inadequate perfusion of organs and tissues. Signs and symptoms of shock include pale, moist, and cool skin; shallow and irregular breathing; dilated pupils; a weak or rapid pulse; dizziness or nausea; and an altered level of consciousness. Shock should not be confused with fainting, which would result in a slower pulse, paleness, and perspiration. Clients who faint generally will recover promptly if allowed to lie flat. If a client exhibits symptoms of shock, the following actions should be taken:

1. Get medical assistance as soon as possible because shock can be life-threatening.

2. Try to determine the cause of shock and correct it if possible. Monitor the client's blood pressure, breathing, and pulse rate.

3. Place the person in a supine position, with the head slightly lower than the legs. If head and chest injuries are present or if respiration is impaired, it may be necessary to keep the head and chest slightly elevated.

4. Do not add heat, but prevent loss of body heat if necessary by applying a cool compress to the client's forehead and covering the client with a light blanket.

5. Do not allow exertion. Keep the client quiet until emergency medical help arrives.

Seizures

Seizures may be caused by a specific disorder, brain injury, or medication. The OT should be able to recognize a seizure and should take appropriate action to keep the client from getting hurt. A client having a seizure will usually become rigid for a few seconds and then will begin to convulse with an all-over jerking motion. The client may turn blue and may stop breathing for up to 50 to 70 seconds. A client's sphincter control may be lost during or at the conclusion of the seizure, so the client may void urine or feces involuntarily. When a client shows signs of entering a seizure, the following steps should be taken:

1. Place the person in a safe location and position him or her away from anything that might cause injury. Do not attempt to restrain or restrict the convulsions.

2. Loosen clothing around the person's neck to assist in keeping the client's airway open.

3. Do not insert any objects into the person's mouth; this can cause injury.

4. Remove sharp objects (glasses, furniture, and other objects) from around the person to prevent injury.

5. When the convulsions subside, roll the person onto his or her side to maintain an open airway and to prevent the person from aspirating any secretions.

6. After the convulsions cease, have the client rest. He or she may experience confusion for a period of time. It may be helpful to cover the client with a blanket or screen to provide privacy.

7. Get medical help.

Insulin-Related Illnesses

Many clients seen in OT have insulin-related episodes. These episodes can occur as the result of severely inadequate insulin levels (hyperglycemia, or a high blood glucose level) or from excessive insulin (hypoglycemia, or a low blood glucose level). It is very important for the OT to be able to differentiate between the conditions of hypoglycemia (insulin reaction) and hyperglycemia (ketoacidosis), which can lead to diabetic coma (Table 9.2). Both conditions can result in loss of consciousness, but medical intervention for each condition is very different.

TABLE 9.2

Warning Signs and Symptoms of Insulin-Related Illnesses

	Insulin Reaction (Insulin Shock)	Ketoacidosis (Diabetic Coma)
Onset	Sudden	Gradual
Skin	Moist, pale	Dry, flushed
Behavior	Excited, agitated	Drowsy
Breath odor	Normal	Fruity
Breathing	Normal to shallow	Deep, labored
Tongue	Moist	Dry
Vomiting	Absent	Present
Hunger	Present	Absent
Thirst	Absent	Present

An insulin reaction (also called insulin shock) can be caused by too much systemic insulin, the intake of too little food or sugar, or too much physical activity. If the client is conscious, some form of sugar (eg, candy, orange juice) should be provided. If the client is unconscious, glucose may have to be provided intravenously. The client should rest, and all physical activity should be stopped. This condition is not as serious as ketoacidosis, but the client should be given the opportunity to return to a normal state as soon as possible.

Hyperglycemia can develop when a person with diabetes fails to take enough insulin or deviates significantly from a prescribed diet. Ketoacidosis and dehydration occur and can lead to a diabetic coma and eventual death if not treated. This should be considered a medical emergency requiring prompt action, including assistance from qualified personnel. The client should not be given any form of sugar. Usually, an injection of insulin is needed, followed by IV fluids and salt. A nurse or physician should provide care as quickly as possible. Table 9.2 explains how to differentiate the symptoms of hyperglycemia and hypoglycemia.

Respiratory Distress

Dyspnea control postures may be used to reduce breathlessness in clients in respiratory distress. The client must be responsive and must have an unobstructed airway. The high Fowler's position (Fig. 9.6A) may be used for clients in bed. The head of the bed should be in an upright position at a 90-degree angle. If available, a footboard should be used to support the client's feet. The orthopneic position (Fig. 9.6B) may be used for clients who are sitting or standing. In either case the client bends forward slightly at the waist and supports the upper body by leaning the forearms on a table or counter. Pursed-lip breathing (ie, a breathing pattern of inhaling through the nose and slowly exhaling through pursed lips) can help decrease dyspnea and the respiratory rate (see Chapter 44 for additional suggestions).

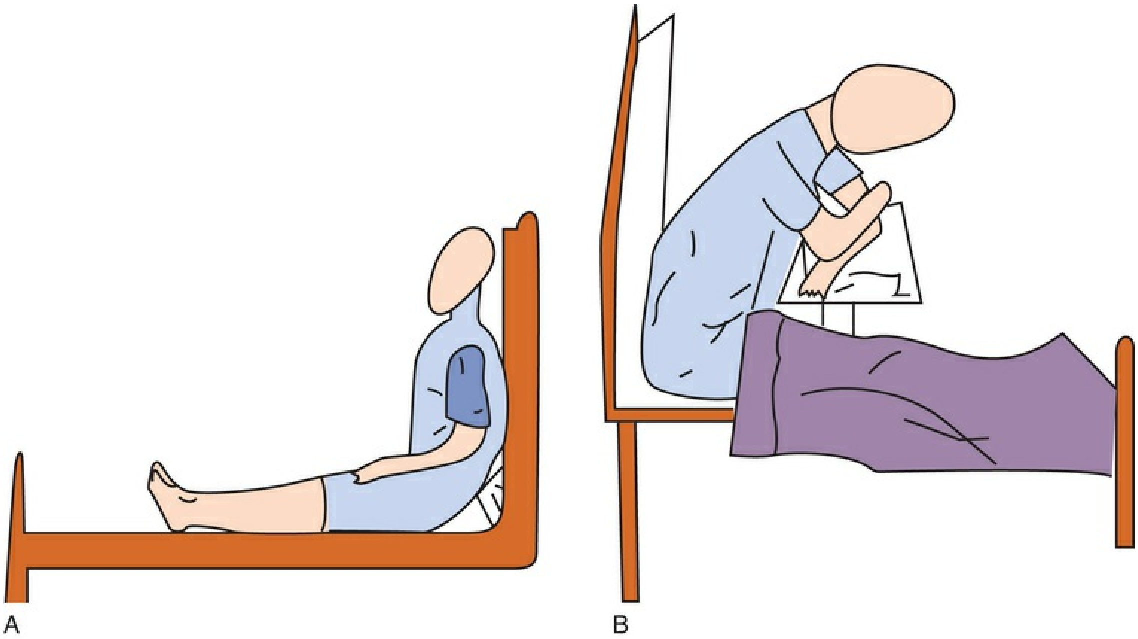

FIG 9.6 A, High Fowler's position. B, Orthopneic position.

Choking and Cardiac Arrest

All healthcare practitioners should be trained to treat clients who are choking or suffering from cardiac arrest. CPR is a series of potentially lifesaving actions that increase an individual's chance of surviving cardiac arrest. CPR certification involves instruction in recognizing a cardiac arrest, activating the emergency response system, performing specific CPR techniques, and using an automatic external defibrillator (AED). In addition, training in recognizing and providing intervention when an individual is choking is provided. In 2010 the American Heart Association introduced new standards for the performance of CPR and emergency cardiovascular care.[3] Previous guidelines comprised three basic steps to CPR: establish the airway; provide mouth-to-mouth resuscitation (breathing); and provide chest compressions—this process became known as the A-B-Cs of emergency treatment. The new guidelines[10] advise initiating chest compressions first, followed by establishing the airway, and then breathing (or C-A-B). Specific certification training courses are offered by both the American Heart Association and the American Red Cross. The following information is presented as a reminder of the basic techniques and is not meant to be substituted for training.

The urgency of choking cannot be overemphasized. Immediate recognition and proper action are essential (Fig. 9.7). When assisting a conscious adult or a child who is older than 1 year, the following steps should be taken:

1. Ask the client, “Are you choking?” If the client can speak or cough effectively, do not interfere with the client's own attempts to expel the object.

2. If the client is unable to speak, cough, or breathe, check the mouth and remove any visible foreign object.

3. If the client is unable to speak or cough, position yourself behind the client. Clasp your hands over the client's abdomen, slightly above the umbilicus but below the diaphragm.

4. Use the closed fist of one hand, covered by your other hand, to give 3 or 4 abrupt thrusts against the person's abdomen by compressing the abdomen in and up forcefully (this technique is also known as the Heimlich maneuver). Continue to apply the thrusts until the obstruction becomes dislodged or is relieved, or the person becomes unconscious. It is no longer recommended that a rescuer perform a finger sweep to remove the object.

5. Seek medical assistance.

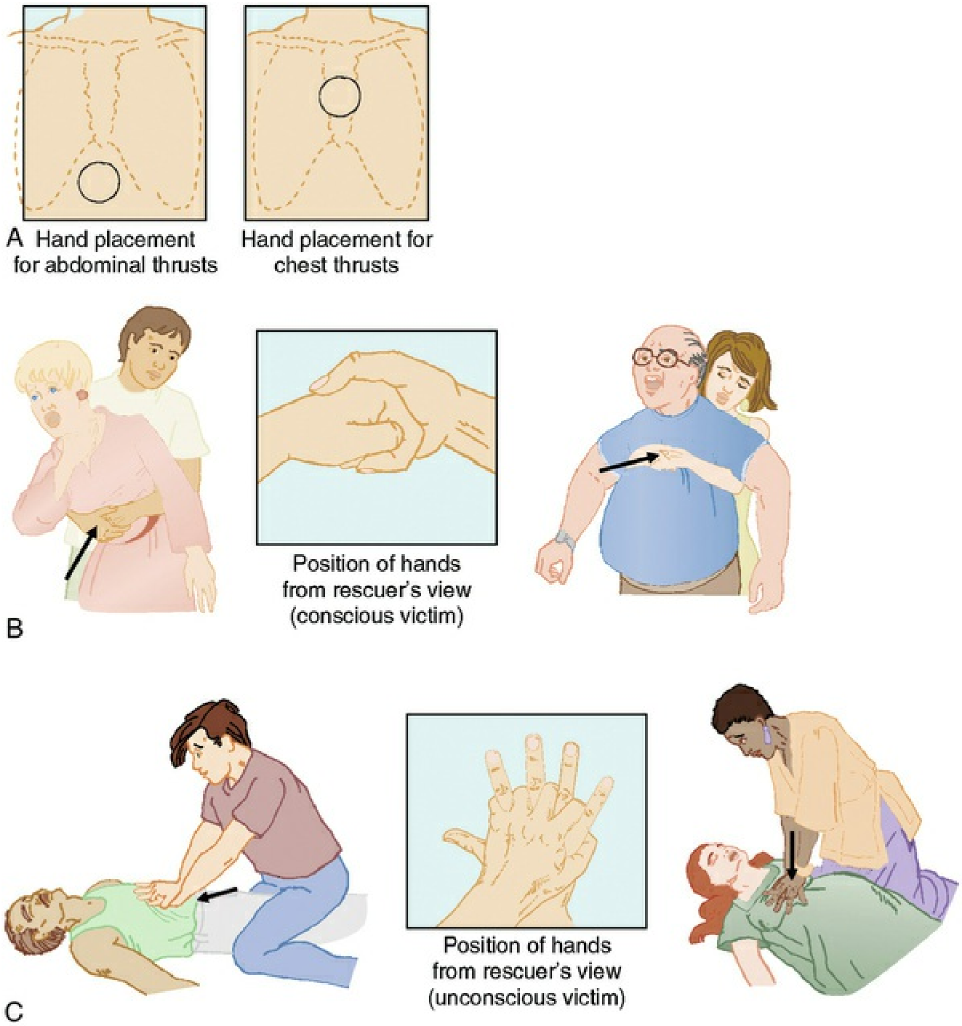

FIG 9.7 Abdominal thrust maneuver (also known as the Heimlich maneuver) used for removal of foreign bodies blocking the upper airway. A, Hand placement. B, Maneuver for conscious victims. C, Maneuver for unconscious victims. (From Black JM, Hawks JH: *Medical-surgical nursing: clinical management for positive outcomes,* ed 8, St Louis, 2009, Saunders.)

When assisting an adult or a child who is older than 1 year who appears to be unconscious, the following steps should be taken:

1. Ensure that it is safe for you to intervene (no hazards or risky environmental conditions).

2. Activate the emergency response system (call for help, or call 911). Get an AED (defibrillator), if available. If two persons are available, one should call for help and get the AED while the other individual initiates CPR.

3. Attempt to awaken or rouse the individual.

4. If the individual is unresponsive, place the person in a supine position on a firm surface. Check for a pulse, limiting the time to do this to no more than 10 seconds.

5. Initiate chest compressions. Kneel next to the client and place the heel of one hand on the inferior portion of the sternum superior to the xiphoid process (approximately in line with the nipples). Put your other hand over your first hand with the fingers interlaced. Position your shoulders directly over the client's sternum, keep your elbows extended, and press down firmly, depressing the sternum at least 2 inches with each compression; avoid excessive depths (greater than 2.4 inches). Relax after each compression, allowing the chest to fully recoil after each compression, but do not remove your hands from the sternum. The relaxation and compression phases should be equal in duration. Compressions should be applied at a rate of 100 to 120 per minute.

6. If you are not trained in CPR, continue to perform only chest compressions until help arrives or the victim awakens (“hands only” CPR).

7. If you are trained in CPR, perform 30 chest compressions, then open the victim's airway using the head-tilt, chin-lift method.

8. Check for respiration by observing the chest or abdomen for movement, listen for sounds of breathing, and feel for breath by placing your cheek close to the person's mouth. If no sign of breath is present, the client is not breathing and you should initiate breathing techniques.

9. Pinch the client's nose closed and maintain the head tilt to open the airway. Place your mouth over the client's mouth and form a seal with your lips. Perform two full breaths. Your breaths should be strong enough to make the victim's chest rise. Some persons prefer to place a clean cloth over the client's lips before initiating mouth-to-mouth respirations. If available, a plastic CPR device can be used to decrease contact between the caregiver's mouth and the client's mouth and any saliva or vomitus.

10. Evaluate for circulation by palpating the carotid artery for a pulse. Sometimes it can be difficult to locate a pulse, so also observe the client for signs of life—breathing, movement, consciousness. If no pulse or signs of consciousness are noted, you must return to performing external chest compressions.

11. If you are performing CPR procedures without assistance, you should repeat 30 chest compressions, followed by 2 breaths. Continue this sequence (30 compressions/2 rescue breaths) until qualified help arrives, the victim shows obvious signs of life (eg, moving or breathing), or you are physically unable to continue. Limit the interruption of chest compressions to less than 10 seconds. In all instances the client will require hospitalization and evaluation by a physician.

12. If you have access to an AED, continue to perform CPR until you can attach the chest pads and turn on the machine. If you are alone and you observed the victim collapse, put the AED on immediately. If you did not observe the collapse, attach the AED after approximately 1 minute of CPR. The AED will analyze the victim's heart for rhythm and will provide a shock if necessary. The AED provides auditory instructions for operation. After placement of the chest pads, it will analyze the victim's heart for rhythm and will direct the rescuer to provide a shock or to continue CPR.

Note: Extreme care must be taken when attempting to open the airway of a person who may have experienced a cervical spine injury. In such cases use the chin lift, but avoid the head tilt. If the technique does not open the airway, the head should be tilted slowly and gently until the airway is open.

As mentioned, these procedures are appropriate to use for adults and for children 1 year of age or older. CPR is contraindicated if clients have clearly expressed their desire for “do not resuscitate” (DNR). This information should be clearly documented in the medical chart. A pamphlet or booklet containing diagrams and instructions for CPR techniques can be obtained from most local offices of the American Heart Association or from a variety of websites.

Summary

All OT personnel have a legal and professional obligation to promote safety for self, the client, visitors, and others. The OT should be prepared to react to emergency situations quickly, decisively, and calmly. The consistent use of safe practices helps reduce accidents for both clients and workers and reduces the length and cost of treatment.

Threaded Case Study

Donna, Part 2

To adequately prepare the OT clinic as a safe environment for clients and staff, clear policies and procedures pertaining to client safety, medical emergencies, infection control, and precautions with special equipment need to be developed and implemented. In the case study presented at the beginning of this chapter, Donna, the director of OT Services, is responsible for developing such policies and procedures. It should be mandatory for all OT personnel to become certified in CPR and first aid. Employee manuals can be produced that orient staff to general safety procedures and infection control standards. Furthermore, in-service education should be developed for newly hired personnel that familiarizes them with the types of specialized medical equipment that OT personnel are likely to encounter in their interventions with clients.

Many resources are available that can assist Donna in establishing these policies and procedures. The Centers for Disease Control and Prevention (*http://www.cdc.gov*), the Occupational Safety and Health Administration (*http://www.OSHA.gov*), and the National Institutes of Health (*http://www.NIH.gov*) are government organizations that provide up-to-date information pertaining to health standards, infection control, medical research, and workplace safety. Information on first aid, choking, and CPR can be obtained from most local offices of the American Heart Association and from the American National Red Cross. In addition, information on emergency procedures may be found on a variety of websites.

Review Questions

1. Why is it important to teach the client and significant others guidelines for handling various emergency situations?
2. Describe at least four behaviors that you can adopt to improve client safety.
3. Why is it important to review a client's chart before initiating an intervention?
4. What types of activities are appropriate when providing an intervention to a client who is ventilator dependent? What precautions must be taken during such activities?
5. Define the following: IV line, A line, NG tube, TPN or hyperalimentation, and catheter.
6. Describe Standard Precautions.
7. Why is it important to follow Standard Precautions with all clients?
8. Demonstrate the proper technique for hand washing.
9. How should you respond to a client emergency?
10. Distinguish between an insulin reaction and ketoacidosis (diabetic coma). What is the appropriate medical intervention for each condition?
11. Describe how you would help a client who is falling forward and one who is falling backward.
12. Which emergency situations might require getting advanced medical assistance, and which situations could a therapist handle alone?

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PART III

Occupational Performance and the Performance Areas: Evaluation and Intervention

OUTLINE

10

Activities of Daily Living

Jean S. Koketsu [a]

CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Describe activities of daily living (ADLs) and instrumental activities of daily living (IADLs), and explain how ADLs and IADLs relate to the current Occupational Therapy Practice Framework (OTPF-3).
2. Explain why it is important to consider the cultural, personal, temporal, and virtual contexts when performing ADL and IADL assessments and training. Give examples of specific cultural, personal, temporal, and virtual contexts that an individual, a community, or a population may have that can affect ADLs and IADLs.
3. Describe a client-centered approach to evaluation, and explain why it is an important consideration in ADL and IADL training.
4. Explain the general procedures for ADL and IADL assessments.
5. Explain how to record levels of independence and summarize the results of an ADL/IADL evaluation.
6. Explain the purpose of performing a home evaluation and when it may be indicated.
7. Give at least five examples of client factors that may have limitations that can affect performance in occupations and how each can affect an ADL and IADL (eg, if someone has shoulder range of motion limitations, he or she may have difficulty putting on a shirt [ADL] and reaching for object on a shelf when cooking a meal [IADL]).
8. Give examples of how difficulties in performance skills (motor and praxis skills, sensory-perceptual skills, emotional regulation skills, cognitive skills, and communication and social skills) can affect specific ADL and IADL abilities.
9. Discuss considerations for selecting adaptive equipment for performance of ADLs and IADLs. Describe at least five pieces of adaptive equipment that may be used to increase independence and the conditions for which each device may be indicated.
10. Describe, perform, and teach specific ADL techniques for individuals with limited range of motion (ROM) and strength, incoordination, paraplegia, tetraplegia, low vision, and for the exceptionally large client.

KEY TERMS

Activities of daily living (ADLs)
Adaptive equipment and techniques
Client-centered approach

Home evaluation

Instrumental activities of daily living (IADLs)

Threaded Case Study

Anna, Part 1

Anna is a 29-year-old woman who has been diagnosed with a T4 spinal cord injury (SCI) from a car accident. She has complete sensory and motor loss below the level of injury. She is currently in an inpatient rehabilitation program. Prior to her injury, Anna lived in a recently purchased house with two bedrooms and one bathroom with her husband and 2-year-old daughter. In addition to caring for her daughter, Anna spent much of her time performing household chores, such as cooking, laundry, and grocery shopping. Anna also took care of her family's finances and enjoyed leading a Bible study group with her friends. Anna dropped their daughter off at a daycare center while she worked part-time as a bookkeeper at her church. Her husband picked up their daughter after spending a full day at his job as an auto mechanic. The family depended on Anna's part-time income to pay some of the bills. Anna's mother, Martha, has been caring for her granddaughter since Anna's accident. Martha agreed to temporarily live with Anna and her husband and granddaughter after Anna's discharge home until Anna can independently take care of her child.

Anna currently requires minimal assistance with basic transfers, bed mobility, and lower body dressing because of decreased endurance, pain in her back, and decreased trunk control. She requires minimal assistance with verbal cues for proper techniques for weight shifts in her wheelchair and skin checks to ensure skin integrity. Anna reports that she has been overwhelmed with all the new things she has had to learn. She requires moderate assistance with bowel and bladder care and showering/bathing tasks. She is independent with wheelchair mobility on indoor flat surfaces but requires standby assistance to propel in tight areas and corners and while propelling up ramps because of fatigue, decreased trunk control, and reduced upper body strength. She is independent with seated-level activities, such as hygiene and grooming at the sink and light kitchen tasks in the rehabilitation unit's kitchen.

Anna and her husband are concerned about the amount of assistance she may require when Anna is discharged from the rehabilitation program. They want to eventually grow their family and have concerns about sexual functioning, intimacy, and fertility. Their home is also not wheelchair accessible. Although they appreciate Martha and her offer to live with them after Anna's discharge home from the hospital, they hope that Martha does not have to live with them long term.

Anna wants to be independent in taking care of herself, her daughter, her household, and her husband. She wants to drive again, return to her Bible study classes, and resume her part-time job. She is not sure how she can resume the occupations she considers important to fulfilling her roles as a wife, mother, homemaker, worker, and active community member.

Critical Thinking Questions

1. What ADL and IADL tasks will Anna need to master in order to be more independent and to return home safely with her family?

2. What is the role of occupational therapy in helping Anna to return home safely and to eventually reach her goals of independence?

3. With all the occupational performance areas that need to be addressed, how can an occupational therapist prioritize which areas to address?

The American Occupational Therapy Association (AOTA), the U.S. national professional organization for occupational therapy practitioners, presents its current intervention guidelines in the "Occupational Therapy Practice Framework: Domain and Process," third edition (OTPF-3), an official document intended for both internal and external audiences.[6] This chapter describes both the aspects of the domain and the process of occupational therapy (OT) in regard to activities of daily living (ADLs) and instrumental activities of daily living (IADLs). It also focuses on specific intervention strategies for assisting clients to optimize occupational functioning.

According to the OTPF-3, ADLs and IADLs are considered two of eight broad categories of occupation in which clients engage.[6] ADLs and IADLs include, but are not limited to, routine tasks of personal care, functional mobility, communication, home management, and community mobility.[6,24] Evaluation and training in the performance of these important life tasks have long been important aspects of OT programs in virtually every type of health and wellness practice area. Loss of ability to care for personal needs and to manage the environment can result in loss of self-esteem and a deep sense of dependence. Family roles are also disrupted because partners are frequently required to assume the function of caregiver when one loses the ability to perform ADLs or IADLs independently.

In the broadest sense, service delivery in the areas of occupation begins with the occupational therapist (OT) receiving a referral for service, performing an evaluation, forming and instituting an intervention plan, and assessing the outcome of the process. The OT practitioner and client collaborate to identify which areas of occupation, such as ADLs and IADLs, the client wants or needs to participate in to optimize health and wellness. The need to learn new methods, use assistive devices to perform daily tasks, or modify the environment may be temporary or permanent, depending on the particular dysfunction, the environment, the prognosis for recovery, and a multitude of other factors.

Definitions of Activities of Daily Living (ADLs) and Instrumental Activities of Daily Living (IADLs)

Daily living activities can be separated into two areas: **activities of daily living (ADLs)** (also called personal activities of daily living [PADLs] and basic activities of daily living [BADLs]) and **instrumental activities of daily living (IADLs)**. ADLs require basic skills and focus on activities involved in taking care of one's own body. ADLs include self-care tasks such as bathing and showering, toileting and toilet hygiene, dressing, eating (or swallowing), feeding, functional mobility (eg, transfers and bed mobility), sexual activity, and care of personal devices such as hearing aids, orthotics, glasses, and **adaptive equipment**.[6]

IADLs require a more advanced level of skills in all performance areas. IADLs generally require use of executive functions,[41] social skills, and more complex environmental interactions than ADLs. IADL tasks include care of others and of pets, childrearing, communication management, community mobility (eg, driving and use of public transportation), and financial management; Anna, the client in our case study, has reported most of these as areas to be addressed. Other IADLs include the category of health management and maintenance, such as Anna performing regular weight shifts to maintain good skin integrity while up in the wheelchair and remembering her therapy appointments. Home establishment and management, a category that includes housecleaning and meal preparation and cleanup, are two other IADLs that Anna was responsible for in her home. Religious observance occupations (eg, Anna's ability to lead and participate in her Bible study), safety and emergency maintenance (eg, Anna's ability to appropriately notify authorities in case of emergencies), and shopping are other important IADLs (Box 10.1).

Box 10.1

OTPF-3 Categories for ADLs and IADLs

Activities of Daily Living (ADLs)

- Bathing and showering
- Toileting and toilet hygiene
- Dressing
- Swallowing/eating
- Feeding
- Functional mobility
- Personal device care
- Personal hygiene and grooming
- Sexual activity

Instrumental Activities of Daily Living (IADLs)

- Care of others (including choosing and selecting caregivers)
- Care of pets
- Childrearing
- Communication management
- Driving and community mobility

- Financial management
- Health management and maintenance
- Home establishment and management
- Meal preparation and cleanup
- Religious and spiritual activities and expression
- Safety and emergency maintenance
- Shopping

For a more detailed list, please refer to the OTPF-3.

Considerations in ADL and IADL Occupational Analysis and Training

The overall goal of any ADL and IADL training program is for the client and family to learn to adapt to life changes or situations and to participate as fully as possible in occupations that are meaningful. The following sections present important areas the OT must consider when analyzing ADLs and IADLs. Each area is defined in relation to an ADL or IADL evaluation and intervention plan.

Definition of "Client"

According to the OTPF-3, the term *clients* refers to persons, groups, and populations who receive OT services.[6] "Persons" include the actual person receiving services (eg, Anna) and those involved in the client's care (eg, Anna's husband and immediate family). "Groups" refers to collectives of individuals (eg, Anna's church community) who may receive general consultation or referral by an OT on accessibility. "Populations" refers to larger collectives of people who live in similar locales, such as cities or states, or who share similar concerns; for example, refugees, survivors of particular natural or manmade disasters, or people with paraplegia who live in the United States, such as Anna. Most of the intervention strategies in this chapter relate to providing such intervention to persons or individuals as clients (eg, Anna), although it is acknowledged that OTs also provide services to groups and populations in the areas of ADLs and IADLs.

Client Factors

Client factors are specific abilities, characteristics, or beliefs that reside within the client to influence performance in occupations.[6] One general category of client factors is values, beliefs, and spirituality. Does Anna's belief in her potential to improve or her ideas about her purpose in life influence her performance? OT practitioners' comfort level with the topic and self-reflection in the area may help them be more client centered and may enhance their therapeutic use of self with a client such as Anna.[92] Other general categories include body functions and structures (Box 10.2). Does Anna have the strength, range of motion (ROM), coordination, sensation, balance, and cognitive functions to participate in occupations? How is Anna coping emotionally?

Box 10.2

Client Factors

Examples of Values, Beliefs, and Spirituality

Values: Honesty, fairness, equality, and commitment

Beliefs (thoughts held as true): "Practice makes perfect"; trials are punishment for previous wrongs

Spirituality: Purpose and meaning of life

Examples of Body Functions

- *Specific mental functions (affective, cognitive, perceptual):* Emotional regulation, anxiety, executive functions (eg, organization and time management), attention, memory, and discrimination of sensation
- *Global mental functions:* Alertness, orientation to person, temperament/personality, energy, and quality of sleep
- *Sensory functions:* Vision, hearing, vestibular (perception of body position and movement), taste, smell, proprioception, touch, pain, temperature, pressure

- *Neuromusculoskeletal and movement-related functions:* Joint mobility and stability, muscle strength/tone/endurance, reflexes, involuntary/voluntary control (eg, coordination, fine motor control, and eye movement), gait patterns
- *Cardiovascular, hematological, immunological, and respiratory functions:* Blood pressure, heart rate, respiratory rate/rhythm/depth, physical endurance, stamina, wound healing capacity, bruising tendencies[a]
- *Voice and speech functions:* Fluency of speech, rate of speech, volume-audibility[a]
- *Digestive, metabolic, and endocrine functions:* Effect on bowel movements, continence, rate of healing, hormonal imbalance[a]
- *Genitourinary and reproductive functions:* Continence, ability to have intercourse or children[a]
- *Skin and related structures functions:* Wound healing, protection of the skin, nail care, and awareness of abnormalities[a]

Body Structures[a]

- Includes structures of the nervous system, eyes, ears, voice/speech/swallow structures, cardiovascular, immunological, endocrine, genitourinary, reproductive, movement, skin and related structures

[a]OT practitioners must be knowledgeable about these functions and structures as they relate to occupations, which include ADLs and IADLs, the focus of this chapter.

For a more detailed list, please refer to the OTPF-3.

Client factors can be assessed to determine the potential for remediation and restoration or the possible need for adaptive equipment or other modifications. In Anna's case, it would be important to know whether the spinal cord injury is complete and whether she has potential for muscle return to determine an appropriate approach to treatment. Cardiovascular system functioning is another area of pertinence. Is Anna's blood pressure stable enough for her to perform ADLs, or does she have orthostatic hypotension? Anna's cognitive functions (eg, memory, attention, and problem solving) are also important to assess in relation to ADLs and IADLs. Performance of ADLs and IADLs are occupations in which clients are directly confronted with what they can and cannot do as they had done previously; therefore, it is important to be alert to emotional functioning. The OT questions, “Is Anna requiring cues to perform her weight shifts and skin checks because she has a memory deficit? Or is she having difficulty learning new techniques and strategies because of issues surrounding coping with the disability?” Specific assessments to identify and measure client factors contribute information that influences ADL and IADL performance.

Sleep and Rest

Adequate sleep and rest are essential to optimal functioning in occupations for all people but particularly for clients in the hospital setting or those who are medically or otherwise compromised (see Chapter 13). Individuals who are hospitalized are particularly at risk of poor sleep, which can affect how a client (eg, Anna) may function while in an inpatient rehabilitation unit. As cited in Young et al.,[100] research has shown that approximately 50% of individuals admitted to general medical units complain of sleep disruption.[35,57] Young et al.[100] found that 50% to 70% of people with chronic pain complained of poor sleep, which suggested poorer pain tolerance. A prospective study on sleep-related breathing disorder (SRBD) and rehabilitation outcomes of stroke patients showed poorer functional recovery rates during a hospital rehabilitation stay.[26] Research has shown that electronic alerting sounds, staff conversations, and voice paging can be particularly disruptive to sleep while a client is in the hospital.[19] Researchers posit that sleep disturbance may be a modifiable predictor of rehabilitation outcomes and suggest that improving sleep/wake patterns during rehabilitation may result in better functional recovery among older adults.[1] Education in good sleep hygiene, optimal sleep/wake patterns, and advocacy for optimal sleep environments in hospital settings can go far to help clients such as Anna, who are treated by OTs in that setting. An OT working with Anna can expect better outcomes from interventions for ADLs and IADLs if she gets adequate sleep and rest.

Performance Skills

The OTPF-3 describes performance skills as "goal directed actions that are observable as small units of engagement in daily life occupations."[6] These skills include motor-praxis, sensory-perceptual, emotional regulation, cognitive, communication, and social skills. Whereas client factors reside within a person, performance skills are observable and demonstrable. Examples of a motor-praxis skill for IADLs may be Anna's ability to reach and bend down to retrieve a pot from a low cupboard or to maintain balance while performing the ADL of transferring to a low, soft surface. A client with difficulty in sensory-perceptual skills may have difficulty with the ADL of dressing to properly orient his T-shirt. A client who has difficulty with the cognitive skill of sequencing the steps of a task may have difficulty taking a shower. Should he turn on the water first or transfer into the shower first? Should he start drying himself off first or rinse the soap off first?

Performance Patterns

Habits, routines, roles, and rituals are all performance patterns according to the OTPF-3.[6] All can be helpful or detrimental to occupational performance. The OTPF-3 describes habits as "specific, automatic behaviors that can be useful, dominating, or impoverished" (OTPF-3, p. S8).[6] An example of an ADL habit may be automatically placing a napkin on one's lap before starting to eat or placing the right leg into pant legs first, then the left leg.

Routines are "established sequences of occupations or activities that provide a structure for daily life" (OTPF-3, p. S8).[6] An example of a routine ADL may be Anna's routine of waking up at the same time every day and completing the sequence of toileting, showering, dressing, hygiene and grooming, and eating breakfast on a regular basis. Her ADL routine may have to be drastically altered for her to accommodate additional ADL tasks that she previously never had to perform, such as skin checks and weight shifts to accommodate her diagnosis of C6 quadriplegia/tetraplegia and the resulting high risk for pressure ulcers.[37] Anna's IADL routine may have been to help her daughter get ready for the day by completing such activities as changing her diaper, getting her dressed and cleaned, making her breakfast, packing her lunch, and driving her to daycare.

Roles are "expected by society, shaped by culture and context; they may be further conceptualized and defined by a client" (OTPF-3, p. S8).[6] Examples of roles might include the husband of a wife with severe rheumatoid arthritis or a college student who lives independently in an apartment with a roommate. Important roles for Anna are those of wife, mother, daughter, worker, and Bible study leader.

Rituals are "symbolic actions with spiritual, cultural, or social meaning."[6] The rituals may reinforce values and beliefs.[6] Examples of rituals that are in the realm of ADLs and IADLs include praying or saying grace before every meal or celebrating particular holidays with foods served only on that date that have special cultural meanings.

Understanding performance patterns, including habits, routines, roles, and rituals, allows the OT practitioner to identify performance deficits, determine priorities in goal setting, and help the client reestablish continuity in daily living. For example, with her new functional status, Anna may not be able to perform all the previous morning IADL routines with her daughter. She may have to establish new routines with her daughter and learn to perform those activities differently. Or others, at least in the early stages, may have to assume responsibility for those tasks. Anna may need to redefine her own expectations to perform activities that she currently sees as her role in the family, an important undertaking for an OT to help facilitate.

Environment and Context

The OTPF-3 explains that occupations occur in social and physical environments within a context and that the terms *environment* and *context* may be used interchangeably in the literature (OTPF-3, p. S8).[6] A physical environment includes the natural and the built environment and the objects in them. A few of the external environments for Anna are her home and its contents, her place of work, and her church. The social environment includes the client's relationships with persons, groups, and populations. Anna's social environment includes her husband, daughter, parents, coworkers, and friends. Given Anna's circumstances, questions abound, such as who will be her primary caregiver when she goes home, her mother or her husband? How long will Anna's mother live with her family? How will Anna return to work and community activities? Can Anna's family home be modified? Will Anna be alone at home at times? Will she continue to maintain her current social network of friends, or will she also need to develop others? The answers to the questions about the physical and social environments strongly influence the treatment priorities.

Cultural, Personal, Temporal, and Virtual Contexts

Although the terms *context* and *environment* have been used interchangeably in the literature they are defined separately in the OTPF-3, which considers them to be interrelated (OTPF-3, p. S9).[6] Context can refer to situations or conditions within and around the client. The OTPF-3 describes context as cultural, personal, temporal, and virtual.

A cultural context includes "customs, beliefs, activity patterns, behavioral standards, and expectations accepted by the society" (p. 59) in which one is a member.[6] Cultures can differ vastly in terms of ADLs and IADLs. For example, one culture may view bathing as a private event, whereas another may consider it a communal event.

Cultural context is also important to consider in understanding differences in how independence is defined and valued. The AOTA position paper on the construct of independence supports the view that independence is "defined by the individual's culture, values, support systems, and ability to direct his or her life."[44] A thorough evaluation allows the OT practitioner to understand what activities are critical to each client; this aids the OT in reestablishing the client's sense of directing his or her own life. An example of differing cultural values frequently occurs when an OT raised in a more Westernized culture considers it important to foster independence in ADLs and IADLs, but a client from a different cultural view may not see independence in ADL tasks as highly valued. The OT practitioner may unfairly label the client as unmotivated. For the individual whose culture does not value ADL or IADL independence, the OT may focus primarily on teaching the client and family to adapt. The focus would be on family training and identifying the activities of highest value to the client and family.

Personal context includes a person's demographic features, such as age, gender, and educational level, which also need to be considered in ADLs and IADLs. The ADL and IADL tasks and routines may differ based on any one of many demographic factors. For example, a young adult woman may consider it important to regain the ability to shave her legs, whereas an elderly woman may not. *Temporal context* includes contexts that refer to time, such as time of year, time of day, or stages of life. An example of how temporal context can be important in ADLs is determining when certain tasks, such as dressing and eating a meal, occur during the day. *Virtual context* refers to interactions in "simulated, real-time, or near-time situations absent of physical contact" (OTPF-3, p. S9).[6] An example of virtual context for Anna is her ability to use technology, such as an alarm on her smart phone, to cue her to do her weight shifts to protect her skin or to perform other occupations, such as staying connected with friends. Others who have no use of their hands may use voice-activated features on devices to cue them to carry out daily routines.

A multitude of software applications ("apps") are now available and downloadable on mobile devices that can help people fulfill a particular purpose, such as keeping track of exercise regimens. The AOTA has a frequently updated list of apps that OTs may find useful in their practice or that can be used by clients (eg, Apps for Rehabilitation, Disability, Participation).[9] The pervasive use of technology requires OTs to be aware of the significance of virtual context for clients.

Finances

Financial resources available for potential expenses, such as assistant care, special equipment, and home modifications, are another important consideration for ADL and IADL performance. For example, consider a client who is a new full-time wheelchair user and who can no longer stand to take showers, thus requiring significant assistance from a caregiver to perform the task. If the client has unlimited financial resources; owns his or her home; has an able-bodied, committed caregiver; wants to take showers daily; and is eager to fully remodel the home for accessibility, an OT experienced in home modifications may recommend a fully remodeled bathroom by a licensed contractor. Anna has fewer financial resources, but she has reliable caregivers, and she and her husband own their home. She also wants to shower regularly. In Anna's case, an OT may make recommendations for less costly modifications, such as removing the sliding glass door from the bathtub/shower and replacing it with a shower curtain, and obtaining a bath bench and other equipment.

Occupational Justice

The term *occupational justice* was coined by Townsend in 2003 (OTPF-2, p. 630).[3] According to the OTPF-3, the term describes the OT profession's concerns with the ability of all people, “regardless of age, ability, gender, social class or other differences,”[62] to be given the opportunity to engage in occupations, including the ADLs and IADLs that are important to them. Many times occupational therapists are the first to recognize the disparity in abilities to meet occupational needs because of social, economic, and other factors. Occupational therapists can assist in supporting social policies, actions, and laws that allow all people to engage in occupations that are important to them.[6]

An example of applying this principle of occupational justice to the most basic of ADLs involves Anna's roommate in the inpatient rehabilitation unit, who does not have the resources to bring in clothes to practice dressing skills. The only clothes Anna's roommate had were destroyed in the accident that brought her into the hospital. Anna's roommate has only her hospital-issued gown and pants to practice dressing skills. On a small scale the OT can help equalize this disparity by working with social services to allow Anna's roommate access to clothes she can use so as to increase her independence in this important ADL. A common situation for an OT is a client who needs a piece of adaptive equipment, such as a transfer bath bench, that is neither covered by insurance nor within the client's ability to purchase. Creative, compassionate, and resourceful OTs can help bridge this disparity and thus help all clients participate in ADLs and IADLs that are important to them.

Evaluation of ADLs and IADLs

According to the OTPF-3, occupational therapy's overarching goal for both the domain and the process is "achieving health, well-being, and participation in life through engagement in occupation."[6] A comprehensive evaluation of occupational performance involves collaborating with the client to determine what he or she wants and needs to do to support health and participation.[6] According to the OTPF-3, occupations include ADLs, IADLs, rest and sleep, education, work, play, leisure, and social participation. A comprehensive evaluation includes a thorough occupational profile and an analysis of occupational performance, including assessing client factors, performance skills, performance patterns, the physical and social environment, and the client's contextual framework.[6]

As outlined by the OTPF-3, the process of delivering OT services to a client occurs by means of evaluation, intervention, and targeted outcomes. The process may seem linear but is actually dynamic, allowing the OT practitioner to continually assess the progress toward reaching goals.[6]

In a **client-centered approach**, the therapist collaborates with the client or the family/caregivers, centering the OT process on the client's priorities and fostering an active participation in moving toward the outcome. Evaluation consists of initially creating an occupational profile and analyzing occupational performance. An occupational profile describes the client's occupational history, patterns of daily living, interests, values, and needs.[6]

General Procedure

The focus of the OT evaluation is to discover what occupations are important for the client, to determine what a client can do, and to identify barriers, problems, and supports that affect the client's participation in those occupations.[6] The type of client information and data collected differs, based on the client's needs, the practice setting, and the frame of reference or practice models of the OT.[6] This textbook focuses on OTs who treat adults with physical dysfunction; therefore, the general procedure described highlight areas that may be targeted in assessing that group.

The initial interview may serve as a screening device to help determine the need for further assessment or treatment. The therapist makes a determination of further need for assessment and OT intervention based on knowledge of the client, the dysfunction, and previous assessments. Not all clients who receive an OT referral will need intervention. However, the interview alone can lead to inaccurate assumptions about actual performance. Clients may overestimate or underestimate their abilities or may not understand the timelines for which they are being asked. Instead of just an interview, observation of actual performance of ADLs is invaluable in assessing the client's status.

Clinical assessment of relevant client factors, such as ROM, strength, sensation, and cognition, may occur prior to the actual observations of ADLs or IADLs. In any physical disabilities settings, particularly in the hospital setting, or after any new surgery or procedure, it is essential that OTs educate themselves about any medical precautions or contraindications by reading the medical chart or consulting with the medical staff. For example, the physician may still have bed-rest orders in place; a neck brace may be required before any out-of-bed activities; an extremity may have non-weight-bearing precautions; active range of motion to a joint may not be allowed; or a person may not be allowed to shower.

When the OT first met Anna shortly after her admission, she may have been seen in the intensive care unit (ICU), or she may have been on bed rest and awaiting surgery or some type of stabilization of her spine. The OT at that point may have interviewed Anna, gotten some background and her occupational history, and assessed her upper body ROM and also sensation. The OT would have gleaned information about Anna's cognition and emotional status based on those brief assessments: Is she alert, oriented (person, place, time)? Can she follow directions? Can she recall what she had for breakfast that morning? Does she initiate asking for help?

Ideally, the OT assesses the performance of activities in the environment and context in which they usually take place.[10] For example, a dressing assessment could be arranged early in the morning in the treatment facility, when the client is dressed by nursing personnel, or in the client's home. A self-feeding assessment should occur at regular meal hours. If this timing is not possible, the assessment may be conducted during regular treatment sessions in the OT clinic under simulated conditions. Requiring the client to perform routine self-maintenance tasks at irregular times in an artificial environment may contribute to a lack of carryover, especially for clients who have difficulty generalizing learning, or it may cause confusion in clients with cognitive impairment.

The therapist should initially select relatively simple and safe tasks from the ADL and IADL checklist/assessment form and then progress to more difficult and complex items. For example, with Anna, transfer training would likely start with transfers from her wheelchair to her bed and then progress to commode transfers, which are more difficult. Tasks that would be unsafe or that obviously cannot be performed should be omitted and the appropriate notation made on the assessment form.

During the performance analysis, the therapist should observe the methods the client uses or attempts to use to accomplish the task and try to determine the causes of performance problems. Common causes include weakness, spasticity, involuntary motion, perceptual deficits, cognitive deficits, and low endurance. If problems and their causes can be identified, the therapist has a good foundation for establishing training objectives, priorities, methods, and the need for assistive devices.

Other important aspects of this analysis that should not be overlooked are the client's need for privacy and dignity in the performance of personal ADLs and the OT's questions about them. The client's feelings and cultural attitudes about having his or her body viewed, discussed, and touched should be respected. With safety in mind, privacy should be maintained for performance of basic ADLs such as toileting, grooming, bathing, and dressing tasks. For example, even if the OT needs to be an arm's length away (or closer) for safety while assessing a private ADL, dignity and a semblance of “privacy” could be provided by the therapist turning his or her gaze away, by closing the curtains, by making sure nobody else can see or hear the discussion, or by placing a small towel in a strategic location. Attempts by the therapist to honor a client's privacy as best able are usually highly appreciated and can go far to build trust in the development of the therapeutic relationship. Even if the therapeutic relationship between the primary occupational therapist and client may be good, situations may arise in which it may be necessary to change therapists when more private ADLs are practiced. For example, Anna may be fine with working with a male OT during cooking tasks but may prefer a female OT when performing showering and dressing tasks or when questions arise about sexual function or fertility. As the therapist interacts with the client during the performance of daily living tasks, it may be possible to elicit the client's attitudes and feelings about the particular tasks, priorities in training, dependence and independence, and cultural, family, and personal values and customs regarding performance of ADLs.

Performance of ADLs and IADLs

An occupational performance analysis of ADLs and IADLs may include using a checklist as a guide for questioning and selecting specific activities to perform, as identified during the interview for the occupational profile. For example, in Anna's case the OT may select lower extremity dressing and basic transfers as two key activities to have Anna perform. The OT can then determine strategies to promote independence and provide caregiver instruction regarding how to provide Anna with the appropriate level of assistance.

Many types of ADL and IADL checklists and standardized tests are available. They cover similar categories and performance tasks. The use of a standardized test ensures a more objective assessment and provides a standard means of measurement. A standardized assessment tool can be used at a later time for reevaluation, and some assessments allow for comparison to a norm group. Both Asher[12] and Letts et al.[51] have developed resources on assessments that can be used for selecting appropriate tools for evaluation. The OT should review the literature periodically to learn about new assessments developed by occupational therapists and about those that have been developed as interdisciplinary assessments. One example is the internationally recognized Assessment of Motor and Process Skills (AMPS), an OT-focused assessment of the quality of a person's ADL performance.[29-32,58] Another interdisciplinary assessment is the Functional Independence Measure (FIM).[29,84]

Recording the Results of the ADL Assessment

During the interview and performance analysis, the therapist makes appropriate notations on the checklists. If a standardized assessment is used, the standard terminology identified for that assessment is used to describe or measure performance. Nonstandardized tests may include separate checklists for self-care, home management, mobility, and home environment assessments. When describing levels of independence, OTs often use terms such as *maximum, moderate,* and *minimal assistance.* These quantitative terms have little meaning to healthcare professionals unless they are clearly defined. It also should be specified whether the level of independence refers to a single activity, a category of activities (eg, dressing), or all ADLs. The following general categories and their definitions are suggested.

1. **Independent.** Client can independently perform the activity without cueing, supervision, or assistance, with or without assistive devices, at normal or near normal speeds. Task is completed safely. If the client requires assistive devices or performs the activity at a slower than customary speed, the term *modified independence* may be used.

2. **Supervised.** Client requires general supervision (not hands on) and may require a verbal cue for safety. The OT feels comfortable being greater than an arm's length away at all times.

3. **Standby assistance (SBA)/contact guard assistance (CGA).** Client requires caregiver or someone to provide hands-on guarding to perform a task safely. *Note:* OTs may tend to use the term standby assistance, whereas other disciplines may use contact guard assistance.

4. **Minimal assistance.** Client requires 25% physical or verbal assistance of one person to complete a task safely. (Client performs 75% or more of the task.)

5. **Moderate assistance.** Client requires 50% physical or verbal assistance of one person to complete a task safely. (Client performs 50% to 74% of the task.)

6. **Maximal assistance.** Client requires physical or verbal assistance for 51% to 75% of an activity by one person. (Client performs 25% to 49% of the task.) The helper is doing more than half the work or task, while client is performing less than half.

7. **Dependent.** Client requires more than 75% physical or verbal assistance. Client does less than 25% of the task. For example, she or he can perform only one or two steps of the activity or very few steps of the activity.

These definitions are broad and general, and they can be modified to suit the approach of the particular treatment setting.

As stated previously, the AOTA published a position paper on a definition of *independence* that differs from the relatively narrow definition noted earlier. Hinojosa stated, "Independence is a self-directed state of being characterized by an individual's ability to participate in necessary and preferred occupations in a satisfying manner, *irrespective of the amount or kind of external assistance desired or required.*"[44] This means that an individual's independence is not related to whether an individual performs the activity or not or in a modified fashion or with assistance. Information from the ADL assessment is summarized succinctly for inclusion in the client's permanent record so that other professionals involved in the care of the client can refer to it. Fig. 10.1 presents two forms related to the sample case study for Mrs. Hayes, a 79-year-old woman who had had a cerebrovascular accident (CVA). Two evaluation forms are provided to illustrate Mrs. Hayes's progress: a detailed ADL assessment form (Fig. 10.1A), and an abbreviated ADL form (Fig. 10.1B). The detailed form with Mrs. Hayes's information incorporated into it will help the novice OT practitioner appreciate the details of many ADLs and IADLs that may be taken for granted. An abbreviated form is more likely to be used in actual practice.

OCCUPATIONAL THERAPY DEPARTMENT
Activities of Daily Living Evaluation/Progress Form

Name: Mrs. Hayes Age: 72 Onset Date: 2/3 Today's Date: 4/3

Medical Diagnosis: Lt. CVA Treatment Diagnosis: dysphagia, mild right hemiparesis; ↓'d independence ADL/IADL

Past Medical History: Unremarkable per pt. report and chart

Precautions: Soft foods, thick liquids

Mode of Ambulation: Mod A 20' with FWW, primarily uses w/c Hand Dominance: Right

Social / Home environment: Married 45 years, was primary caregiver to husband, lives in one-story house which they own; four adult children live out of area; has 24 hour caregivers to assist in home since CVA

Occupational Profile/Previous Level of Function: Prior to the CVA, pt. was I with ADL, IADL, volunteering at thrift store, going for walks with friends, paying bills, driving and caring for husband who has ↓'d vision and diabetes but who is otherwise ambulatory and cognitively intact. Pt. was a homemaker while she raised her four children and highly values her independence, community involvement and volunteering. Pt. enjoyed spending time with friends, potted gardening and entertaining her family including many grandchildren when they visit from out of town. Her goals are to be as independent as possible in her ADL/IADL, to be able to help her husband and to be able to enjoy previous leisure activities.

Grading key:	Abbreviations key:		Symbol key:
I = Independent S = Supervised SBA = Standby assistance Min A = Minimal assistance Mod A = Moderate assistance Max A = Maximum assistance D = Dependent N/A = Not applicable N/T = Not tested	ADL = activity of daily living AROM = active range of motion avg. = average bilat. = bilateral c/o = complains of CVA = cerebrovascular accident Executive Function Performance Test = EFPT FWW = front-wheeled walker HTN = hypertension lbs. = pounds LE = lower extremity min. = minutes DTL = dysphagia thickened liquids	PROM = passive range of motion Pt. = patient PT = physical therapist ther ex = therapeutic exercise UE = upper extremity w/c = wheelchair WFL = within functional limits WNL = within normal limits	↓ decrease ↑ increase ↔ to and from ' feet " inch 2° secondary to (due to)

Activities of Daily Living
Functional Mobility: Transfers/Ambulation

Date	4/3/11	5/3		Comments
Tub or shower transfer	Min A	S		Cues for safety, ¯balance, set-up required of bath bench
Toilet transfer	S	I		
Wheelchair transfer	S	I		
Bed and chair transfer	S	I		
Car transfer	N/T	S		
Wheelchair management	SBA	I		Difficulty managing armrest and footrest.
Wheelchair mobility	I (indoor, flat surface)	I (outdoor, smooth surfaces, slight incline)		
Functional ambulation	Mod A 20' per PT report	Min A 20' per PT report		FWW 20'

A

Self feeding/Eating (swallowing)

Date	4/3/11	5/3		Comments
Butter bread	N/T	I		
Cut meat	Min A	I		Rocker knife
Eat with fork	I	I		
Eat with spoon	I	I		
Eat with chopsticks	N/T	N/A		
Drink with straw	N/T	I		Nectar DTL
Drink from cup (cold)	I	I		
Drink from mug (hot)	N/T	I		
Pour from pitcher	N/T	I		
Diet:				Soft Diet/Nectar DTL
Managing fluids	Min A	I		Written instructions provided
Managing foods	Min A	I		Written instructions provided
Follow through with swallow techniques	Dep	S		Poor follow-through of techniques

Undress

Date	4/3/11	5/3		Comments
Underwear	Mod A	I		Seated
Slip/Undershirt/Bra	Min A	I		Seated
Dress	N/A	N/A		Pt. reports, "I only wear pants."
Skirt	N/A	N/A		
Blouse/Shirt	N/T	I		Seated, slowed pace with buttons
Slacks/Jeans	Mod A	I		Seated
Panty hose/Tights	N/A	N/A		
Housecoat/Robe	N/T	I		
Jacket/Coat	I	I		
Belt/Suspenders	N/A	N/A		
Hat	N/A	N/A		
Sweater (cardigan)	N/T	I		
Sweater (pullover)	N/T	I		
Mittens/Gloves	N/A	N/A		
Glasses	I	I		
AFO/Prosthesis	N/A	N/A		
Shoes	Min A	I		Seated, slip-on, prefers Velcro to laces
Socks	Min A	I		Seated
Boots	N/A	N/A		

Dress

Date	4/3/11	5/3		Comments
Underwear	Mod A	I		
Slip/Undershirt/Bra	Min A	I		
Dress	N/A	N/A		
Skirt	N/A	N/A		
Blouse/Shirt	N/T	I		
Slacks/Jeans	Min A	I		Seated, stand to hike pants
Panty hose/Tights	N/A	N/A		
Housecoat/Robe	N/T	I		
Jacket/Coat	I	I		
Belt/Suspenders	N/A	N/A		
Hat	N/A	N/A		
Sweater (Cardigan)	N/T	I		
Sweater (Pullover)	N/T	I		
Mittens/Gloves	N/A	N/A		
Glasses	I	I		
AFO/Prosthesis	N/A	N/A		
Shoes	Min A	I		Seated, slip-on, prefers Velcro to laces
Socks	Min A	I		Seated
Boots	N/A	N/A		

Clothing Fasteners

Date	4/3/11	5/3		Comments
Button	Min A	I		Slowed pace with ½" diameter buttons
Snap	Min A	I		
Zipper	Min A	I		Uses large (1" x ¼") zipper pull on jacket
Hook and eye	N/T	I		Slowed pace (bra)
Untie shoes	Mod A	I		Pt. currently prefers Velcro or slip-on shoes
Velcro	Mod A	I		Seated: shoes

Hygiene and Grooming/Bathing/Toileting

Date	4/3/11	5/3		Comments
Blow/Wipe nose	I	I		
Wash face and hands	I	I		Seated
Showering/Bathing general status	Mod A	S (set-up only)		Seated on bath bench
Wash upper body	Min A	I		
Wash lower body	Mod A	I		Long-handled sponge, hand-held shower hose
Shampoo hair	Min A	I		Seated
Brush teeth	I (seated)	I (standing)		Seated
Brush dentures	N/A	N/A		
Brush/comb hair	I	I (standing)		Seated
Curl hair	N/A	N/A		
Shave	N/A	N/A		
Apply makeup	N/T	I (seated)		Lipstick only
Clean fingernails	N/T	I		
Trim nails	N/T	SBA		Recommended nail file
Apply deodorant	N/A	N/A		
Initiate need to perform toileting task, bowel/bladder mgmt.	I	I		
Use toilet paper	I	I		
Use feminine hygiene products	N/A	N/A		
Personal Device Care (e.g., glasses, hearing aids, splints, etc.)	I	I		Glasses

Sexual Activity

Date	4/3/11	5/3		Comments
Able to have needs met	Dep	I		4/3 Pt. reports she and her husband have not had intercourse for 5 years due to her husband's erectile dysfunction. Couple sleeps in the same bed but husband is afraid to cuddle because he is afraid he will "hurt" her. 5/3 Couple instructed that cuddling will not injure pt.

IADL
Health Management and Maintenance

Date	4/3/11	5/3		Comments
Identify proper medication	Min A	S		Reading glasses required.
Open medicine bottle	Min A	S		Recommended non-child-proof and use of Dycem
Manipulate pills	SBA	SBA		Needs pill-organizer (at least 1" large pill holders)
Manage syringe	N/T	Min A		For husband's meds
Draw medication	N/T	Min A		For husband's meds
Follow medication routines	N/T	S		
Follow home exercise program/therapy program	Min A	S		Rt. UE home exercise program and with swallowing techniques
Arrange medical appointments	Dep	Min A		Uses large wall calendar

Communication Management

Date	4/3/11	5/3		Comments
Verbal	S	S		Dysarthria with slowed/slurred but understandable speech. Cues needed to slow down.
Initiate communication verbal or non-verbal	I	I		
Read	I	I		
Hold book	S (paperback)	I (book holder)		Reports fatigue with holding book.
Turn page	S	I		
Write	Mod A	SBA (1/4" letters); fair legibility		Poor legibility (1/2" letters)
Type/Use keyboard	N/A	N/A		Pt. "doesn't like" computers
Handle mail	N/T	S		
Use of call light	N/A	N/A		
Use home telephone	Mod A	I		
Use cell phone	N/T	S (answer phone only)		Recommended cell phone with larger buttons. Prior to CVA, pt. did not use often
Retrieve messages	N/A	N/A		
Use personal digital assistant	N/A	N/A		Pt. reports she does not like electronic gadgets though her children want her to use them to communicate.

Care of Others

Date	4/3/11	5/3		Comments
Care of pets	N/A	N/A		
Child-rearing	N/A	N/A		
Caregiving for others:	Dep	Dep		Difficulty with assisting with husband's insulin due to poor coordination in hand

Financial Management

Date	4/3/11	5/3		Comments
Managing cash	Mod A	I		
Using checkbook	Mod A	S		
Paying bills	Mod A	S		
Other				

Religious Observance (To Participate in Chosen Belief Practices)

Date	4/3/11	5/3		Comments
Individually	I	I		To say "grace" before meals
Corporately	N/T	Dep		Pt. reports she goes to church twice a year during the holidays.

Safety and Emergency Maintenance

Date	4/3/11	5/3		Comments
Initiates getting help in emergency	S	I		
Recognizes safety hazards	S	I		
Awareness of deficits and limitations	S	I		Husband reports pt. doesn't always ask for help when she needs it (e.g., with transfers)

Rest and Sleep

Date	4/3/11	5/3		Comments Check here if there are no problems with sleep and rest.
# hours of sleep at night: # naps taken per day: Time in naps:	6 1 2 hours	7.5 1 45 min.		4/3 Pt. c/o discomfort in her bilat. LEs and waking at night with inability to fall asleep 2° "too much on my mind." Pt. reports difficulty with sleep prior to CVA. MD notified.
Wakes up rested to perform ADL/IADL	No	No, but "better" than before per pt.		5/3 Pt. following through with at least two sleep hygiene strategies a day per OT recommendations.
Emotions & energy level WFL in late afternoon (poor, fair, good) to perform occupations	Poor	Fair		"I have a hard time remembering things and concentrating." Recommended pt. see primary MD regarding sleep issues: Pt. agreed. 5/4 Overnight sleep study scheduled for 6/7.

Combined Performance Activities
Operate Objects in External Environment

Date	4/3/11	5/3		Comments
Light switches	I	I		w/c level
Doorbell	N/T	I		
Door locks/Handles	Dep	S (adapted key holder)		Difficulty turning key 2° hand weakness.
Faucets	I	I		Lever style
Shades/Curtains	N/T	S		
Open/Close window	N/T	Dep		Windows throughout house are difficult to open. Husband to call children to fix.
Hang up garment	N/T	N/A		

Community Mobility

Date	4/3/11	5/3		Comments
Driving	Dep	Dep		
Walking	Mod A	Min A 20'		5/3 Uses w/c in community
Bicycle	Dep	Dep		
Powered mobility	N/A	N/A		
Public transportation				
Bus	NT	NT		
Train or light rail, other	NT	NT		
Taxi cab	NT	NT		
Paratransit	NT	NT		

Summary of Evaluation Results (Client Factors)
Perceptual/Cognitive/Emotional Regulation

Date	4/3/11		5/3				Comments
Intact = IN Impaired = IM	IN	IM	IN	IM	IN	IM	☐ Check here if perceptual, cognitive status are grossly intact
Follows directions	√		√				
Orientation (person, place, time)	√		√				
Topographical orientation	√						
Memory		√	√		√		
Attention span		√			√		Min A to attend for 15 min. during ADL eval.
Problem solving		√			√		4/3 Min A with cooking tasks 5/3 SBA with cooking tasks
Sequencing of task	√		√				
Visual spatial	√		√				
Left/right discrimination	√		√				
Motor planning	√		√				
Emotional regulation and coping		√			√		4/3 Min cues/encouragement required when pt. frustrated with fine motor tasks. 5/3 Only occasional cues for 45 min. session

Functional Range of Motion

Date	4/3/11				5/3								Comments
Intact = IN Impaired = IM	L		R		L		R		L		R		√ Check here if AROM or PROM is WNL for all functional tasks below (Circle AROM, PROM or both)
	IN	IM	IN	IM	IN	IM	IN	IM	IN	IM	IN	IM	
Comb Hair													
Feed Self													
Fasten Buttons													
Pull up back of pants													
Zip Zipper													
Tie shoes													
Reach shelf													
Put on socks													

Sensation

Date	4/3/11				5/3								Comments
Intact = IN Impaired = IM	L		R		L		R		L		R		√ Check here if sensation is WNL for UE
	IN	IM	IN	IM	IN	IM	IN	IM	IN	IM	IN	IM	
Light Touch													
Pain (Location)													
Temperature													
Proprioception													
Stereognosis													
Other													

Vision (Sensory and Perceptual)

Date	4/3/11				5/3								Comments
Intact = IN Impaired = IM	L IN	L IM	R IN	R IM	L IN	L IM	R IN	R IM	L IN	L IM	R IN	R IM	[√] Check here if vision is grossly intact [√] Needs corrective lenses
Visual fields													
Visual attention (e.g., "neglect")													
Visual acuity (near)													
Visual acuity (far)													
Visual tracking													

Strength: Indicate Muscle Grade as Appropriate

Date	4/3/11		5/3				Comments
Left = L or Right = R	L	R	L	R	L	R	[√] Check here if strength is grossly WFL for UE, head/neck
Head/Neck							
Shoulder flexion							
Shoulder extension							
Elbow flexion							
Elbow extension							
Supination							
Pronation							
Wrist extension	WNL	WFL	WNL	WNL			
Gross grasp	WNL	WNL	WNL	WNL			
Grip strength	35 lbs.	25 lbs.	37 lbs.	27 lbs.			Jamar Dynamometer avg. of 3 measurements
Muscle tone	WNL	WNL	WNL	WNL			

Coordination/Endurance

Date	4/3/11				5/3								Comments
Left = L or Right = R	L IN	L IM	R IN	R IM	L IN	L IM	R IN	R IM	L IN	L IM	R IN	R IM	[√] Check here if UE fine and gross motor ability are WFL
Fine motor	√			√	√			√					Difficulty with buttons, dialing phone.
Gross U.E.	√		√		√		√						
General endurance (good, fair, poor)	Fair (for eval)												Pt. c/o "I'm tired" at end of eval. Pt. reports endurance declines as day progresses.

Performance Skills
Functional Balance

Date		4/3/11	5/3		Comments
Sitting	Static	I (w/c)	I		
	Dynamic	Min A	I		Edge of bed
Standing	Static	Min A	I		5/3 While stabilizing with one UE on counter.
	Dynamic	Mod A	Min A		
Walking	Even surfaces	Mod A (20' per PT report)	Min A per PT report for 50'		
	Uneven surfaces	N/T	Mod A per PT for 20'		
Stoop		N/T	Min A		
Carry objects		N/T	I (w/c) Mod A walking		
Open/ Close door					
Reach for objects off floor		Max A	Min A		

Occupational Therapy Initial Assessment

Name: ________________ DOB: ________________ Onset Date: ________________ Today's Date: ________________

Medical Dx: ________________ Treatment Dx: ________________

Past Medical History: ________________

Precautions: ________________

Occupational profile/previous level of function: ________________

Areas of occupation: ________________

ADL Status	Date:	Date:	Comments	**I-ADL Status**	Date:	Date:	Comments
Eating/Swallowing				Care of others/Child rearing			
Self feeding				Care of pets			
Hygiene/Grooming				Communication management (e.g., writing, phone, etc)			
UE dressing				Community mobility			
LE dressing				Financial management			
Bowel/Bladder management and toilet hygiene				Health mgmt and maintenance			
Bed mobility				Laundry			
Functional AMB/ transporting objects				Light housekeeping			
Transfers				Meal prep. and clean-up			
Bathing/Showering				Religious observance			
Personal device care				Safety and emergency maintenance			
Sexual activity				Shopping			

Key:	
Independent	I
Supervised	S
Stand by assist	SBA
Minimum assist	Min
Moderate assist	Mod
Maximum assist	Max

B

Rest & Sleep:	Date:	Date:	Comments	Functional Cognition	Date:	Date:	Comments
Poor: Feels unrested after night's sleep, fatigue during day affecting ADL due to poor sleep. Poorly educated in good sleep hygiene techniques. Fair: Sleep is adequate to perform ADL/IADL during day but could use more productive sleep. Fair knowledge and follow-through of good sleep hygiene techniques. Good: Feels well-rested after a night's sleep, demonstrates good knowledge of good sleep hygiene techniques with good follow-through.				☐ Check here if cognition is WNL for ADL/IADL			
Education (formal and informal):				Attention			
Work Employment/Volunteer:				Short-term memory:			
Leisure participation:				Long term memory:			
Social participation (community, family, peers):				Problem solving:			
				Safety awareness:			

Client Factors	Date:	Date:	Comments		Date:	Date:	Comments
ROM RUE: LUE: Other:				Strength RUE: LUE: Other:			
Sensation RUE: LUE: Other:				Muscle Tone RUE: LUE: Other:			
Fine coordination RUE: LUE: Other:				Selective muscle movement and control RUE: LUE: Other:			
LE function:				Endurance			
Hearing				Vision			
Performance Skills	Date:	Date:	Comments	**Functional Cognition**	Date:	Date:	Comments
Balance Static: Sit: Stand:				Sensory/Perceptual skill (position in space, body awareness, midline, neglect etc)			
Dynamic: Sit: Stand:				Emotional regulation (behavior, coping, etc)			

Pt/Family goals:
OT short term goals:
OT long term goals:

Rehab Potential: ☐ Poor ☐ Fair ☐ Good ☐ Excellent

OT Intervention Plan: ______________________________

____

____

Frequency/Duration:

Patient/Family in agreement with plan of treatment and goals: ☐ yes ☐ no

Therapist's signature:	Date:	Re-eval Date:	Re-eval Date:
Physician's signature:	Date		

Adapted from Smith, J. (2006). Documentation of occupational therapy services. In H.M. Pendleton and Schultz-Krohn (Eds), Pedretti's occupational therapy: Practice skills for physical dysfunction (6th ed, p. 127). St. Louis: Mosby Elsevier.

American Occupational Therapy Association. (2008). Occupational therapy practice framework: Domain and process (2nd ed). American Journal of Occupational Therapy Association, 62, 625-683.

FIG 10.1 A, ADL evaluation form. B, OT initial assessment.

A third form, also frequently used, is a home management checklist (Fig. 10.2).

Occupational Therapy Department
Home Management Checklist

Name ______________________________ Date ____________
Address ______________________________ Age ____________
Roles ______________________________
Diagnosis ______________________________
Activity Precautions ______________________________
Description of home
Owns home ________ Apartment ________ Board and care ________
No. of rooms ____________ Bathroom description ______________________________
No. of floors ____________ ______________________________
Stairs ____________ ______________________________
Elevator ____________ ______________________________

Will client be required to perform the following activities? If not, who will perform?
Identify with ** the I-ADLs most important to the client.

Activity	Yes/NO	Who will perform?	Activity	Yes/NO	Who will perform?
Meal prep			Laundry		
Serving			Child care		
Wash dishes			Housekeeping		
Shopping			Other:		

Key:

Independent- I
Supervised- S
Stand by Assist- SBA
Minimum Assist- Min
Moderate Assist- Mod
Maximum Assist- Max
Dependent- D
Not Applicable- N/A
Not Tested- NT

Meal preparation

Date				Remarks
Manage faucets				
Handle stove controls				
Open packages				
Carry items				
Open cans				
Open jars				
Handle milk carton				
Empty garbage				
Retrieve refrigerator items				
Reach cupboards				
Peel vegetables				
Cut safely				
Break eggs				
Use electric mixer				
Use toaster				
Use coffee maker				
Use microwave				
Manage oven				
Pour hot water				

Set up/clean up for meal preparation

Date				Remarks
Set table				
Carry items to table				
Load/empty dishwasher				
Wash dishes				
Wash pots and pans				
Wipe counters/stove				
Wring out dishcloth				

Cleaning activities

Date				Remarks
Pick up object from floor				
Wipe spills				
Make bed				
Use dust mop				
Dust high surfaces				
Dust low surfaces				
Mop floor				
Sweep				
Use dust pan				
Vacuum				
Clean tub and toilet				
Change sheets				
Carry pail of water				
Carry cleaning tools				

Laundry/cleaning activities

Date				Remarks
Do hand washing				
Wring out clothes				
Hang clothing				
Carry laundry to and from washer and dryer				
Manage controls on appliances				
Use washing machine				
Retrieve clothes from dryer				
Iron				

Heavy household activities

Date				Remarks
Clean stove and oven				
Clean refrigerator				
Shopping				
Put away groceries				
Wash windows				
Change light bulbs				
Wash bathtub & toilet				
Maintain smoke alarms				
Recycle/compost				

Miscellaneous household activities

Date				Remarks
Retrieve newspaper				
Retrieve mail				
Feed pet				
Manage pet waste				
Let pet in and out				
Reach thermostat				
Use scissors				
Water houseplants				

Shopping

Date				Remarks
Prepare shopping list				
Select appropriate items				
Finding items in store				
Initiates asking for help as needed in store				
Reaching for objects in store				
Pushing cart				
Manage money, ATM, checkbook at store				
Purchasing within budget				
Putting away groceries or purchased items				

Suggestions for home modification: ______________________

FIG 10.2 Home management checklist. (Courtesy Lorraine Pedretti, MS, OTR.)

When reviewing the forms just discussed, the reader should keep in mind that the assessment and progress summaries relate only to the ADL and IADL portions of the intervention program.

It must be noted that computerized documentation has become the standard for medical records.[50] The term *electronic health record* (EHR) is widely used in the United States. The EHR is a digitized/electronic version of a client's medical chart and is kept by the provider.[21] OT documentation is included in the EHR.

Instrumental Activities of Daily Living

Home Management Assessment

Home management tasks are assessed similarly to self-care tasks. First, the client should be interviewed to elicit a description of the home and of previous and current home management responsibilities. Tasks the client needs to perform when returning home, in addition to those that he or she would like to perform, should be determined during the interview. If the client has communication or cognitive deficits, reliable friends or family members may be enlisted to obtain relevant information. The client may also be questioned about his or her ability to perform relevant tasks on the activities list. The assessment is more meaningful and accurate if the interview is followed by a performance assessment in the ADL kitchen or apartment of the treatment facility or, if possible, in the client's home. An example of a standardized assessment to evaluate the executive skills required to perform IADLs is the Executive Function Performance Test (EFPT).[16,41] Examples of specific IADL tasks to evaluate for home management can be found in the home management checklist (see Fig. 10.2).

The therapist should select tasks and exercise safety precautions consistent with the client's capabilities and limitations. The initial tasks should be simple one- or two-step procedures that are not hazardous, such as wiping a dish, sponging a tabletop, and turning the water on and off. As the assessment progresses, tasks graded in complexity and involving safety precautions should be performed, such as making a sandwich and a cup of coffee and vacuuming the carpet. For example, with Anna, initial tasks may include making a sandwich and using the microwave because using a manual wheelchair in her own home is new for her and requires working from a seated versus a standing position. As Anna performs these simple tasks using her wheelchair, the OT will be able to observe and make suggestions about modification to her kitchen, reorganization, safety techniques, or methods to transport items and simplify tasks.

Home management skills apply to women, men, and sometimes adolescents and children. Individuals may live independently or share home management responsibilities with others. In some homes, it is necessary for a role reversal to occur after the onset of a physical disability. In Anna's case, she has stated she would like to participate in previous home management activities and eventually return to work. Anna's occupational therapist will collaborate with her on home tasks to be completed by her so that interventions can be prioritized. Until Anna can perform the tasks more independently, Anna's mother or husband may be available to perform some of these tasks with direction from Anna.

If a client will be home alone, several basic ADL and IADL skills are needed for safety and independence. Lysack et al.[54] studied 122 African American women from urban areas who previously had lived alone who had a primary rehabilitation condition, such as a CVA or hip replacement. The researchers looked at FIM scores 3 and 6 months after discharge from a hospital. In telephone interviews they found that independence in five ADLs (eating, grooming, toileting, dressing, and bathing) was significantly related to live-alone status. In the same study, 9 of 10 IADLs were significantly related to live-alone status at 6 months after discharge, and four items (phone use, taking medications, managing finances, and food preparation) were highly significant.

The data suggest that investment in improved functional outcome is worthwhile, and higher functional performance is related to live-alone status. Findings such as these underscore the importance of OT intervention as it is in the domain of practice to focus on occupations and areas such as ADLs and IADLs.[6] The occupational therapist can assess the potential for remaining at home alone through the activities of the home management assessment. An evaluation such as the EFPT can be used to assist in determining whether a person is safe to remain at home or to help determine how much assistance is required for some IADL tasks.[16,41] A child with a permanent disability also needs to be considered for assessment and training for IADL skills because he or she will develop and mature, and have a growing need for independence.

Case Study

Mrs. Hayes

Mrs. Hayes is a 79-year-old woman who incurred a cerebral thrombosis, which resulted in a left cerebrovascular accident 2 months ago. She lives in a modest home with her husband of 45 years. Mrs. Hayes was active before the CVA, volunteering 10 hours a week at a local charity thrift store with her friends and caring for her husband, who has diabetes and poor vision. Mr. Hayes needs help with his medications and with cooking, but he is ambulatory, cognitively intact, and independent with ADLs. Mrs. Hayes was independent with all of the indoor home management activities and paid the bills for herself and her husband. She and her husband have a gardener, but Mrs. Hayes enjoyed gardening with potted plants.

After the CVA, Mrs. Hayes spent 3 weeks in the acute inpatient rehabilitation unit. While she was in the rehabilitation facility, the OT performed a home evaluation (see the following section, Home Assessment). Following through with the OT's recommendations, Mrs. Hayes's family made simple home modifications that would increase her safety and independence when she came home.

The CVA had resulted in an ataxic gait, mild dysarthria (slurred speech), dysphagia (swallowing deficit), and mild right hemiparesis (weakness). Mrs. Hayes was referred to outpatient OT for evaluation and training in ADLs and IADLs and for treatment of dysphagia.

The initial evaluation involved an interview with the client and her husband to create an occupational profile. Mrs. Hayes expressed concern about how she and her husband would manage because her four adult children lived 5 hours away. Her children have hired caregivers through an agency who are with the couple in shifts for 24 hours a day. Mrs. Hayes and her husband are anxious to be on their own again and do not want to be a financial burden on their children.

Based on the priorities and problems identified by the client and her husband, the occupational performance analysis included the use of the EFPT[41] and an ADL performance evaluation. The initial performance evaluation was completed during the first 1-hour session, and the EFPT was completed during the second visit.

During the initial evaluation, Mrs. Hayes became restless after 15 minutes, but with minimal redirection she continued to attend to the tasks. She also demonstrated decreased frustration tolerance during the assessment and required minimal encouragement to continue with fine motor tasks, which were difficult for her. Mrs. Hayes is independent with eating (as long as she is in compliance with a soft diet for swallowing problems), basic hygiene, and grooming while seated and with toileting tasks. Mrs. Hayes requires supervision with transfers from her wheelchair to the bed and the toilet but requires minimal assistance to transfer onto the bath bench because of occasional loss of balance, setup, and cues for safety. She requires minimal assistance with upper body dressing and bathing and moderate assistance for lower body dressing. She has difficulty with handwriting, use of the telephone, and handling keys. She requires moderate assistance to walk 20 feet using a quad cane but is independent with manual wheelchair mobility on indoor flat surfaces. Her visual fields are intact and she has no visual-spatial deficit. Her left upper extremity (UE) strength and active range of motion (AROM) are within normal limits (WNL). Her right UE strength is WNL proximally, but testing by use of a dynamometer demonstrates mild weakness in her hand. Right UE AROM is WNL. Her muscle tone in her bilateral UEs is WNL. Her right hand coordination is mildly impaired, as demonstrated with moderate difficulty pushing buttons on the phone and tying her shoes. She is able to stand while holding on to a stable surface but cannot use her hands for a task while standing because of mild balance impairments.

Results of the EFPT demonstrated significant deficits in organization of cooking and bill-paying tasks, requiring moderate assistance to complete both. The EFPT results indicated that Mrs. Hayes required minimal assistance with medication management and phone management.

A swallow assessment demonstrated moderately impaired tongue coordination and minimal delay with a swallow. Mrs. Hayes has already modified her diet by selecting very soft foods and slightly thickened liquids.

Mrs. Hayes tolerated the full OT evaluation but reported, “I'm tired,” at the end of the session. She reported that her endurance is diminished since the CVA, especially toward the end of the day. She admitted that in the later afternoon hours, “I have hard time remembering things and concentrating.” When queried about her sleep, Mrs. Hayes reported that she has difficulty falling asleep and that she wakes up in the middle of the night and cannot fall back asleep because of “too much on my mind” and discomfort in her legs. She reported having sleep difficulties prior to the CVA.

Mrs. Hayes is highly motivated and has the potential to prepare simple hot meals and perform basic self-care independently, except for showering, for which she may require supervision. Mrs. Hayes would like to be as independent as possible in her ADLs and IADLs and would like to resume caring for her husband. She acknowledges that her right hand has gotten stronger, but she reports frustration that it is taking longer than she expected. She would like to eventually resume her leisure activities.

Progress Report

Mrs. Hayes has attended OT two times a week for 6 weeks. She is generally cooperative and motivated, although periodically becomes discouraged as she continues to have an ataxic gait and requires the use of the manual wheelchair for independent mobility. Treatment has focused on lower extremity (LE) dressing, tub transfers, oral-motor exercises to improve swallowing, instruction in sleep hygiene techniques, and simple meal preparation. Because the caregiver drives Mrs. Hayes and her husband to the OT appointments, the OT has also trained the caregiver in how to assist the client to be more independent in her ADLs.

Mrs. Hayes has made significant progress in the treatment program, progressing from requiring moderate assistance with lower extremity dressing to being independent while seated. She has improved from chair-level grooming to standing with one-hand stabilization while using the other hand to brush her hair and teeth. Progress has been made from requiring minimal assistance with bathing to requiring supervision only with bathing on a shower bench. Initially requiring supervision with bed to wheelchair transfers, she is now independent. From requiring minimal assistance with transfers onto the shower bench, she now requires supervision, mainly for setup of the environment. From moderate difficulty with use of the phone, she has progressed to using the phone independently; from requiring moderate assistance with bill-paying activities and medication management, she has progressed to the supervised level. From being dependent with oral-motor exercises, she has progressed to supervised. Mrs. Hayes is now independent in cold meal preparation after initially requiring moderate assistance. Mrs. Hayes reports some improvement in her sleep at night and states that she is following through with two sleep hygiene strategies, but she says that she still has difficulties and does not wake up refreshed.

Mrs. Hayes continues to require a soft diet and slightly thickened liquids because of swallowing difficulties. She consistently follows through with the use of safety techniques for swallowing and is safe and independent to do so. She continues to have impaired hand function but is learning compensatory techniques to adapt her method of performing various ADLs. She is also strengthening her right hand with exercises provided by the occupational therapist to restore as much function as possible to that hand.

The occupational therapist, in consultation with Mrs. Hayes, has coordinated treatment and goals with the physical therapist and social worker. The therapist has recommended that the social worker refer the client's husband to a low-vision center for evaluation because he was dependent on his wife and never received instruction in low-vision training. His independence will relieve some of Mrs. Hayes's burden of caregiving. Mrs. Hayes has also been referred to the National Sleep Foundation for more information and to her primary physician, who referred her to a physician specializing in sleep medicine. The sleep specialist evaluated Mrs. Hayes and scheduled her for an overnight sleep study in 4 weeks. (See Chapter 13 for more information on the occupation of sleep and rest.)

Mrs. Hayes and her husband are pleased with her increased independence. With input provided by the occupational therapist, the family will reduce the hours needed for a hired caregiver to 16. For 8 hours a day during the day, the hired caregiver will assist Mrs. Hayes with bathing, meals, driving to appointments, shopping, and housekeeping. Occupational therapy will now focus on hot meal preparation, bed making, and exploring leisure interests, along with continuing to work toward improvement of oral-motor and hand function and improving sleep hygiene techniques.

Critical Thinking Questions

1. What deficits is Mrs. Hayes experiencing, and what compensatory strategies can she be taught to improve her ADLs and IADLs?

2. What role does the occupational therapist have in helping Mrs. Hayes meet her goals for ADLs and IADLs?

3. With all the areas that Mrs. Hayes needs to work on with the occupational therapist, how can the

OT prioritize the goals that are most important for Mrs. Hayes to accomplish so that she can continue to live in her home safely with her husband?

Home Assessment

The AOTA Representative Assembly's position paper on complex environmental modifications asserts that evaluation and provision of complex adaptations to environments where people complete daily occupations is within the scope of practice of OT practitioners.[66] One of the most important places where people complete many life occupations is the home.[24] To help with the transition from a treatment facility to home, or to optimize performance in a dwelling in which a client already lives, a home evaluation may be performed. A **home evaluation** can serve several purposes; it allows the OT to assess the home for safety and accessibility, and it also provides a way for the OT to assess client functioning at home and to perform some caregiver training.

From the initial meeting with a client or caregivers, the occupational therapist must have an idea about the home environment to which the client will return. For example, the OT treating Anna or Mrs. Hayes should know from early on whether the client lives in a second story apartment without an elevator or in a one story house. When the client's discharge from the treatment facility is imminent, a home assessment may be carried out to facilitate the client's maximal independence in the living environment. Other professionals also make home modification recommendations, but they are often provided by occupational therapists.[73] Stark et al.[77] found that home modification interventions by occupational therapists have demonstrated greater efficacy in reducing falls and improving function in older adults than interventions delivered by other professionals.

The AOTA document "Research Opportunities Tables on Home Modifications" points future researchers toward areas that can be studied further, and it acknowledges the strong evidence that OTs make important contributions in this area.[7]

Generalist OTs who work with clients with physical dysfunction regularly provide recommendations, but OTs can also specialize in this practice area and obtain advanced training.[66] OT practitioners who want to make recommendations must make sure that they have the training to do so. For example, an OT who has not had advanced training or experience in home modification should not recommend that Anna's family knock down walls or make structural changes. The OT Code of Ethics and Ethics Standards must be followed.[5]

Before performing a home assessment, occupational therapists must recognize that they will be assessing someone else's space. Chase and Christianson[22] pointed out that the "choices regarding the home belong to clients and may be highly significant to them." In addition, these researchers noted that the home is not just the sum of its physical characteristics; emotional components also are a part of it.[22] It is important that the therapist be mindful of this throughout the home assessment process and that he or she uses a client-centered approach; studies have shown greater adherence to recommendations with this method.[90]

Not all clients seen by an occupational therapist in a facility need or receive a home evaluation (this point is discussed later). The home assessment provides the family with a list of modifications and durable medical equipment (DME) needed to maximize safety and independence in the home (Box 10.3). It also helps the therapist understand the physical, cultural, and social environment the client will be returning to, so that realistic treatment methods and goals related to mobility, ADLs, and IADLs are established. Insufficient or incorrect information about accessibility can lead to costly mistakes in ordering equipment, and this ultimately may impair the client's safety and potential for greater independence.

Box 10.3

Durable Medical Equipment (DME)

- Equipment that can withstand repeated use ("durable" and long-lasting)
- Primarily and customarily used to serve a medical purpose
- Generally not useful to a person in the absence of an illness or injury
- Appropriate for use in the home

DME that OTs in the United States customarily recommend includes hospital beds, commodes, bath equipment, and client lifts (for transfers). Other professionals may recommend DME in the realm of their expertise, such as walkers, medication infusion pumps, and blood glucose monitors

From the US Social Security Administration website:[89] *https://secure.ssa.gov/poms.nsf/lnx/0600610200* and the Medicare website:[86] *http://www.medicare.gov/coverage/durable-medical-equipment-coverage.html.*

The home evaluation should be performed when the client's mobility status has been stabilized and is close to what it is expected to be at discharge. Collaboration with the physical therapist about a client's ambulatory status and potential is essential to determine the necessity and timing of home evaluation. For example, if the physical therapist reports that a client will be primarily walking at discharge, recommendations for home modifications may be very different from those for a client whose primary mode of mobility will be a wheelchair.

Ideally, the occupational and physical therapists perform the home assessment together. During the home visit, the client and essential caregivers and family members should be present. However, if it is not feasible to take the client, a wheelchair and other necessary equipment may be taken. Budget, time factors, and reimbursement issues may not allow two professionals to go to the client's home or may prohibit a home visit altogether.

If a home evaluation is not possible prior to discharge, an environmental audit, which consists of checklists with potential hazards, can be performed.[77,78] The rehabilitation team along with the client and family members should identify the most serious concerns and develop a plan to address them. Stark et al.[78] give an example of a frequently used housing audit, the Home Falls and Accidents Screening Tool (Home FAST[55]). Fig. 10.3 shows a home safety checklist that can be completed by the client or the client's family. Family members or caregivers could take pictures and measurements of the home or draw floor plans. Fig. 10.4 shows an OT home evaluation checklist, which is completed by the OT practitioner.

Home Safety Checklist

Help prevent falls: *Use this list to prioritize work tasks. Leave a copy of this list with the family so they can make further improvements. Note: 32 inch doorway recommendations are for average size person. If overall width of wheelchair or equipment is greater than 28" need 34 to 36" wide door*

1. Exterior entrances and exits

- Increase lighting at entry area
- Install stair rails on both sides
- Install door lever handles; double-bolt lock
- Install bevelled, no step, no trip threshold
- Remove screen or storm door if needed
- Create surface to place packages when opening door
- Install peephole on exterior door at level needed for mobility device
- Repair holes, uneven joints on walkway
- Provide non-slip finish to walkway surface/ramps
- Add ramp
  - Length ________________
  - Width ________________
  - Rails ________________
  - Platform size ___________

2. Interior doors, halls, stairs

- Create clear pathways between rooms
- Apply color contrast or texture change at top and bottom stair edges
- Install door lever handle
- Install swing-clear/off set hinges to widen doorway. Minimum width: 32 inches
- Install bevelled thresholds (max ½ inch)
- Replace or add non-slip surface on steps
- Repair or install stair handrails on both sides
- Clear clutter

3. Bathroom

- Install swing-clear/off set hinges to widen doorway. Minimum width: 32 inches
- Install secure wall reinforcement and place grab bars at toilet, bath and shower
- Install adjustable-height shower head
- Install non-slip strips in bath/shower
- Secure floor bathmat with non-slip, double-sided rug tape
- Elevate toilet height by adding portable seat or raising toilet base on a pedestal
- Adapt flush handle or install flush sensor
- Adapt or relocate toilet paper dispenser
- Round counter corners to provide safety
- Insulate hot water pipes if exposed
- Create sitting knee clearance at basin by removing vanity door and shelves underneath
- Install mirror for sitting or standing view
- Install good-quality non-glare lighting
- Install shower with no threshold if bathing abilities are severely limited
- Install bidet

Recommend :	• shower seat	• transfer tub bench	• 3 in1 commode
	• shower/commode tub slider system	• power tub lift	• other

4. Kitchen

- Increase task lighting at sink, stove, etc.
- Install D-type cupboard door handles
- Install adjustable shelving to increase access to upper cabinets
- Increase access to under counter storage space by installing pull-out units
- Insulate hot water pipes if exposed
- Install hot-proof surface near oven
- Install switches and outlets at front of counter
- Install pressure-balanced, temperature-regulated, lever faucets
- Create sitting knee clearance under work sites by removing doors or shelves
- Improve color contrast of cabinet and counters surface edges for those with low vision
- Add tactile and color-contrasted controls for those with low vision
- Move microwave to reachable work surface
- Arrange frequently stored items within easy reach given current mobility device and function

5. Living, dining, bedroom

- Widen or clear pathways within each room by rearranging furniture
- Secure area rug edges with double-sided tape
- Remove throw rugs
- Improve access to and from chairs and beds by inserting risers under furniture legs
- Use side bed rail or chairs with armrests
- Install telephone jack near chair or bed
- Enlarge lamp switch or install touch-control lamp at bedside
- Install adjustable closet rods, shelving and light source for better storage access
- Install vertical pole adjacent to chair and sofa
- Raise furniture to appropriate height using leg extender products
- Install uniform level floor surfaces using wood, tile or low-pile rugs

6. Laundry

- Build a counter for sorting and folding clothes
- Adjust clothesline to convenient height
- Relocate laundry appliances
- Use reacher

7. Telephone and door

- Install phone jacks near bed, sofa, and chair
- Install flashing light or sound amplifier to indicate ringing doorbell for those with visual or hearing problems
- Install mailbox at accessible height

8. Storage space

- Install lights inside closet
- Install adjustable closet rods and shelves
- Install bi-fold or pocket doors

9. Windows

- Install handles and locks that are easy to grip, placed at appropriate heights

10. Electrical outlets and controls

- Install light fixtures or outlet for lamps
- Install switches at top and bottom of stairs

11. Heat, air, light, security, water temp, carbon monoxide controls

- Install smoke/CO detectors, fire extinguishers
- Increase residents' access to environmental control systems
- Ensure water temperature is set at safe temperature (120 degrees Fahrenheit, 49 degrees Celsius) to prevent burns (U.S. Consumer Product Safety Commission, Tap water scalds, Document # 5098 retrieved from http://www.cpsc.gov/cpscpub/pubs/5098.html on August, 26, 2010)

FIG 10.3 Home safety checklist. (Adapted from Rebuilding Together: *www.rebuildingtogether.org/downloads/home-safety-checklist.pdf*; from Ralph K Davies Medical Center: Occupational/physical therapy home evaluation form, San Francisco, 1993; and Alta Bates Hospital: Occupational therapy home evaluation form, Albany, CA, 1993.)

Home Evaluation Checklist

Name ______________________________ Date ____________

Address ______________________________

Roles ______________________________

Diagnosis ______________________________

Number of people who live in the home ______________________________

Current mobility status	☐ Independent	☐ needs assist	☐ dependent
Mobility Device used in home:	☐ ambulatory, no device	☐ walker	☐ cane
	☐ power wheelchair	☐ manual wheelchair	

Exterior

Home located on: ______________________________

Type of house	☐ owns home	☐ mobile home	
	☐ apartment	☐ board and care	
Number of floors	☐ one story	☐ split level	☐ two story
Driveway surface	☐ inclined	☐ smooth	
	☐ level	☐ rough	
Is the DRIVEWAY negotiable with current mobility device?	☐ yes	☐ no	
Is the GARAGE accessible?	☐ yes	☐ no	

Entrance

Accessible entrances	☐ front	☐ side	☐ back
Steps	Number ____________		
	Height of each ____________		
	Width ____________		
	Depth ____________		
Are there HANDRAILS?	☐ yes	☐ no	
If yes, where are they located?	☐ left	☐ right	

HANDRAIL height from step surface? ____________

If no, how much room is available for HANDRAILS? ____________

Are landings negotiable?	☐ yes	☐ no

Briefly describe any problems with LANDINGS:

____

____

____

Ramps	☐ yes	☐ no	
	☐ front	☐ back	
	Height ____________		
	Width ____________		
	Length ____________		
Are there HANDRAILS?	☐ yes	☐ no	
If yes, where are they located?	☐ left	☐ right	Height ____________

Condition of current ramp ____________

If no ramp, how much room is available for one? ____________

Given 1" rise:12" length ratio for ramp, how long should the ramp be? ____________

Porch		
	Width ____________	
	Length ____________	
Level at threshold?	☐ yes	☐ no
Lighting available at porch?	☐ yes	☐ no
Door		
Width ____________		
Threshold height ____________		
Negotiable?	☐ yes	☐ no
	☐ swing in	
	☐ swing out	
	☐ sliding	
Do door locks work?	☐ yes	☐ no
Can door lock be reached with use of current mobility device and can it be safely locked and unlocked considering current status?	☐ yes	☐ no
Type of door knob?	☐ lever	☐ round

Interior

Living Room Is furniture arranged for safe maneuverability with current mobility status?	☐ yes	☐ no

Height of frequently used furniture/chair? ____________

Type of floor covering: ____________

Able to control TV, phone, lights from seat in living room?	☐ yes	☐ no

Comments ____________

Hallways

Can current mobility device be maneuvered in hallway? ☐ yes ☐ no

Hall width ______________________

Is it adequate for current mobility status? ☐ yes ☐ no

Door width ______________________

Is it adequate for current mobility status? ☐ yes ☐ no

Sharp turns? ☐ yes ☐ no

Steps? ☐ yes ☐ no Number __________

Are there HANDRAILS? ☐ yes ☐ no

If yes, where are they located? ☐ left ☐ right Height __________

Lighting: Is switch within reach with current mobility status? ☐ yes ☐ no

Bedroom

☐ single ☐ shared

Is there room for current mobility device? ☐ yes ☐ no

Type of floor covering? ______________________

Door:

Width ______________

Threshold height ______________

Negotiable? ☐ yes ☐ no

☐ swing in ☐ swing out

Bed:

☐ twin ☐ double ☐ queen

☐ king ☐ hospital bed

Overall height ______________

Safe and accessible with current mobility status? ☐ yes ☐ no

Would hospital bed fit into room if needed? ☐ yes ☐ no

Able to control TV, phone, lights from bed? ☐ yes ☐ no

Clothing:

Are drawers accessible with current mobility status? ☐ yes ☐ no

Able to reach all items in closet (higher and lower)? ☐ yes ☐ no

Is there adequate lighting in closet? ☐ yes ☐ no

Comments: ____

____

Bathroom	☐ private	☐ shared	
Door:			
Width ____________			
Swings	☐ in	☐ out	
Will door close with current mobility device inside?	☐ yes	☐ no	
Threshold height ____________			
Negotiable?	☐ yes	☐ no	
Tub/Shower	☐ tub/shower combination	☐ shower stall	☐ tub only
Height, floor to rim ____________			
Height, inside bottom to rim ____________			
Width and length inside	Width ____________	Depth ____________	
Glass doors?	☐ yes	☐ no	
	☐ sliding	☐ swing	☐ in ☐ out
Width of doors ____________			
Handheld shower?	☐ yes	☐ no	
Type of faucet controls	☐ 2 levers	☐ single lever	☐ round
If seated, will user be able to reach faucets?	☐ yes	☐ no	
Is tub/shower accessible safely with current mobility status?	☐ yes	☐ no	
The following equipment is currently being used for bathing in the home	☐ shower seat	☐ transfer tub bench	☐ 3 in1 commode
	☐ shower/commode tub slider system		☐ power tub lift
	☐ shower commode chair		
Is there room for the caregiver to assist?	☐ yes	☐ no	
Sink:			
Height ____________		☐ open (no cabinets)	
Faucet type ____________		☐ closed (cabinets below)	
Able to reach and use faucet and sink with current mobility status?	☐ yes	☐ no	
Height of mirror ____________			
Appropriate height to sit?	☐ yes	☐ no	
Can shelf be reached with current mobility status?	☐ yes	☐ no	
Are hot water pipes insulated?	☐ yes	☐ no	
Type of faucet controls	☐ 2 levers	☐ single lever	☐ round
Electrical outlets within reach from seated or standing position	☐ yes	☐ no	

Comments on clutter/organization? ____

Toilet:

Height from floor____________________

Location of toilet paper____________________

Distance from toilet to side wall L ____________________ R ____________________

Grab bars: ☐ yes ☐ no

Location ____________________

Comments: ____

The following equipment is currently being used for toileting ☐ raised toilet seat ☐ toilet safety rails ☐ 3 in1 commode ☐ grab bars ☐ bidet

Kitchen

Door:

Width____________________

Threshold height____________________

Negotiable? ☐ yes ☐ no

Stove:

Height____________________

Location of controls ☐ front ☐ rear

Able to reach and operate controls/burners with current mobility status? ☐ yes ☐ no

Oven:

Height from floor to door hinge and door handle ____________________

Location of oven____________________

Is there a nearby surface to rest hot foods on when removed from oven? ☐ yes ☐ no

Microwave Oven:

Height from floor to door hinge and door handle ____________________

Location of microwave oven____________________

Is there a nearby surface to rest hot foods on when removed from microwave oven? ☐ yes ☐ no

Sink:

Will w/c fit underneath? ☐ yes ☐ no

Type of faucet controls ☐ 2 levers ☐ single lever ☐ round

Can faucet be reached while seated? ☐ yes ☐ no

Are hot water pipes insulated? ☐ yes ☐ no

Cupboards:

Height of counters?____________________

Accessible from seated position or with current mobility status?	☐ yes	☐ no	
Is there under-the-counter knee space for a work area?	☐ yes	☐ no	

Refrigerator:

Type:	☐ side by side	☐ freezer on top	☐ freezer on bottom
Hinges on	☐ left	☐ right	
Able to reach all shelves in the refrigerator?	☐ yes	☐ no	
Able to reach all shelves in the freezer?	☐ yes	☐ no	

Switches/outlets:

Able to reach with current mobility status?	☐ yes	☐ no	

Lighting:

Adequate in work areas of kitchen?	☐ yes	☐ no	

Kitchen table:

Height from floor ____________________

Will w/c fit under table?	☐ yes	☐ no	

Comments: ____________________

Laundry

Door:

Width ____________________

Threshold height ____________________

Negotiable?	☐ yes	☐ no	
Steps:	☐ yes	☐ no	

Number ____________________

Height ____________________

Width ____________________

Are there HANDRAILS?	☐ yes	☐ no	
If yes, where are they located?	☐ left	☐ right	Height ____________
Washer:	☐ Top load	☐ Front load	
Can user reach controls and inside to retrieve clothing?	☐ yes	☐ no	
Dryer:	☐ Top load	☐ Front load	
Can user reach controls and inside to retrieve clothing?	☐ yes	☐ no	

Comments: ____________________

Safety

Throw rugs	☐ yes	☐ no	
Location ____________			
Is client and/or family willing to remove?	☐ yes	☐ no	
Water Temperature			
Is water temperature set at 120 degrees Fahrenheit?	☐ yes	☐ no	
Phone			
Type	☐ programmable	☐ cordless	☐ mobile
	☐ attached to base		
Within reach of chair?	☐ yes	☐ no	
Within reach of bed?	☐ yes	☐ no	
Able to retrieve phone, dial and hear caller?	☐ yes	☐ no	
Emergency phone numbers posted and programmed into phone?	☐ yes	☐ no	
Location ____________			
Mailbox			
Able to reach and empty?	☐ yes	☐ no	
Location ____________			
Doorbell			
Able to identify visitors?	☐ yes	☐ no	
Able to hear doorbell?	☐ yes	☐ no	
Thermostat			
Able to reach and read controls?	☐ yes	☐ no	
Location ____________			
Electric outlets/switches			
Height of outlets? ____________			
Electrical extension cord hazards?	☐ yes	☐ no	
Drapes/Curtains/Blinds			
Able to open with current mobility status?	☐ yes	☐ no	
Windows/Doors			
Able to open with current mobility status?	☐ yes	☐ no	

Imperfect floor/floor covering? ☐ yes ☐ no
Location ____________

Sharp-edged furniture? ☐ yes ☐ no
Location ____________

Fire extinguisher ☐ yes ☐ no
Location ____________

Smoke detector ☐ yes ☐ no
Location ____________

Client hears and understands meaning of smoke detector? ☐ yes ☐ no

Guns present: ☐ yes ☐ no

Locked? ☐ yes ☐ no

Comments on condition of house:

Cleanliness: ____________

Disrepair: ____________

Clutter issues: ____________

Health issues: ____________

Equipment present:
☐ shower seat ☐ transfer tub bench ☐ 3 in1 commode
☐ shower/commode tub slider system ☐ power tub lift
☐ raised toilet seat ☐ toilet safety rails ☐ grab bars installed
☐ tub safety rail ☐ shower commode chair ☐ lift recliner chair
☐ hospital bed with rails ☐ stair glide

Other equipment/Status of equipment (e.g., borrowed, in disrepair, etc): ____________

Problem list: ____________

Recommendations for modifications: ____________

Equipment recommendations: ____________

Patient/Family willing to make modifications: ☐ yes ☐ no

Patient/Family able to make modifications: ☐ yes ☐ no

Cost constraints: ____________

Referrals needed: ____________

Comments: ____________

FIG 10.4 Home evaluation checklist. (Adapted from Ralph K Davies Medical Center: Occupational/physical therapy home evaluation form, San Francisco, 1993; and Alta Bates Hospital: Occupational therapy home evaluation form, Albany, CA, 1993.)

Much of the information can also be obtained by interviewing the client and family members after a client's trial home visit (a visit that must be approved by the insurance company). The family member or caregiver may be instructed to complete the home visit checklist during the trial home visit and provide photographs or sketches of the rooms and their arrangements. Problems encountered by the client during a trial home visit should be discussed and the necessary recommendations for their solution made. If a home evaluation is not possible while the client is in the hospital, the home assessment may also be referred to the home health agency that will provide home care services to the client.

The client and a family member should be interviewed prior to the home evaluation to determine the client's and family's expectations and the roles the client will assume in the home and community. The family's values or those of their culture regarding people with disabilities may influence role expectations and whether independence will be encouraged. Willingness to make modifications in the home can also be determined. The purposes and procedure of the home assessment should also be clearly explained to the client and caregivers prior to the actual visit.

Understandably, the first time home (which may be at the home evaluation) after an illness or injury can be emotion filled for everyone concerned, especially for the client. Before the OT performs a home evaluation, especially with the client present, it is important that he or she know whether the home being evaluated is new for the client or whether drastic home changes have already had to be made. For example, if Anna had lived in a second story apartment prior to her accident, her family may have had to move to a first story home. Or if Anna's mother was going to move into her home to help care for her daughter and granddaughter, rooms may have been switched, furniture moved, belongings displaced. Knowing this ahead of time can help the occupational therapist and other rehabilitation team members be ready to provide emotional support to the client as needed.

If the client is present during the home visit, sufficient time should be scheduled so that he or she can demonstrate required functional mobility skills, such as selected self-care and home management tasks in the dwelling. During the assessment, the client should use the mobility aid and any assistive devices that he or she is accustomed to using or expected to use. For example, Anna and Mrs. Hayes would be asked to propel their manual wheelchairs throughout the home to determine what access issues they will encounter. The therapist should bring a sturdy tape measure to measure the width of doorways, the height of stairs, the height of the bed, and other dimensions. With permission, the OT can take photos during the assessment and refer to them later to assist with problem-solving placement of safety equipment, adaptive devices, and home modifications.

The therapist can take the required measurements while surveying the general arrangement of rooms, furniture, and appliances. Fig. 10.4 provides a format for documenting critical measurements. It may be helpful to sketch the size and arrangement of rooms for later reference and to attach these sketches to the home assessment checklist. (For more information on standardized assessments, see Letts et al.,[51] Anemaet et al.,[8] and Stark et al.[78]) Three commonly used standardized home safety assessments are the Safety Assessment of Function and the Environment for Rehabilitation (SAFER),[63] the Westmead Home Safety Assessment (WeHSA),[26] and the Housing Enabler.[46] However, researchers found that those three commonly used assessments do not address environmental features specific to individuals with vision loss.[14]

Next, the client demonstrates functional mobility skills and essential self-care and home management tasks. The client's ability to use the entrance to the home and to transfer to and from an automobile, if it is to be used, should be included in the home assessment.

During the performance assessment, the therapist should observe safety factors, ease of mobility and performance, and limitations imposed by the environment. If the client needs assistance for transfers and other activities, the caregiver should be instructed in the methods that are appropriate. The client may also be instructed in methods to improve maneuverability and to simplify the performance of tasks in a small space.

Access to the bathroom and maneuvering with a wheelchair or walker are common problems. Frequently, a bedside commode is recommended until a bathroom can be made accessible or modified to allow independence with toileting (Fig. 10.5). Shower seats can be used in the tub if a client can transfer over the edge of the tub and also may be used in a shower. A transfer tub bench (Fig. 10.6) is recommended for individuals who cannot safely or independently step over the edge of the tub. Installation of a handheld shower hose increases access to the water and also eliminates risky turns and standing while bathing.

FIG 10.5 Three-in-one commode. (Courtesy North Coast Medical, Gilroy, CA.)

FIG 10.6 Transfer tub bench. (Courtesy North Coast Medical, Gilroy, CA.)

The Americans with Disabilities Act (ADA) established standards for accessible design, which can be used as general guidelines and are available at the ADA's website (*www.ada.gov*).[88] Not all modifications recommended should necessarily meet the ADA guidelines because the home will be modified to suit the individual and to compensate for that specific disability. The ADA guidelines are meant to apply to public areas and to meet the needs of people with a variety of disabilities (see Chapter 15). The ADA standards may serve as a resource, but they should not be the only guidelines the OT uses when making recommendations.[24] The OT should recommend that the family use only licensed contractors who are aware of building code requirements in their area.

Christenson and Lorentzen[24] suggested the optimal reach zone (OZR) as a more realistic criterion for recommendations.[97] According to the OZR method, items should be placed in a zone that is 20 to 44 inches above the floor and a maximum depth of 20 inches. Christenson and Lorentzen[24] pointed out that no specific rule can accommodate every person, but ideal heights have been determined for some items that require vision, reach, or grasp; for example, clothing rods, thermostats, electric switches, and door handles should be placed between 27.3 and 45.5 inches from the ground.[64]

In a study by Cummings et al.,[27] the most common home safety recommendations were to remove mats and throw rugs (48%), to change footwear (24%), and to use a nonslip bathmat (21%). Other recommendations included changing behaviors, such as using a commode or keeping a light on at night.[27] In their small study of older adults in an independent living community, Van Oss et al.[90] found that items rated most useful included nonslip bath strips, a suction-bottom foot scrubber, a tub seat, a bath mat for outside the tub, a reacher, a magnified mirror, a pill bottle magnifier, a raised toilet seat, and a jar gripper. Box 10.4 presents additional common recommendations for home safety and access, and Box 10.5 shows a list of supplies to take on a home evaluation.

Box 10.4

Common Home Recommendations

1. Installation of a ramp or railings at the entrance to the home

2. Removal of throw rugs, clutter, and exposed electrical wires

3. Removal of door thresholds (if not level) and doorjambs

4. Installation of safety grab bars around the toilet and bathtub

5. Rearrangement or removal of furniture to accommodate a wheelchair or other assistive devices

6. Rearrangement of kitchen and other storage for access

7. Lowering of clothes rods in closets

Box 10.5

Supplies to Take on a Home Evaluation

- Measuring tape—use heavy duty (at least 30 feet long) or infrared distance measurer[13]
- Paper, pen, or laptop for notations
- Home evaluation checklist
- Digital camera, video
- Light meter[13]
- Maps or GPS
- All important emergency phone numbers (eg, nursing station, your supervisor, and healthcare provider)
- Any durable medical equipment you think the client may need (eg, wheelchair, walker, commode, and bath bench)
- Tool kit for quick fixes
- Cell/mobile phone

If taking client on the home evaluation:

- Urinal, as appropriate
- Blood pressure cuff, stethoscope, gloves

When the home assessment is completed, the therapist must write a report summarizing the information on the form and describe the client's performance in the home. The report should conclude with a summary of the environmental barriers and the functional limitations the client encountered. Recommendations should include additional safety equipment and assistive devices needed. Modification recommendations should include specific details about size, building specifications, costs, and sources. Recommendations may also include further functional goals to improve independence in the individual's home environment. Team members should be notified about the client's performance in the home and accessibility problems so that they can practice skills or be made aware of issues prior to discharge. For example, the OT may report to the physical therapist that a client such as Mrs. Hayes will eventually need to negotiate a step down into the living room to be more independent. The OT may report to the psychologist that Anna had a difficult time emotionally handling her visit home with her new functional status.

The therapist should carefully review all recommendations with the client and family. The family should receive a written report with the recommendations clearly written. This review should be done with tact and diplomacy in a way that gives the client and family options and the freedom to decline them or consider alternative possibilities. Family finances may limit the implementation of needed changes. The social worker, case manager, and/or insurance company may be involved in working out funding for needed equipment and alterations, and the client should be made aware of this service when cost is discussed. Sprague[75] noted that determination of a household's available resources and obtaining further funding, if needed, are among the most important activities in the home modification process. The OT may assist in helping to justify and prioritize projects for funding. Sprague provided ideas and a detailed list of possible funding sources in the United States for home modifications.[75] The therapist should include recommendations regarding the feasibility of the client's discharge to the home environment or of the client remaining in or managing the home alone. If there is a question regarding the client's ability to return home safely and independently, the home assessment summary should include the additional functional skills the client needs to return home. If the OT feels that the home is not safe to live in or if there is imminent danger, appropriate parties should be notified immediately and steps taken to ensure the safety of the client.

Financial Management

If the client is to resume management of money and financial matters independently, a cognitive and perceptual assessment that accurately tests these skills should be implemented. Because some persons with physical disabilities have concurrent involvement of cognition and perception, the level of impairment should be determined. The OT evaluates the methods and routines the client typically implements for financial management. For example, one client may pay each bill as it arrives by writing a check, whereas another client may pay bills once a month online. The skills needed for each are different and require different levels of organization. As with any other performance area, the OT will break down the activity into small tasks and focus treatment on building skills for each component of the task. Caregivers may require training if the role of financial manager is new and must be assumed. In the case of Mrs. Hayes, she is having cognitive deficits and handwriting difficulties. She may need to teach her husband how to manage bill paying, or they may choose to work together. The client may be capable of handling only small amounts of money or may need retraining in activities that require money management, such as shopping, balancing a checkbook, or making a budget. If a physical limitation is involved, the therapist may introduce adaptive writing devices or practice skills, such as handling coins or bills, taking a wallet out of the pocket, and calculating appropriate tips for service provided. A social worker should also be notified if a client is cognitively unable to manage finances and has no reliable support, and therefore is at risk of financial abuse.

Community Mobility

The OTPF-3[6] classifies community mobility as an IADL and includes the use of public or private transportation such as walking, driving, riding the bus, taking a taxi, riding a train, and traveling by airplane or any number of other transportation systems. Occupational therapists with advanced training and experience can specialize in the area of adaptive driving (see Chapter 11), but OTs in all areas of practice need to address community mobility. The ability to maneuver in the community opens up doors for access to many other occupations.[79,80] Lack of access can close the door, preventing many people from participating in all the other occupations, such as work, education, play, leisure, and social participation. A study by Metz[59] found that mobility in the community can contribute to positive health outcomes physically, psychologically, socially, and with overall life satisfaction.

The OT evaluates the client's potential to participate in the community under circumstances in which some type of community mobility is required. Zahoransky[101] categorized community mobility in these ways:

- Walking with or without the use of an ambulation aid, such as a cane or walker. A study by Lynott and Figueiredo[53] found that walking is second to driving a private automobile as the preferred way for older adults to be mobile in the community.
- Using wheeled mobility devices (eg, bicycle, motorcycle)
- Using a powered device (eg, power wheelchair or scooter)
- Riding as a passenger, with a family member, friend, or caregiver as primary transport
- Driving oneself in a vehicle that may or may not be adapted (see Chapter 11)
- Using public transportation (eg, taxi, bus, van, subway, airplane, or other transit system)

The OT must assess the client's physical, perceptual, cognitive, functional, and social capabilities to be independent and safe with community mobility. The OT should be familiar with the environment in which the client lives and accesses the community, and the therapist also should be aware of available resources, such as special parking placards and how to obtain them, adaptive driving programs, and types of transportation available.

Examples of physical capabilities to be considered are whether the client has the endurance to be safely mobile in the community and whether he or she can safely use assistive devices (eg, a walker, cane, crutch, or wheelchair) and perform transfers needed to go beyond the home environment. Wheelchair mobility skills include managing uneven pavement, curbs, and inclines and crossing the street. Other functional skills the OT must evaluate that influence community mobility are handling money, carrying objects in a wheelchair or with other assistive devices, and managing toileting in a public restroom.

Cognitive skills include geographical and topographical orientation, reading a schedule and a map or knowing how to get directions, and problem-solving or obtaining help if an issue should arise.

If the disability is new, the client may need to develop new social skills or relearn old skills with new modifications. Assertive or confident behaviors, such as requesting an accessible table at a restaurant, obtaining assistance with unreachable items in the grocery store, becoming comfortable with a new body image in the able-bodied community, and asking for help when needed, can be daunting for a person who is newly disabled.

Visual-spatial skills are critical to safety in judging distance stepping down from a curb, driving a car, and maneuvering a wheelchair on a narrow sidewalk. The visual-spatial skills are identified during an evaluation and considered in relation to the cognitive, physical, and functional deficits the client exhibits. Some individuals have awareness of their deficits and compensate well. Others are not aware of the deficits or have difficulty with devising or remembering compensatory strategies and therefore will require greater supervision with community mobility than others.

The OT should also assess the client's community environment, such as security, terrain, availability of curb cutouts, travel distance, location of bus and train stations, duration of traffic lights, and availability of help if needed. For Anna, her place of worship is important, so this could be an area that should be assessed. Accessibility of worship space is not mandatory according to the ADA, but inclusion is a basic part of worship in synagogues, temples, mosques, churches.[72] Shamberg and Kidd[72] provided a useful checklist in their article for basic worship space accessibility that would be helpful for Anna and others in her church.

Accessibility of public transportation should also be considered. Some communities have door-to-door cab and van services, which have certain restrictions or set protocols. Some of these restrictions include the need to arrange transportation a week in advance, the ability to get out the front door and to the curb independently, and the ability to transfer independently into the vehicle. If the client is to use a public bus, he or she must learn how to use the electric lifts and how to lock a wheelchair into place. Because not all bus stops are wheelchair accessible, the neighboring bus stops should be surveyed.

Community mobility requires preplanning by the occupational therapist and the client; accurate assessment of the client's abilities; and knowledge of potential physical, cognitive, visual-perceptual, and social or emotional barriers the client may encounter. Armstrong and Lauzen's Community Integration Program[11] is a valuable resource that provides practical treatment protocols to establish a community-living skills program. Attaining independence in community mobility allows the client to expand his or her life occupations beyond those in the home and allows full participation in the community.

Health Management and Maintenance

Health management and maintenance include the client's ability to develop, manage, and maintain routines to promote health and wellness.[6] The client's abilities in the practical aspects of health management must be assessed, including the ability to maintain fitness and an adequate nutrition and fluid intake, avoid unhealthy behaviors, obtain adequate sleep, handle medications, and know when to call a healthcare provider and how to make a medical appointment. The evaluation of the client's ability to perform these activities may be completed solely by the occupational therapist but will probably include other team members, such as a nurse, nurse practitioner, or the physician. Caregivers and family members may also need to be involved in this area. Sanders and Van Oss[69] found in their study of 149 community-living older adults that 51% of the sample required some type of social support to take medications. Most of the help involved verbal reminders and assistance with picking up or arranging for refills. The information provided by the OT's evaluation of the client's cognition, visual perception, and physical abilities can greatly enhance the skilled nurse's ability to use appropriate interventions and strategies when teaching medication management to the client.

The OT assessment can be helpful in determining which aspects of the task need to be modified for the client to be independent. For example, the occupational therapist can work jointly with a nurse to ensure that a client with hemiplegia and diabetes can manage insulin shots. The OT evaluation considers the client's cognitive and perceptual abilities to make judgments about drawing the insulin out of the bottle, measuring the insulin, and injecting the insulin. Physical concerns include how to stabilize the insulin bottle, accurately see the measurement, and handle the syringe with one hand. Another example might involve determining the best strategies for a client using eye drops to open the container and measure and dispense the correct amount of medication into the eye. Sanders and Van Oss[69] found that 91% in their study of older adults used timing of activities to remember to take medications. Seventy-one percent of the participants planned medications around mealtimes and 52% around wake or bedtimes. Because the OT usually questions clients about their ADL and IADL routines, the connection of commonly performed activities with timing of the taking of medication can be a valuable strategy for some clients.

Sanders and Van Oss[69] also found that 64% of the older adults in their study embedded medication use around breakfast, 40% around morning hygiene, and 33% around evening hygiene. Weekly routines (eg, loading pillboxes on Sundays) and monthly routines were also used to help with medications. Interestingly, the researchers noted that although physicians recommended that their clients use charts to track medication usage, fewer than 10% did so.[69]

The OT may also evaluate and train the client in other skills that affect health management. Examples include using the phone, finding the appropriate phone numbers, and providing the needed information to make a medical appointment.

Because she has paraplegia, Anna's new health management and maintenance routine may include performing regular skin checks and weight shifts to prevent decubiti (pressure sores) from developing. An occupational therapist can help Anna obtain necessary adaptive aids and devise strategies to ensure good skin health. Considering that many lifestyle factors can affect skin integrity, OT practitioners are well suited to assist clients such as Anna in this area.[37]

Health maintenance is an issue for the client and the entire healthcare team. The occupational therapist plays an important role because of the scope of the ADL and IADL assessments, which may identify and help resolve problems related to health maintenance.

ADL and IADL Training

If it is determined after an assessment that ADL and IADL training are to be initiated, it is important to establish appropriate short- and long-term goals, based on the assessment and on the client's priorities and potential for independence.

The OT should estimate which ADL and IADL tasks are possible and which are not within the client's potential to achieve. The therapist should explore with the client the use of alternative methods of performing the activities, environmental modifications to support safety and independence, and the use of any assistive devices that may be helpful.

The ADL and IADL training program may begin with simple tasks and gradually increase in complexity.

Methods of Teaching ADLs

The therapist must tailor methods of teaching the client to perform daily living tasks to suit each client's learning style and ability. The client who is alert and grasps instructions quickly may be able to perform an entire process after a brief demonstration and oral instruction. Clients who have perceptual problems, poor memory, and difficulty following instructions of any kind need a more concrete, step-by-step approach in which the amount of assistance is gradually reduced as success is achieved. For these clients it may be important to break down the activity into small steps and progress through them slowly. A demonstration of the task or step by the therapist in the same plane and in the same manner in which the client is expected to perform can be helpful. Accompanying the demonstration with oral instructions may or may not be helpful, depending on the client's receptive language skills and ability to process and integrate two modes of sensory information simultaneously.

Evidence suggests that a variety of interventions may be effective in helping people with cognitive deficits after a CVA and that a focus on use of "authentic occupations" in the clinic were more effective than contrived cognitive activities.[39] A review of the literature by Gillen et al.[39] showed some correlation in the use of "gesture training" on measures of functional independence in ADLs for people with apraxia as described by Smania et al.[74]; cognitive strategy training, such as internal rehearsal, verbalizing actions while executing ADLs, and external cueing, may also help. In general Gillen et al.[39] suggested that the literature supports a performance focus and use of strategy training techniques and compensatory techniques as being effective in treating clients with CVA-related cognitive impairment.

Physical cueing, such as passive movement of the part through the desired pattern to achieve a step or a task, and gentle manual guidance through the task are helpful tactile and kinesthetic modes of instruction. These techniques can augment or replace demonstration and oral instruction, depending on the client's best avenues of learning. It is necessary to perform a step or complete a task repeatedly to achieve skill and speed and to have a task that is currently declarative learning (consciously knowing what to do) become automatic/procedural learning (unconsciously knowing how to do it). Tasks may be repeated several times during the same training session if time and the client's physical and emotional tolerance allow, or they may be repeated daily until the desired retention or level of skill is achieved.

Other methods of teaching include forward and backward chaining. As Batra and Batra[15] pointed out, forward chaining is a concept first described by B. F. Skinner in relation to operant conditioning (reinforcement or punishment to change behavior). In this technique, tasks ("chains") are broken down into serial steps and then taught from first step to last step. In backward chaining, the task is taught in reverse chronological order. Forward or backward chaining can be used to teach ADL skills. An example of forward chaining for the ADL of putting on a sock may be having a client practicing holding a sock open, then the OT finishing the rest of the task if the client gets stuck. After that step has been mastered, the client may place the sock over the toes, and, eventually pull up the whole sock. In backward chaining, the therapist assists the client until the last step of the process is reached. The client then performs this last step independently. In the sock example, when training starts, the therapist helps the client perform the early steps of keeping the sock open, putting the toes, and then the foot, and then the heel of the sock on. The client then pulls up the sock past the ankle and masters that step. The process continues, with the therapist offering less and less assistance and the client performing successive steps of the task, from last to first ("backward"), until the client can perform the whole task from start to finish. In their small study of children in India with mental retardation, Batra and Batra[15] found that forward and backward chaining techniques were equally effective for ADL training (putting on socks or tying shoelaces). Most likely, OTs use both methods, sometimes in the same session.

Before beginning training in any ADL, the OT must prepare by providing adequate space and arranging equipment, materials, and furniture for maximal safety and convenience; this serves as an example to the client of using work simplification and energy conservation techniques. The OT practitioner should be familiar with the task to be performed and any special methods or assistive devices that will be used in its performance. The OT should be able to perform (or should know how to perform) the task as skillfully as he or she expects the client to perform it. After preparation, the activity is presented to the client, usually in one or more of the modes of guidance, demonstration, and oral instruction described earlier. The OT ensures the appropriate environmental setup for success and safety. For example, a chair with arms or a safely locked wheelchair may be provided to start. The client's feet are placed flat on the floor (or, if a wheelchair is used, on the footplates). Personal care items are located within safe reaching distance when the client is initially learning an activity. The client then performs the activity either along with the occupational therapist or immediately after being shown, with the required amount of supervision and assistance. Performance is modified and corrected as needed, and the process is repeated to ensure learning.

Because other staff or family members are frequently reinforcing the newly learned skills, staff and family training is critical to reinforce learning and ensure that the client carries over the skills from previous treatment sessions. The therapist should check performance in progress and later arrange to check on the adequacy of performance and carryover of learning with the client, the nursing personnel, the caregiver, or the supervising family members.

Recording Progress in ADL Performance

The ADL checklists used to record performance on the initial assessment usually have one or more spaces for recording changes in abilities and the results of reassessment during the training process. The sample checklist shown earlier in this chapter (see Fig. 10.1) is designed and completed for illustration purposes using Mrs. Hayes's information. If a standardized assessment is used during the initial evaluation, it should be used in the reevaluation process to objectively measure the level of progress the client has attained.

Progress is usually summarized for inclusion in the medical record. The progress record should summarize changes in the client's abilities and current level of independence and should also estimate the client's potential for further independence, attitude, motivation for ADL training, and future goals for the ADL program. The information about the client's level of assistance needed for ADLs and IADLs will help with the discharge planning. For example, if a client continues to require moderate assistance with self-care, he or she may need to hire a personal care attendant, or the occupational therapist may justify ongoing treatment if the client has potential for further independence.

Assistive Technology and Adaptive Equipment

An assistive technology (AT) device is defined in the Assistive Technology Act of 2004 as "any item, piece of equipment, or product system whether acquired commercially off the shelf, modified, or customized that is used to increase, maintain, or improve functional capabilities of individuals with disabilities."[85] AT surveys administered between 1994 and 1997 showed that 16.6 million Americans with disabilities used special equipment aids or ATs.[93] Using the same survey, Carlson et al.[20] found that 8.3 million of those using ATs indicated that the equipment was used for basic ADLs. The terms *assistive technology, adaptive equipment,* and *assistive devices* are generally used interchangeably throughout the profession. Adaptive equipment is used to compensate for a physical limitation, to promote safety, and to prevent injury. Electronic aids to daily living (EADLs) provide a bridge between an individual with limited function and an electrical device such as a telephone or door operator.[81] Physical limitations necessitating the use of these aids may include a loss of muscle strength, loss of ROM, incoordination, or sensory loss. An example of using adaptive equipment to improve safety is the use of a bed or door alarm to alert a caregiver that a client with impaired cognition and poor balance is getting out of bed or wandering. The use of adaptive equipment to prevent joint injury is indicated for the person with rheumatoid arthritis (eg, an eating utensil with a built-up handle). Occupational therapists in general practice assess the need for and recommend adaptive equipment and technology on a regular basis. OTs can also specialize in this area and obtain further education and certifications, such as Assistive Technology Professional (ATP), a credential granted by the Rehab Engineering and Assistive Technology Society of North America (RESNA) (*http://www.resna.org*).[65]

Before recommending a piece of adaptive equipment, the OT practitioner must complete a thorough assessment to determine the client's functional problems and the causes of the problems. The OT practitioner may also consider other solutions first, before settling on adaptive equipment as the solution. Some practical solutions would be to avoid the cause of the problem, use a compensatory technique or alternative method, get assistance from another person, or modify the environment. Typical of these considerations is the case of Mr. Rojas (discussed in the case study that follows). The environment was adapted, wheelchair positioning and setup were adapted, and compensatory strategies were used, instead of adaptive equipment.

Other factors to consider in the selection of adaptive equipment are whether the disability is short or long term, the client's tolerance for gadgets, the client's feelings about the device, and the cost and upkeep of the equipment

Offering good suggestions and sound advice on improving engagement in occupations is within the domain of OT and is an important responsibility; however, these good qualities, in and of themselves, may not actually mean use of the strategies provided by the therapist. In a study of 154 community-dwelling, functionally vulnerable adults over 70 years old, Chee[23] looked at modifiable factors that can influence the use of adaptive strategies. These adaptive strategies, offered mainly by occupational therapists and physical therapists, comprised environmental strategies (assistive technology, home modifications) or behavioral strategies (energy conservation, performance techniques). The researcher looked at sociodemographic information, functional status, perceived importance of learning new strategies, and degree of readiness to change or adapt to functional decline. “Readiness” was defined as the extent to which a study participant acknowledged a functional deficit and demonstrated or showed a willingness to change or modify the environment. The study's findings concurred with those of other studies; that is, that individuals with a higher stage of “readiness” are more likely to use home environmental adaptations than those who are not ready. Chee suggested that environmental strategy adherence could be improved by enhancing the readiness of older adults through education, problem solving, and more opportunities to practice. The study targeted older adults, but Chee suggested that an intervention process–related variable (eg, readiness) may affect the acceptability of therapeutic strategies offered by therapists to other clinical populations. Another finding was that living arrangements of the participants significantly predicted adherence to behavioral strategies offered. Participants who lived alone demonstrated higher use of prescribed behavioral strategies than those who lived with others.[23]

Case Study

Mr. Rojas

Mr. Rojas is 75 years old and lives in a nursing home. The occupational therapist received a referral for a self-feeding assessment because he has recently lost weight, and the nursing aides have reported that he needs assistance with eating. The nurse mentioned that he thought Mr. Rojas needed a utensil with a built-up handle to feed himself.

The OT assessment included an interview with Mr. Rojas, observation of him eating lunch in his usual location (in his room with the use of an over-bed table), physical assessment (including strength, ROM, sensation, coordination), and gross cognitive and perceptual assessments. Mr. Rojas stated that he would like to be able to feed himself because he likes to eat his food when it is hot, and he likes to be as independent as possible. The results indicated that Mr. Rojas had problems with sitting properly in his wheelchair. The over-bed table was too high and limited his ability to reach the plate. His strength, ROM, coordination, and sensation were within normal limits, except that bilateral shoulder flexors and abductors were F− (3−/5). Mr. Rojas' cognition and perception were adequate to relearn simple self-care tasks.

Treatment involved working on wheelchair positioning, lowering the over-bed table, and then teaching the client how to use a compensatory technique of elbow propping to bring his hand to his mouth during eating. The OT assessment did not indicate a need for adaptive equipment at this time; instead, the environment was adapted, wheelchair positioning modified, and a compensatory method taught.

If the results of the assessment had indicated that Mr. Rojas had a weak grasp or hand incoordination, a utensil with a built-up handle and plate guard might have been used to promote independence with self-feeding.

Specific ADL and IADL Techniques

In many instances specific techniques to solve specific ADL problems are not possible. Sometimes the occupational therapist has to explore a variety of methods or assistive devices to reach a solution. It is occasionally necessary for the therapist to design a special device, method, orthotic, or piece of equipment to make a particular activity possible for the client to perform. Many of the assistive devices available today were first conceived of and made by occupational therapists and clients. Special methods used to perform specific activities also evolved through the trial-and-error approaches of therapists and their clients. Clients often have good suggestions for therapists because they live with the limitation and are confronted regularly with the need to adapt the performance of daily tasks.

The purpose of the following summary of techniques is to give the reader some ideas about how to solve ADL and IADL problems for specific classifications of dysfunction. The focus is on compensatory strategies involving changing the method in which an activity is performed, changing the environment, or using an assistive device. If the client has the potential for improvement of specific deficits, treatment that includes remediation and restoration should be considered. For example, if a client has hand weakness as a result of a fracture of his hand, the therapist may offer alternative methods and adaptive equipment to manage until strength improves, but hand strengthening should also be a component of the treatment program, assuming there are no contraindications. Ideally, every suggestion provided should be actually tried with a client before recommendations are made.

In the following chapter sections, recommended techniques are summarized for individuals with these physical deficits:

- Limited ROM or strength
- Incoordination
- Hemiplegia or use of only one upper extremity
- Paraplegia
- Quadriplegia
- Low vision
- Exceptionally large size body (bariatric population)

These ADLs and IADLs are addressed for each of the physical deficits previously listed:

- Dressing activities
- Feeding activities (eating and swallowing are addressed in Chapter 27)
- Personal hygiene and grooming activities
- Communication management and environmental adaptations
- Functional mobility (transfers and wheelchair mobility are addressed in Chapter 11)
- Home management, meal preparation, and cleanup activities

ADLs for the Person With Limited Range of Motion or Strength

The major problem for persons with limited joint ROM is compensating for the lack of reach and joint excursion through such means as environmental adaptation and assistive devices. Individuals who lack muscle strength may require some of the same devices or techniques to compensate and to conserve energy. Some adaptations and devices are outlined here.[4,68]

Lower Extremity Dressing Activities

1. Use one of many commercially available dressing sticks with a plastic-coated coat hook on one end and a small hook on the other (Fig. 10.7) for pushing and pulling garments (eg, underwear, pants) off and on the feet and legs.

FIG 10.7 Collapsible dressing stick. (Courtesy North Coast Medical, Gilroy, CA.)

2. To put on socks, use one of many different commercially available models of sock aides (Fig. 10.8). To take off socks, use a reacher (Fig. 10.9) or dressing stick (see Fig. 10.7).

FIG 10.8 Easy-Pull Sock Aid. (Courtesy North Coast Medical, Gilroy, CA.)

FIG 10.9 Extended-handle reacher. (Courtesy North Coast Medical, Gilroy, CA.)

3. Eliminate the need to bend to tie shoelaces or to use finger joints in this fine motor activity by using elastic shoelaces or other adapted shoe fasteners (eg, Velcro-fastened shoes or secure slip-on shoes).

4. Use reachers (see Fig. 10.9) to pick up socks and shoes, arrange clothes, remove clothes from hangers, pick up objects on the floor, and put on and take off pants.

Upper Extremity Dressing Activities

1. Use front-opening garments that are one size larger than needed and made of fabrics that have some stretch.

2. Use dressing sticks (see Fig. 10.7) to push a shirt or blouse over the head.

3. Use larger buttons or zippers with a loop on the pull-tab.

4. Replace buttons, snaps, and hooks and eyes with Velcro or zippers (clients who cannot manage traditional fastenings).

5. Use one of several types of commercially available buttonhooks (Fig. 10.10) if finger ROM or strength is limited or unavailable.

FIG 10.10 Buttonhook with built-up handle. (Courtesy North Coast Medical, Gilroy, CA.)

6. A front opening or Velcro replacements for the usual hook-and-eye fasteners may make it easier to put on and remove a bra. Slipover, stretchable bras (which may be called sleep bras or comfort bras) or a bra-slip combination also may eliminate the need to manage fastenings. Regular bras may be fastened in front at waist level, then slipped around to the back and the arms put into the straps, which are then worked up over the shoulders. Bra band extenders may also be suggested. An

ambulatory person with narrow hips, good balance, and leg ROM but poor upper extremity ROM may find it easier to put on a bra by clasping the bra, putting the bra on the floor, stepping into it, and pulling it up over the hips onto the chest.

7. Quilted vests with armhole openings that are large (but not so large they get caught on things) are easier to put on and take off than jackets for those with shoulder ROM limitations.

Feeding Activities

1. Use built-up handles on eating utensils that can accommodate limited grasp or prehension (grip or pinch pattern) (Fig. 10.11).

FIG 10.11 Fork with built-up handle and swivel. (Courtesy North Coast Medical, Gilroy, CA.)

2. Elongated or specially curved handles on spoons and forks may be needed to reach the mouth. A swivel spoon or spoon-fork combination can compensate for limited forearm supination (see Fig. 10.11).

3. Long plastic straws and straw clips on glasses or cups can be used if neck, elbow, or shoulder ROM limits hand-to-mouth motion or if grasp is inadequate to hold the cup or glass.

4. Universal cuffs (Fig. 10.12) or utensil holders can be used if grasp is very limited and built-up handles are not sufficient. Notice that the utensil sleeve is placed so that the tool to be used is put in the palm of the hand, not on the top of the hand.

FIG 10.12 Universal cuff. (Courtesy North Coast Medical, Gilroy, CA.)

5. Plate guards or scoop dishes may be useful to prevent food from slipping off the plate (see Fig. 10.11).

6. Cups with nose cutouts may be useful to persons who have limited neck ROM or who may be wearing a neck brace (Fig. 10.13).

FIG 10.13 Nose cutout tumbler. (Courtesy North Coast Medical, Gilroy, CA.)

Personal Hygiene and Grooming Activities

1. A handheld flexible shower hose for bathing and shampooing hair can eliminate the need to stand in the shower and offers the user control of the direction of the spray. The handle can be built up or adapted for limited grasp.

2. A long-handled bath brush or sponge with a soap holder (Fig. 10.14) or a long cloth scrubber can allow the user to reach the legs, feet, and back. A wash mitt (Fig. 10.15) and soap on a rope can aid limited grasp. For the economically minded, bar soap can be placed in a cutoff leg of light-colored pantyhose and tied to the bath chair to eliminate the need to bend to pick up soap. If reach is limited to wash the hair, a soft rubber brush with extended handle or specially designed long-handled adaptive aid can be used to shampoo the hair.

FIG 10.14 Long-handled brush. (Courtesy Patterson Medical, Warrenville, IL.)

FIG 10.15 Bath mitt. (Courtesy North Coast Medical, Gilroy, CA.)

3. A wall-mounted hair dryer may be helpful. This device is useful for clients with limited ROM, upper extremity weakness, incoordination, or hemiplegia. The dryer is mounted (wall or stand) to allow the user to manage the hair with one arm or to position himself or herself to compensate for limited ROM.[28]

4. Long handles on a comb, brush, toothbrush, lipstick, mascara brush, and safety or electric razor may be useful for clients with limited hand-to-head or hand-to-face movements. Extensions may be constructed from inexpensive wooden dowels or lengths of various diameter polyvinyl chloride (PVC) pipe found in hardware stores. The handles can be built up or adapted for limited grasp.

5. Pump deodorant, hair spray, and spray powder or perfume can extend the reach by the distance the material sprays.

6. Electric toothbrushes and a Water-Pik may be easier to manage than a standard toothbrush; each may need to be adapted for limited grasp.

7. A short reacher (or kitchen tongs) can extend reach for using toilet paper. Several types of toilet aids are available in catalogs that sell assistive devices. Bidets can be used to help with perineal cleansing; more expensive products, such as the Toto Washlet, can help wash (variable temperature settings) and dry the area while providing a warm seat. Squeeze bottles with water may be sufficient for some who have limited ROM to reach the backside to wipe. Products such as the One-Drop Powerful Deodorizer can be a portable way for those with weak pinch strength to get rid of offensive odors.

8. If the shoulder cannot be raised enough to allow removal of hair from the underarms with a razor or wax, an epilator hair removal system (eg, Epilady rechargeable hair remover) can help perform this task.

9. Dressing sticks can be used to pull garments up after the client has used the toilet. An alternative is to use a long piece of elastic or webbing with clips on each end that can be hung around the neck and fastened to pants or panties, preventing them from slipping to the floor during use of the toilet.

10. Safety rails (Fig. 10.16) can be used for bathtub transfers, and safety mats or strips can be placed on the bathtub bottom to prevent slipping.

FIG 10.16 Tub safety rail. (Courtesy North Coast Medical, Gilroy, CA.)

11. A transfer tub bench (see Fig. 10.6), shower stool, or chair set in the bathtub or shower stall can eliminate the need to sit on the bathtub bottom or stand to shower, thus increasing safety.

12. Grab bars can be installed to prevent falls and to ease transfers.

13. Pump dispensers for shampoo, conditioners, and lotions are easier to manage than containers that require lifting and pouring of contents. If containers that require lifting and pouring are used, the contents should be transferred from larger containers to smaller ones, and objects should be placed in an accessible location in the shower.

Communication Management and Environmental Adaptations

1. Extended built-up or lever handles on faucets can accommodate limited grasp.

2. Telephones should be placed within easy reach, or portable phones can be used and kept with the client. A speakerphone or headset may be necessary. Phones with large push buttons or voice-activated phones may be helpful if individual finger movements are difficult or not possible. Cell phones with Bluetooth devices can be used for hands-free, voice-activated answering and calling.

3. Built-up pens and pencils can be used to accommodate limited grasp and prehension. A Wanchik writer (Fig. 10.17) and several other commercially available or custom-fabricated writing aids also can be used.

FIG 10.17 Wanchik writer. (Courtesy North Coast Medical, Gilroy, CA.)

4. Personal computers, word processors, voice recognition computer software, book holders, and electronic books can facilitate communication for those with limited or painful joints.

5. Lever-type doorknob extensions (Fig. 10.18), commercially available lever-style doorknobs, adapted car door openers, doors with push-button combination locks, and adapted key holders can compensate for hand ROM and strength limitations.

FIG 10.18 Doorknob extension. (Courtesy North Coast Medical, Gilroy, CA.)

Functional Mobility

The individual who has limited ROM and may have some generalized weakness, but no significant muscle weakness, may benefit from the following assistive devices.

1. A glider chair that is operated by the feet can facilitate transportation if hip, hand, and arm motion is limited.

2. Platform crutches can prevent stress on hand or finger joints and can accommodate limited grasp. Confer with the physical therapist about this option because platform crutches may increase the weight and size of the walking aid and may actually be a detriment to the client's gait or may increase pressure on the shoulder.

3. Enlarged grips on crutches, canes, and walkers can accommodate limited grasp. Confer with the physical therapist about this option.

4. A raised toilet seat can be used if hip and knee motion is limited.

5. A walker with padded grips and forearm troughs can be used if marked hand, forearm, or elbow joint limitations are present. Confer with the physical therapist about this option.

6. A walker or crutch bag, tray, or basket can facilitate the carrying of objects.

Home Management, Meal Preparation, and Cleanup Activities

Home management activities can be facilitated by a wide variety of environmental adaptations, assistive devices, management, energy conservation methods, and work simplification techniques.[25,99] The principles of joint protection are essential for those with rheumatoid arthritis and other inflammatory joint conditions (see Chapter 38). The following are suggestions to facilitate home management for persons with limited ROM.[49]

1. Store frequently used items on the first shelves of cabinets, just above and below counters or on counters where possible. Eliminate unnecessary items.

2. Use a high, stable stool to work comfortably at counter height, with the feet firmly placed on the ground; or, if a wheelchair is used, attach a drop-leaf table to the wall to create a planning and meal preparation area. Pullout breadboards can also serve as a wheelchair-accessible countertop workspace.

3. Use a utility cart of comfortable height to transport several items at once.

4. Use reachers to get lightweight items (eg, a cereal box) from high shelves. Place frequently used items in the refrigerator and on shelves in cabinets where items are easily accessible and reachable.

5. Stabilize mixing bowls and dishes with nonslip mats.

6. Use lightweight utensils, such as plastic or aluminum bowls and aluminum pots. Use lightweight plates, cups, and other serving containers.

7. Use an electric can opener and an electric mixer.

8. Use electric scissors or adapted loop scissors to open packages (Fig. 10.19B). Avoid using the teeth to rip open packages because this may wear down, weaken, or break the teeth.

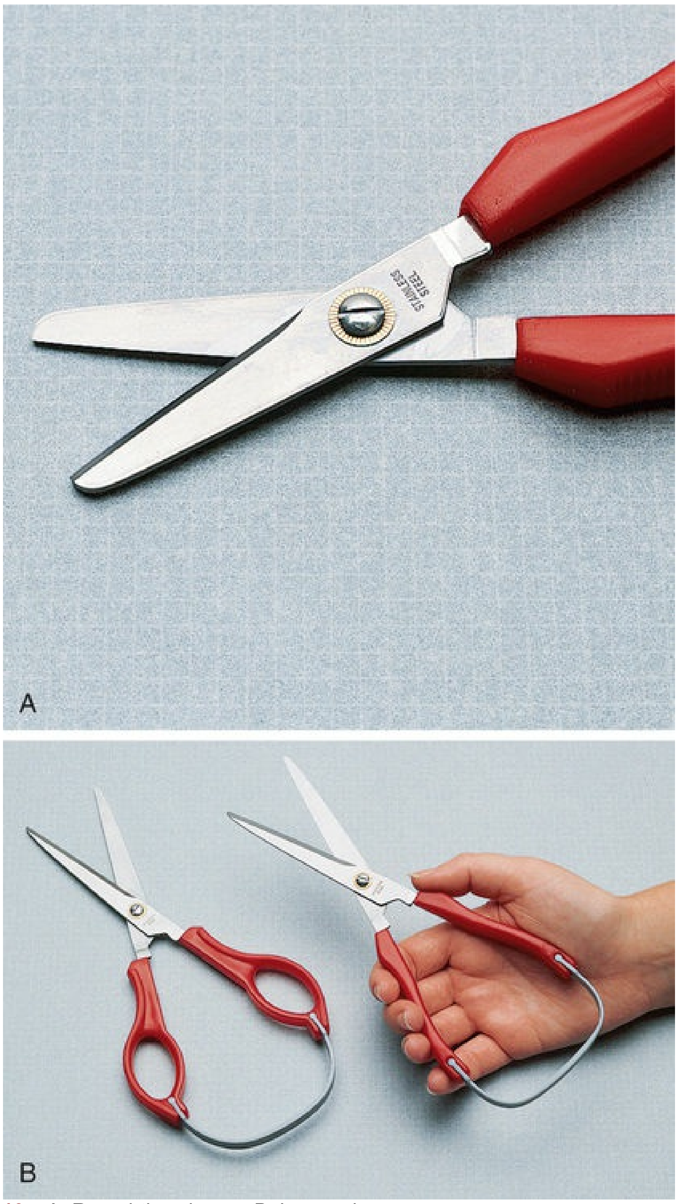

FIG 10.19 A, Round-tip scissors. B, Loop scissors. (Courtesy North Coast Medical, Gilroy, CA.)

9. Eliminate bending by using extended and flexible plastic handles on dust mops, brooms, and dustpans.

10. Use adapted knives for cutting (Fig. 10.20), or consider using precut vegetables and meat for cooking.

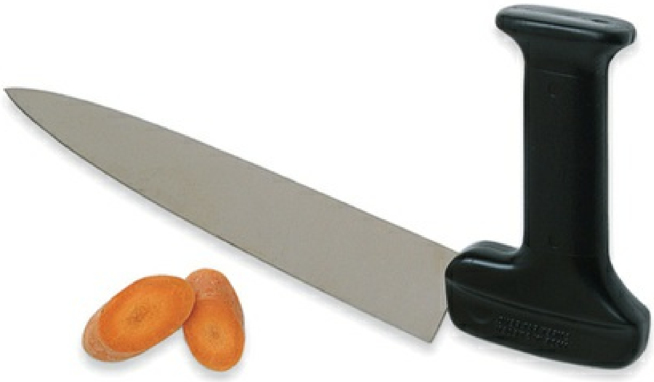

FIG 10.20 Swedish steak knife. (Courtesy North Coast Medical, Gilroy, CA.)

11. Use pullout shelves or lazy Susans to organize cupboards or the refrigerator to eliminate bending and to ease access to items.

12. Eliminate bending by using a wall oven or a countertop toaster oven or microwave oven. When remodeling the kitchen, consider elevating the dishwasher to a convenient height for wheelchair use or for those who have difficulty bending.

13. Use pump dispensers for dish soap instead of dish soap containers with pour spouts, which require lifting and pouring of contents. Ensure that the pump dispenser is not too tall to reach and that the base is stable. Single-use, premeasured, water-soluble dishwasher detergent packets eliminate numerous steps.

14. Use a piece of Dycem or other nonslip material (eg, a piece of puffy shelf liner, a thick rubber band around a jar lid, or jar openers) to open containers. Keep these handy in multiple locations.

15. Eliminate leaning and bending by using a top-loading automatic washer and elevated dryer. Alternatively, mount front-loading washers and dryers on an elevated platform. Wheelchair users or people of shorter stature can benefit from front-loading appliances. Use a reacher or other extended tool (eg, tongs or even a small bamboo rake) to remove clothes from the washer or dryer. Place smaller items in net bags for ease of retrieval from the machines.

16. Use an adjustable ironing board to make it possible to sit while ironing, or eliminate ironing by choosing permanent press clothing or wrinkle-free material.

17. For child care, elevate the playpen and diaper table and use a bathinette (portable folding baby bathtub) or a plastic tub on the kitchen counter for bathing to reduce the amount of bending and reaching by the ambulatory parent. The crib mattress can be in a raised position until the child is 3 or 4 months of age.

18. Use slightly larger and looser fitting garments with Velcro fastenings on children.

19. Use a reacher to pick up items from the floor. For individuals without hand function, investigate the Cripper, a reaching device designed for people with quadriplegia who have use of wrist extensors, elbow flexors, and shoulder musculature (Fig. 10.21).

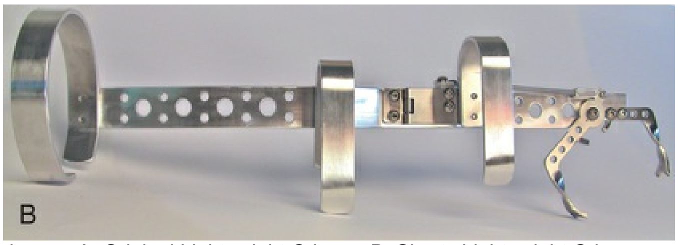

FIG 10.21 Crippers. A, Original Lightweight Cripper. B, Shorty Lightweight Cripper. (Courtesy Quadtools, Camino, CA.)

20. Use a lightweight comforter instead of a top sheet and blanket to increase the ease of making the bed.

ADLs for the Person With Incoordination

Incoordination in the form of tremors, ataxia, and athetoid or choreiform movements can be caused by a variety of central nervous system (CNS) disorders, such as Parkinson's disease, multiple sclerosis, cerebral palsy, Friedreich's ataxia, Huntington's disease, and head injuries. The major problems encountered in ADL performance are safety and adequate stability of gait, body parts, and objects to complete the tasks.[43]

Fatigue, stress, emotional factors, and fear may influence the severity of incoordinated movement. The client must be taught appropriate fatigue management techniques, along with appropriate work pacing and safety methods to prevent the fatigue and apprehension that could increase incoordination and affect performance (see Chapter 35, Section 3).[49]

Stabilizing the trunk and arm reduces some of the incoordination and may allow the individual to improve occupational performance.[38] Propping the elbow on a counter or tabletop, pivoting from the elbow, and moving only the forearm, wrist, and hand in the activity can help provide some stability to the arm when in use. When muscle weakness is not a major deficit for the individual with incoordination, the use of weighted devices can help with stabilization of objects. Use of weights on the wrists by those with intention tremors due to static brain lesions has been found to provide some functional improvement in self-feeding.[56] A Velcro-fastened weight can be attached to the client's arm or to the back of the client's hand to reduce ataxia, or the device being used (eg, eating utensils, pens, and cups) can be weighted.

Dressing Activities

To prevent falls, the client should attempt to dress while sitting on a sturdy surface (eg, a chair with arms and a back) with the feet planted firmly on floor, or in a wheelchair with the wheels locked. The following adaptations can reduce dressing difficulties.

1. Front-opening garments that fit loosely can facilitate the process of putting on and removing garments.

2. Large buttons, Velcro closures, and zippers with loops on the tab are fasteners that are easier to open and close. A buttonhook with a large, weighted handle may be helpful.

3. Elastic shoelaces, Velcro fasteners, other adapted shoe closures, and slip-on shoes eliminate the need for bow tying.

4. Slacks with elastic tops for women or Velcro closures for men are easier to manage than slacks with hooks, buttons, and zippers.

5. Bras with a front opening or Velcro replacements for the usual hook-and-eye fasteners may be easier to put on and take off. A slipover, stretch bra or bra-slip combination also may eliminate the need to manage bra fastenings. Regular bras may be fastened in front at waist level, then slipped around to the back and the arms put into the straps, which are then worked up over the shoulders.

6. When hand function or dexterity is impaired or absent, clip-on ties can be used, as can claspless necklaces that slip over the head and stretchable beaded bracelets.

Feeding Activities

Feeding can be a challenge for clients with problems of incoordination. Lack of control during eating is not only frustrating, it can also cause embarrassment and social rejection. As mentioned previously, some evidence indicates that the use of weights on the wrist may increase functional ability in feeding.[56] It is important to make eating safe, pleasurable, and as neat as possible. Here are some suggestions for achieving this goal.

1. Use plate stabilizers, such as nonskid mats (Dycem), suction bases, or even damp dishtowels.

2. Use a plate guard or scoop dish to prevent food from being pushed off the plate. The plate guard can be clipped to any ordinary dinner plate, so the client can use it when away from home (Fig. 10.22).

FIG 10.22 Plate guard. (Courtesy Patterson Medical, Warrenville, IL.)

3. Prevent spills during the plate-to-mouth excursion by using weighted or swivel utensils for stability. Weighted cuffs may be placed on the forearm, or a glove with weights can be placed on the back of the hand, to reduce involuntary movement.

4. Use long plastic straws with a straw clip on a glass, or use a cup with a weighted bottom to eliminate the need to carry the glass or cup to the mouth, thus avoiding spills. Plastic cups with covers, one or two handles, and spouts may be used for the same purpose (Fig. 10.23). Having more than one cup designed for different drinks at a meal promotes independence and saves time and effort for the individual and caregivers.

FIG 10.23 Cup adaptors. (Courtesy Patterson Medical, Warrenville, IL.)

5. Use a resistance or friction feeder similar to a mobile arm support to help control patterns of involuntary movement during the feeding activities of adults with cerebral palsy and athetosis. These devices may help many clients with severe incoordination to achieve some degree of independence in feeding. The device is available in adaptive equipment catalogs and is listed as a Friction Feeder MAS (Mobile Arm Support) Kit (see Chapter 30, Section 2).

6. Use a mechanical self-feeding device that turns the plate, scoops the food, and brings it to the mouth. Several models are available.

Personal Hygiene and Grooming Activities

Stabilization and handling of toilet articles may be achieved by having the client use the following measures.

1. Articles such as a razor, lipstick, or toothbrush may be attached to a cord if frequent dropping is a problem. An electric toothbrush may be more easily managed than a manual one. It is important to check the weight, operating mechanisms, and other properties of recommended devices to determine whether the client can manage safely.

2. Weighted wrist cuffs may be helpful during the finer hygiene activities, such as hair care, shaving, and applying makeup.

3. A wall-mounted (or stand-mounted) hair dryer (described earlier for clients with limited ROM) can also be useful for clients with incoordination.[28]

4. An electric razor offers more stability and safety than a blade razor. A strap around the razor and hand can prevent dropping.

5. A suction brush attached to the sink or counter can be used for nail or denture care (Fig. 10.24).

FIG 10.24 Suction denture brush. (Courtesy North Coast Medical, Gilroy, CA.)

6. Bar soap could be on a rope. It can be worn around the neck or hung over a bathtub or shower fixture during bathing to keep it within easy reach. A bath mitt with a pocket to hold the soap can be used for washing to eliminate the need for frequent soaping and rinsing and wringing a washcloth. A leg from a pair of light-colored panty hose (which can stretch for use) with a bar of soap in the toe may be tied over a faucet or on a bath chair to keep soap within reach. Liquid soap with a soft nylon scrubber may be used to minimize the handling of soap. Bath gloves can be worn, and liquid soap that is not too slippery can be applied to eliminate the dropping of soap bars and washcloths.

7. An emery board or small piece of wood with fine sandpaper glued to it can be fastened to the tabletop for filing nails. A nail clipper can be stabilized in the same manner.

8. Large solid deodorants are preferable to sprays.

9. Sanitary pads that stick to undergarments may be easier to manage than tampons.

10. Nonskid mats should be used inside and outside the bathtub during bathing. Their suction bases should be fastened securely to the floor and bathtub before use. Safety grab bars should be installed on the wall next to the bathtub, or one could also be fastened to the edge of the bathtub. A bathtub seat or shower chair or bench with backrest could be used. Sponge bathing while seated at a bathroom sink may be substituted for bathing or showering several times a week.

Communication Management and Environmental Adaptations

1. Doorknobs may be managed more easily if replaced or adapted with lever-type handles or covered with rubber or friction tape (see Fig. 10.18).

2. Large-button phones, speakerphones, or using a headset as a telephone receiver may be helpful.

Operator assistance services for dialing may be implemented.

3. Mobile phones or smart phones should be selected based on need for larger key pads and voice dialing capabilities.

4. Writing may be managed by using a weighted, enlarged pencil or pen. A personal computer with a keyboard guard is a helpful aid to communication. A computer mouse may frequently be substituted for the keyboard. A voice recognition program may be used with a personal computer to minimize use of the keyboard or mouse. Most computers have “accessibility” features as a choice on the control panels. These features allow for adjustments such as reducing the sensitivity of the keys to eliminate redundancy of keystrokes and reducing the sensitivity of the mouse.

5. Keys may be managed by placing them on an adapted key holder that is rigid and offers more leverage for turning the key. Inserting the key into the keyhole may be difficult, however, unless the incoordination is relatively mild. Locks for cars and homes can be modified with keypads or electronic door openers.

6. Extended lever-type faucets are easier to manage than knobs that turn and push-pull spigots. To prevent burns during bathing and kitchen activities, the person with incoordination should turn the cold water on first and add hot water gradually. The thermostat on the water heater can be turned down to a safe level or shower heads and tub spigots replaced with models that have a built-in shutoff valve to prevent scalding.

7. Lamps that can be turned on and off with a wall switch, a signal-type device, by motion, or by touch can eliminate the need to turn a small switch. Lights can also be programmed to turn on at specific times of the day if a timer is attached.

Functional Mobility

Clients with problems of incoordination may use a variety of adaptive aids, depending on the type and severity of incoordination. Clients with degenerative diseases sometimes need help recognizing the need for and accepting mobility and ambulation aids; the OT must consult with the physical therapist about devices for gait. The following suggestions can improve stability and mobility for clients with incoordination.

1. Instead of lifting objects, slide them on floors or counters.

2. Use suitable ambulation aids (eg, cane, crutches, or walker) based on suggestions by a physical therapist.

3. Use a utility cart, preferably a heavy, sturdy cart that has some friction on the wheels.

4. Remove doorsills or thresholds, throw rugs, and thick carpeting.

5. Install railings on indoor and outdoor staircases.

6. Substitute ramps for stairs wherever possible.

7. Use a bed transfer handle (or railing) to assist with bed mobility and transfers.

8. Use a wheelchair for indoors or outdoors if upright ambulation is deemed unsafe. Either the OT or the physical therapist may assist in accurate selection, depending on the facility.

Home Management, Meal Preparation, and Cleanup Activities

It is important for the occupational therapist to carefully assess performance of homemaking activities to determine which activities can be done safely, which can be done safely if modified or adapted, and which cannot be done adequately or safely and should be assigned to someone else. Major areas to consider are stabilization, handling and moving of objects and hot items, and use of tools, especially sharp ones. Potential problems need to be addressed to prevent spills, accidents, and injuries such as cuts, burns, bruises, electric shock, and falls. The following are suggestions for performing home management tasks safely.[49]

1. Use a wheelchair and wheelchair lapboard, even if ambulation is possible with devices. The wheelchair saves energy and increases stability if balance and gait are unsteady. Some people with upper extremity incoordination who do not want a lap tray find it safer to place a plastic tray on their laps (when stationary) while performing tasks with their hands.

2. If possible, use convenience and prepared foods to eliminate as many processes as possible (eg, peeling, chopping, slicing, and mixing). Prewashed salads are also now available.

3. Use easy-open containers, or store foods in plastic containers once the original container has been opened. A jar opener is also useful.

4. Use heavy utensils, mixing bowls, and pots and pans to increase stability.

5. Use nonskid mats on work surfaces.

6. Consider using electrical appliances such as crock pots, indoor plate grills, electric fry pans, an electric water heater, toaster ovens, and microwave or countertop convection ovens because they can be safer than using a range-top stove. Safe cleanup of the appliances needs to be strongly considered because appliances such as crock pots are very heavy. Automatic shutoff devices would be safer.

7. Use a blender and stand mixer because they are safer than handheld mixers and easier than mixing with a spoon or whisk. Cleanup needs to be considered because blenders and stand mixers may be heavy or difficult to clean or may have sharp parts.

8. If possible, adjust the work heights of counters, the sink, and the range to minimize leaning, bending, reaching, and lifting, whether the client is standing or using a wheelchair.

9. Use long oven mitts, which are safer than potholders.

10. Use pots, pans, casserole dishes, and appliances with two handles because they may be easier to manage than those with one handle.

11. Use an adapted cutting board with side rails (Fig. 10.25) to stabilize meats and vegetables while cutting. The bottom of the board should have suction cups or should be covered with stair tread, or the board should be placed on a nonskid mat to prevent slipping during use.

FIG 10.25 Cutting board. (Courtesy Patterson Medical, Warrenville, IL.)

12. Use heavy dinnerware, which may be easier to handle because it offers stability and control to the distal part of the upper extremity. On the other hand, unbreakable dinnerware may be more practical if dropping and breakage are problems.

13. Cover the sink, utility cart, and countertops with protective rubber mats or mesh matting to stabilize items.

14. Use a serrated knife for cutting and chopping because it can be easier to control.

15. Use a steamer basket or deep-fry basket for preparing boiled or fried foods to eliminate the need to carry and drain pots containing hot liquids.

16. Use tongs to turn foods during cooking and to serve foods because tongs may offer more control and stability than a fork, spatula, chopsticks, or serving spoon.

17. Use blunt-ended loop scissors to open packages.

18. Vacuum with a heavy, upright cleaner, which may be easier for the ambulatory client. The wheelchair user may be able to manage a lightweight tank-type vacuum cleaner or electric broom.

19. Use dust mitts for dusting. Consider eliminating breakable knickknacks, unstable lamps, and other objects to minimize the dusting required.

20. Eliminate ironing by using permanent press fabrics or a timed dryer or by assigning this task to other members of the household. Lower the ironing board so that the task can be accomplished from a seated position.

21. Use a front-loading washer, a laundry cart on wheels, and premeasured detergents, bleaches, and fabric softeners.

22. Sit when working with an infant and use foam rubber bath aids, an infant bath seat, and a wide, padded dressing table with Velcro safety straps to achieve enough stability for bathing, dressing, and diapering an infant. Some childcare tasks may not be possible if the incoordination is severe.

23. Use disposable diapers with tape or Velcro fasteners because they are easier to manage than cloth diapers and pins and also require less frequent changing.

24. Do not feed the infant with a spoon or fork unless the incoordination is very mild or does not affect the upper extremities. This task may need to be performed by another household member.

25. Children's clothing should be large, loose, and made of nonslippery stretch fabrics and have Velcro fastenings.

26. Use front infant carriers or strollers for carrying.

ADLs for the Person With Hemiplegia or Use of Only One Upper Extremity

Suggestions for performing daily living skills apply to persons with hemiplegia due to brain injury and also to those with conditions such as unilateral upper extremity amputation, fractures, rotator cuff injuries, adhesive capsulitis, burns, and peripheral neuropathic conditions that can result in the dysfunction of one upper extremity.

The client with hemiplegia due to conditions such as CVA, brain injury, or other conditions that affect the brain may have greater difficulty learning and performing one-handed skills than do those with orthopedic or lower motor neuron dysfunction and may need specialized methods of teaching. The client with normal perception and cognition and the use of only one upper extremity may learn the techniques quickly and easily.

In a client with hemiplegia due to brain injury, the trunk and leg may be involved, and static or dynamic balance difficulties may exist in both seated and standing positions. Sensory, visual, perceptual, cognitive, and speech disorders may be present in a mild to severe degree. These disorders may profoundly affect the ability to learn and retain information and to carry over techniques into functional tasks, especially if inattention or neglect of one side of the body is present. Any type of apraxia (eg, difficulty with motor planning, using objects), which is sometimes seen in this group of clients, can also have a profound effect on the potential for relearning different ways to perform once familiar tasks. These clients need to be assessed for sensory, perceptual, and cognitive deficits to determine the potential for ADL performance and to establish appropriate teaching methods to facilitate learning.

The following sections present primarily adaptive techniques rather than restorative techniques. However, it is important to incorporate the upper extremity with hemiplegia to assist in returning function to the extremity. Waddell et al.[94] conducted a study of 15 clients in an inpatient rehabilitation facility who had had a CVA and consequently had UE paresis. These individuals were provided high-repetition, task-specific training in the affected extremity. The researchers found that the clients' UE function had improved enough to allow an OT to devise a treatment plan that provided both adaptive strategies and an intensive focus on restorative strategies.

Research also has shown promise of improved function in the affected extremity with constraint-induced movement therapy (CIMT); the unaffected UE is purposefully constrained to force the client to use the affected UE, when applied in original and modified forms. Hayner et al.[42] found that constraint of the unaffected extremity, in combination with "intrusive cueing" of bilateral use of UEs, may lead to improvement in motor function of the affected extremity.

Major problems for the individual who is newly one-handed, either permanently or temporarily, include reduction of work speed and dexterity, difficulty stabilizing objects in tasks that require both hands, and learning to use the normally nondominant hand to perform tasks that the dominant hand had previously performed. Occupational therapists have an important role in helping such individuals use adaptive strategies to perform occupations in ways that maximize safety and independence.

Dressing Activities

General setup.

If balance is a problem, the client should dress while seated in a locked wheelchair or sturdy armchair. Clothing should be within easy reach. Assistive devices should be used minimally for dressing and other ADLs. Compensatory techniques are preferable to using unnecessary devices. That said, a reacher may be helpful for securing articles and assisting in some dressing activities.

The following one-handed dressing techniques can facilitate dressing for persons who can use only one upper extremity. A general rule for putting on clothing is to begin with the affected arm or leg; start with the unaffected extremity when removing clothing. The following list summarizes the general setup.

- Begin by using a sturdy chair or wheelchair and progress to more difficult surfaces (eg, higher, lower, softer, or more unstable—yet safe—surfaces).
- Keep clothing within easy reach, and keep adaptive equipment set up and within reach.
- Support the feet (or foot) on floor or some other sturdy surface.
- Usually, maintain the body in the upright and midline positions, depending on the task.
- The therapist usually is positioned on the affected side or in the midline or front.

Shirts.

Any of the three following methods can be used to manage front-opening shirts. The first method can also be used for jackets, robes, sweaters, and front-opening dresses.

Method 1.

This method also works well with individuals who have decreased shoulder ROM or pain in the shoulders.

Donning a shirt

1. Grasp the shirt collar with the stronger hand and shake out any twists (Fig. 10.26A).

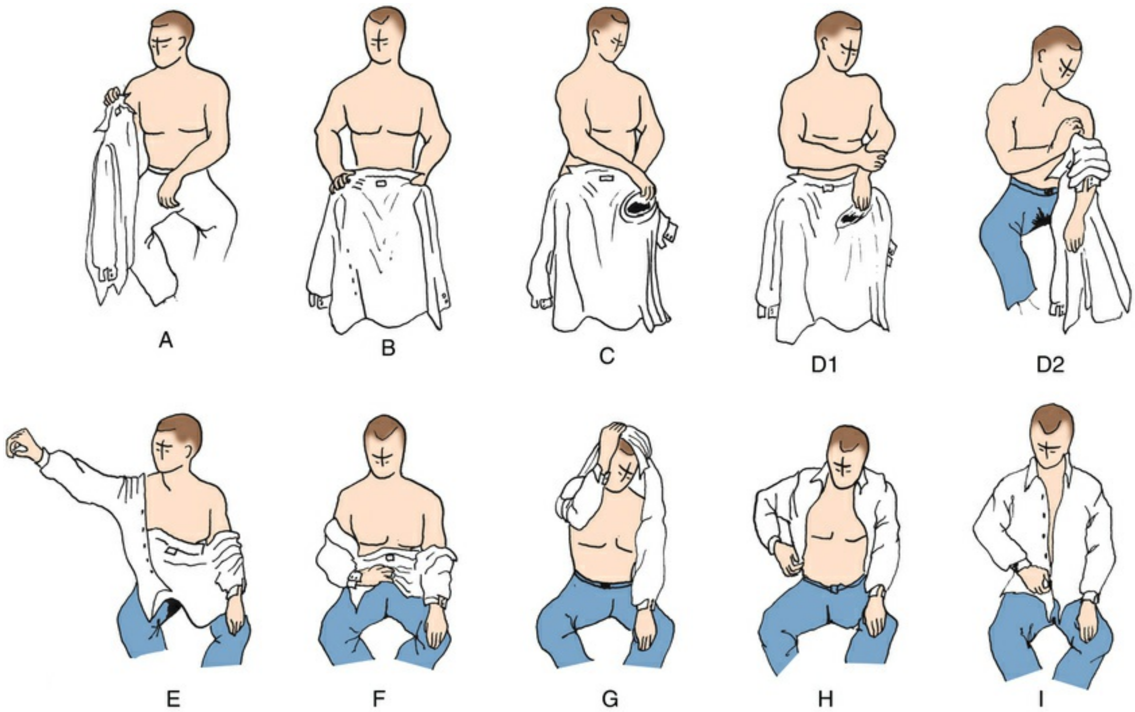

FIG 10.26 Steps in donning a shirt—method 1. (Courtesy Christine Shaw, Metro Health Center for Rehabilitation, Metro Health Medical Center, Cleveland, OH.)

2. Position the shirt on the lap with the inside up and the collar toward the chest (Fig. 10.26B).

3. Position the sleeve opening on the affected side so that the opening is as large as possible and close to the affected hand, which is resting on the lap (Fig. 10.26C).

4. Using the stronger hand, place the affected hand in the sleeve opening and work the sleeve over the elbow by pulling on the garment. Make sure the affected hand is visible through the sleeve before proceeding to the next step (Fig. 10.26D1–D2).

5. Put the stronger arm into its sleeve and raise the arm to slide or shake the sleeve into position past the elbow (Fig. 10.26E).

6. With the stronger hand, gather the shirt up the middle of the back from hem to collar and raise the shirt over the head (Fig. 10.26F).

7. Lean forward, duck the head, and pass the shirt over the head (Fig. 10.26G).

8. With the stronger hand, adjust the shirt by leaning forward and working the shirt down past both shoulders. Reach in back and pull the shirttail down (Fig. 10.26H). Adjust the shirt so that it is smooth, any wrinkles have been removed, and the sleeve is properly positioned on the shoulders and arms. (A person with hemiplegia may not have the sensation, cognition, or vision to realize that a shirt needs adjustment.)

9. Line up the two sides of the shirt front for buttoning and begin with the bottom button (Fig. 10.26I). Button the sleeve cuff of the affected arm. The sleeve cuff of the stronger arm may be prebuttoned if the cuff opening is large. A button may be sewn on with elastic thread or sewn onto a small tab of elastic and fastened inside the shirt cuff (commercially available button extenders can be found in the adaptive equipment catalogs). A small button attached to a crocheted loop of elastic thread is another option. Slip the button on the loop through the buttonhole in the garment so that

the elastic loop is inside. Stretch the elastic loop to fit around the original cuff button. This simple device can be transferred to each garment and positioned before the shirt is put on. The loop stretches to accommodate the width of the hand as it is pushed through the end of the sleeve.

Removing a shirt

1. Unbutton the shirt.

2. Lean forward.

3. With the stronger hand, grasp the collar, or gather up the material in back from collar to hem.

4. Lean forward, duck the head, and pull the shirt over the head.

5. Remove the sleeve from the stronger arm first, then from the affected arm.

Method 2

Donning a shirt

1. Clients who get their shirts twisted or have trouble sliding the sleeve down onto the stronger arm can use method 2. Position the shirt as described in method 1, steps 1 to 3.

2. With the stronger hand, place the involved hand into the sleeve opening and work the sleeve onto the hand and forearm, but do not pull it all the way up over the elbow.

3. With the stronger arm, reach for the shirt from behind and wrap the shirt around the back. Put the stronger arm into the sleeve, and bring the arm out to the side (about 180 degrees of abduction) to get the shirt on. Tension on the fabric from the stronger arm to the wrist of the affected arm will bring the sleeve into position.

4. Lower the arm and work the sleeve on the affected arm up over the elbow.

5. Continue as in steps 6 through 9 of method 1.

Removing a shirt (one sleeve off at a time)

1. Unbutton the shirt.

2. With the stronger hand, push the shirt off the shoulders, first on the affected side and then on the stronger side.

3. Pull off the cuff of the stronger side with the stronger hand.

4. Work the sleeve off by alternately shrugging the shoulder, shaking the arm, and working the sleeve off the stronger arm.

5. Lean forward, bring the shirt around the back, and pull the sleeve off the affected arm.

Method 3

Donning a shirt

1. Position the shirt and work it onto the arm as described in method 1, steps 1 to 4.

2. Pull the sleeve on the affected arm up to the shoulder (Fig. 10.27A). The affected hand should be visible through the sleeve before the next step is done.

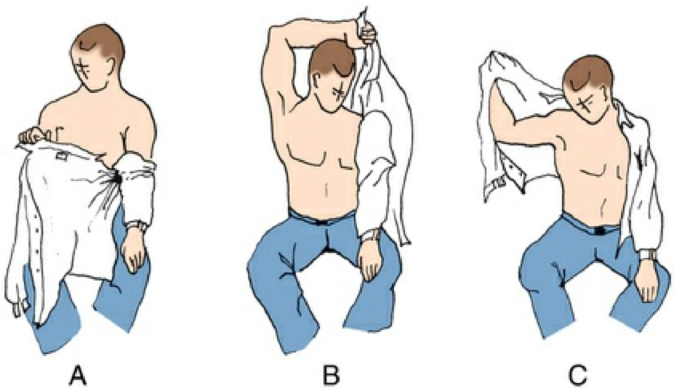

FIG 10.27 Steps in putting on a shirt—method 3. (Courtesy Christine Shaw, Metro Health Center for Rehabilitation, Metro Health Medical Center, Cleveland, OH.)

3. With the stronger hand, grasp the tip of the collar on the stronger side, lean forward, and bring the arm over and behind the head, to wrap the shirt around to the stronger side (Fig. 10.27B).

4. Put the stronger arm into the sleeve opening, directing the arm up and out (Fig. 10.27C).

5. Adjust the shirt and button it as described in method 1, steps 8 and 9.

Removing a shirt.

The shirt may be removed using the procedure described for method 2.

Variation—donning a pullover shirt

1. Position the shirt on the lap, with the bottom of the shirt toward the chest and the label and front of the shirt facing down.

2. With the stronger hand, roll the bottom edge of the back of the shirt up to the sleeve on the affected side.

3. Position the sleeve opening so that it is as large as possible, and use the stronger hand to place the affected hand into the sleeve opening. While sitting upright, pull the shirt sleeve up onto the weaker arm past the elbow. Or, bend forward at the hips so that gravity can assist in placing the arm into the sleeve until the hand emerges from the cuff. Then, sit up and pull the sleeve onto the weaker arm past the elbow.

4. Insert the stronger arm into the sleeve.

5. Adjust shirt on the affected side up and onto the shoulder.

6. Gather the shirt back with the stronger hand, lean forward, duck the head, and pass the shirt over the head.

7. Adjust the shirt. Make sure it is adjusted properly on the shoulders and in the front and back.

Variation—removing a pullover shirt

1. Gather up the shirt with the stronger hand, starting at the top back.

2. Lean forward, duck the head, and pull the gathered back fabric over the head.

3. Remove the shirt from the stronger arm and then from the affected arm.

Trousers.

Trousers may be managed by one of the following methods, which may be adapted for shorts and women's panties. For some people, a well-constructed button fly front opening may be easier to manage than a zipper. Velcro may be used to replace buttons and zippers. Trousers should be worn in a size slightly larger than that worn previously and should have a wide opening at the ankles. They should be put on after the socks have been put on, but before the shoes are put on. If the client is dressing in a wheelchair, the feet should be placed flat on the floor, not on the footrests of the wheelchair.

Method 1

Donning trousers

1. Sit in a sturdy armchair or in a locked wheelchair (Fig. 10.28A).

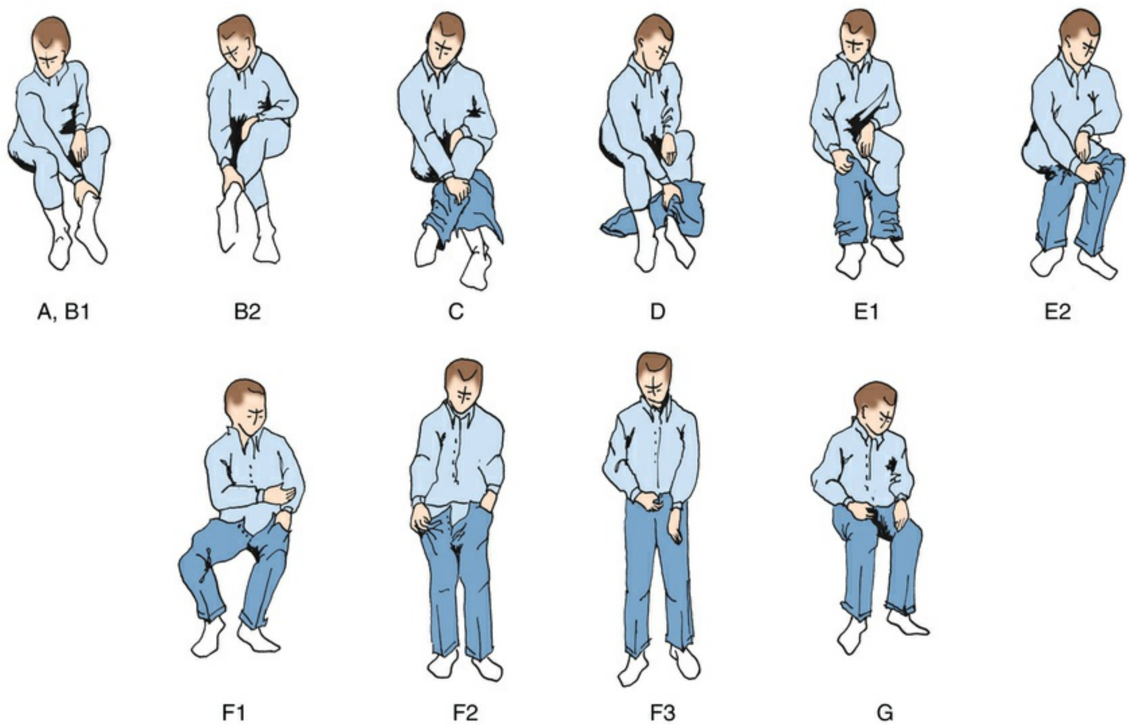

FIG 10.28 Steps in putting on trousers—method 1. (Courtesy Christine Shaw, Metro Health Center for Rehabilitation, Metro Health Medical Center, Cleveland, OH.)

2. Position the stronger leg in front of the midline of the body with the knee flexed to 90 degrees. Using the stronger hand, reach forward and grasp ankle of affected leg or sock around ankle (Fig. 10.28B1). Lift the affected leg over the stronger leg to crossed position (Fig. 10.28B2).

3. Slip the trousers up the affected leg to a point where the foot is completely inside the trouser leg (Fig. 10.28C). Do not pull the trousers above the knee, or it will be difficult to insert the stronger leg.

4. Uncross the affected leg by grasping the ankle (or the portion of sock around the ankle) (Fig. 10.28D). Do not allow the affected leg to just drop because this can cause injury.

5. Insert the stronger leg and work the trousers up onto the hips as far as possible (Fig. 10.28E1–E2).

6. To prevent the trousers from dropping while pulling them over the hips, place the affected hand in the pocket or place one finger of the affected hand into a belt loop (this is an optional technique). If able to do so safely, stand and pull the trousers over the hips (Fig. 10.28F1–F2). This step may take more time and effort, but it is a tip that may prove useful for some.

7. If standing balance is good, remain standing to pull up zipper or to button (Fig. 10.28F3). Sit down to button front (Fig. 10.28G).

Removing trousers

1. Unfasten trousers and work them down the hips as far as possible while seated.

2. Stand, letting the trousers drop past the hips, or work them down past the hips.

3. Remove the trousers from the stronger leg first.

4. Sit and cross the affected leg over the stronger leg, remove the trousers, and uncross the leg.

Method 2

Donning trousers.

Method 2 is used in three situations: (1) for a client sitting in a wheelchair with the brakes locked, the footrests swung away, the feet on the ground, and the wheelchair anti-tips in place; (2) for a client sitting in a sturdy, straight-backed armchair that is positioned with the chair back against the wall; and (3) for a client who cannot stand independently. This method is not recommended for clients who cannot safely extend (bridge) the hips up; those who have severe sensory or perceptual deficits in the affected extremity; those with poor safety judgment and impulsivity control; or those who have a tendency to tip the wheelchair backward.

1. Position the trousers on the legs as in method 1, steps 1 through 5.

2. Elevate the hips by leaning back against the chair and pushing down against the floor with the stronger leg. As the hips are raised, work the trousers over them with the stronger hand.

3. Lower the hips back into the chair and fasten the trousers.

Removing trousers

1. Unfasten the trousers and work them down on the hips as far as possible while sitting.

2. Lean back against the chair, push down against the floor with the stronger leg to elevate the hips, and use the stronger arm to work the trousers down past the hips.

3. Proceed as in method 1, steps 3 and 4.

Method 3

Donning trousers.

Method 3 is used for clients in a recumbent position. It is more difficult to perform than the seated methods. If possible, the head of the bed should be raised to a semireclining position for partial sitting.

1. Using the stronger hand, place the affected leg in a bent position and cross it over the stronger leg, which may be partially bent to prevent the affected leg from slipping.

2. Position the trousers and work them onto the affected leg first, up to the knee. Then uncross the leg.

3. Insert the stronger leg and work the trousers up onto the hips as far as possible.

4. This step may be easier if the bed is flat. With the stronger leg bent, press down with the foot and shoulder to elevate the hips from the bed. With the stronger arm, pull the trousers over the hips, or work the trousers up over the hips by rolling from side to side. If bridging (hips off the bed) is difficult or not possible, the bed should be positioned flat, both knees can be bent, and the client can roll from side to side to hike the pants up over the hips.

5. Fasten the trousers.

Removing trousers

1. In bed, hike the hips by bridging (see Putting on trousers, method 3, step 4). Or, if bridging is not possible or is difficult, position the bed flat, bend the knees, and roll side to side to remove the pants from the hips.

2. Work the trousers down past the hips by bending the knees and rolling side to side; remove the pants first from the stronger leg and then from the affected leg.

Bra

Donning a bra

1. Tuck one end of the bra into the pants, girdle, or skirt waistband and wrap the other end around the waist (wrapping toward the affected side may be easiest). Hook the bra in front at waist level and slip the fastener section around to the back (at waistline level).

2. Place the affected arm through its shoulder strap; then place the stronger arm through the other strap.

3. Work the straps up over the shoulders. Pull the strap on the affected side up over the shoulder with the stronger arm. Put the stronger arm through its strap and work the strap up over the shoulder by directing the arm up and out and pulling with the hand.

4. Use the stronger hand to adjust the breasts in the bra cups.

Note: It is helpful if the bra has elastic straps and is made of stretch fabric. If there is some function in the affected hand, a fabric loop may be sewn to the back of the bra near the fasteners. The affected thumb may be slipped through the loop to stabilize the bra while the stronger hand fastens it. All-stretch bras, prefastened or without fasteners, may be put on by adapting method 1 for pullover shirts, described previously. For clients with some gross arm function, front-opening bras may be adapted with a loop for the affected hand.

Removing a bra

1. Slip the straps down off the shoulders, stronger side first.

2. Work the straps down over the arms and off the hands.

3. Slip the bra around to the front with the stronger arm.

4. Unfasten the bra and remove it.

Necktie

Putting on a necktie.

Clip-on neckties are convenient. If a conventional tie is used, the following method is recommended.

1. Place the collar of the shirt in the “up” position. Bring the necktie around the neck and adjust it so that the smaller end is at the desired length when the tie is completed.

2. Fasten the small end to the shirt front with a tie clasp or spring-clip clothespin.

3. Loop the long end of the tie around the short end (one complete loop) and bring it up the middle of the **V** at the neck. Then bring the tip down through the loop at the front and adjust the tie, using the ring and little fingers to hold the tie end, and the thumb and forefingers to slide the knot up tightly.

Removing a necktie

1. Pull the knot at the front of the neck until the small end slips up enough for the tie to be slipped over the head.

2. The tie may be hung up in this state. To put it on again, slip it over the head, position it around the upturned collar, and tighten the knot as described in step 3 of the preceding section.

Socks or stockings

Donning socks or stockings

1. Sit in a straight-backed armchair or in a wheelchair with the brakes locked, the feet on the floor, and the footrests swung away.

2. With the stronger leg directly in front of the midline of the body, cross the affected leg over the stronger leg.

3. Open the top of the stocking by inserting the thumb and first two fingers near the cuff and spreading the fingers apart.

4. Work the stocking onto the foot before pulling it over the heel. Care should be taken to eliminate wrinkles.

5. Work the stocking up over the leg. Shift the weight from side to side to adjust the stocking around the thigh.

6. Thigh-high stockings with an elastic band at the top are often an acceptable substitute for pantyhose, especially for the nonambulatory individual.

7. Pantyhose may be put on and taken off as for a pair of slacks, except that the legs are gathered up one at a time before the feet are placed into the leg holes.

Removing socks or stockings

1. Work the socks or stockings down as far as possible with the stronger arm.

2. Cross the affected leg over the stronger one as described in step 2 of the preceding section.

3. Remove the sock or stocking from the affected leg. A dressing stick may be required by some clients to push the sock or stocking off the heel and off the foot.

4. Lift the stronger leg to a comfortable height or to seat level and remove the sock or stocking from the foot.

Shoes.

If possible, select supportive slip-on shoes to eliminate lacing and tying. If an individual uses an ankle-foot orthosis (AFO) or short leg brace, shoes with fasteners are usually needed.

1. Use elastic laces and leave the shoes tied.

2. Use adapted shoe fasteners.

3. Use one-handed shoe-tying techniques (Fig. 10.29).

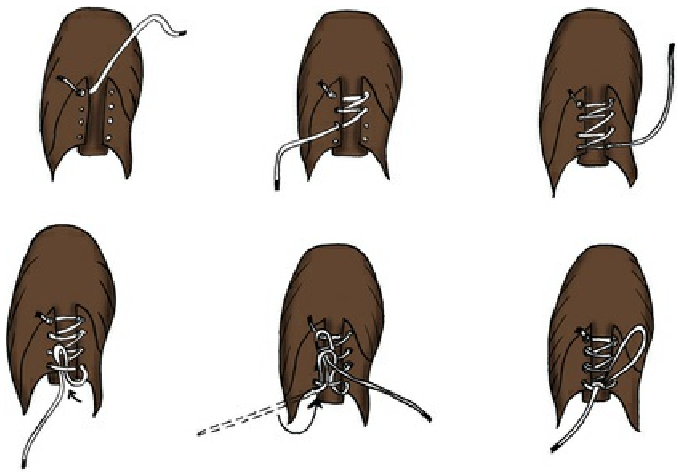

FIG 10.29 Method for tying shoelaces with one hand. (Courtesy Christine Shaw, Metro Health Center for Rehabilitation, Metro Health Medical Center, Cleveland, OH.)

4. It is possible to learn to tie a standard bow with one hand, but this requires excellent visual, perceptual, and motor planning skills, along with much practice.

Ankle-foot orthosis.

The individual with hemiplegia who lacks adequate ankle dorsiflexion to walk safely and efficiently frequently uses an AFO, which may be recommended by a physical therapist, prescribed by a physician, and made by an orthotist. The following methods are two techniques that may be used. The shoe needs to be half to one size bigger than usual.

Donning an ankle-foot orthosis

Method 1

1. Sit in a straight-backed armchair or in a wheelchair with the brakes locked and the feet on the floor. Loosen the fasteners on the shoe, and pull back the tongue to allow the AFO to fit into the shoe. Place the AFO into the shoe (Fig. 10.30A).

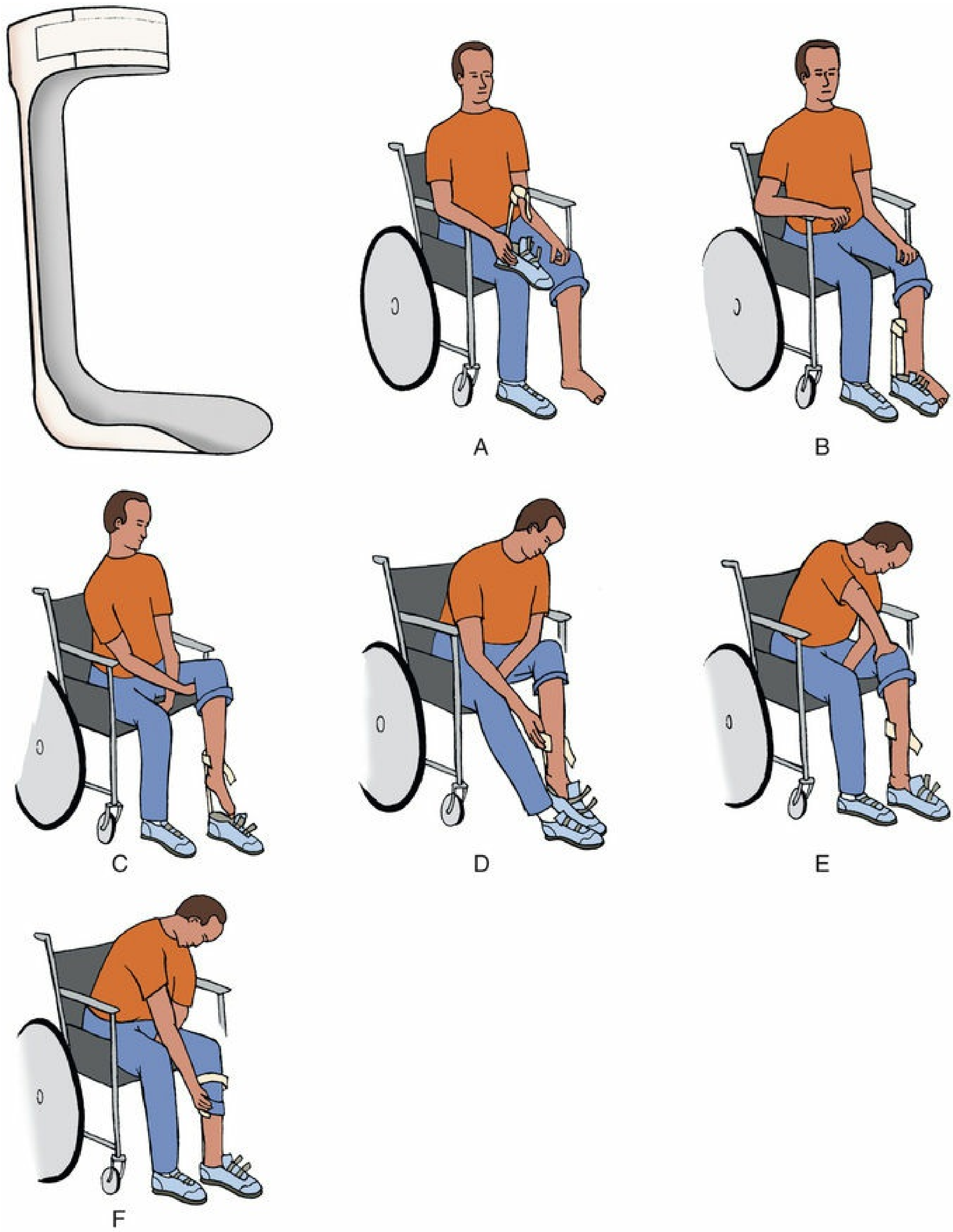

FIG 10.30 Steps in donning an ankle-foot orthosis (AFO).

2. Place the AFO and the shoe on the floor between the legs (but closer to the affected leg), facing up (Fig. 10.30B).

3. With the stronger hand, lift the affected leg behind the knee and place the toes into the shoe (Fig. 10.30C).

4. Reach down with the stronger hand and lift the AFO by the calf piece. Simultaneously, use the unaffected foot against the affected heel to keep the shoe and AFO together. The heel will not be pushed into the shoe at this point (Fig. 10.30D).

5. If leg strength is not sufficient, use the stronger hand to apply pressure directly downward on the

affected knee, pushing the heel into the shoe (Fig. 10.30E). To prevent injury, especially with clients who have poor sensation, make sure the client does not jam the heel into the AFO.

6. Fasten the Velcro calf strap, and then fasten the shoes (Fig. 10.30F). The affected leg may be placed on a footstool to assist with reaching shoe fasteners.

7. To fasten the shoes, the client may use one-handed bow-tying techniques, elastic shoelaces, or other commercially available shoe fasteners; alternatively, Velcro-fastened shoes may be used.

Method 2.

Steps 1 and 2 are the same as the positioning required for putting on trousers.

1. Sit in a sturdy armchair or in a locked wheelchair.

2. Position the stronger leg in front of the midline of the body with knee flexed to 90 degrees. Using the stronger hand, reach forward and grasp the ankle of the affected leg (or the sock around the ankle). Lift the affected leg over the stronger leg to crossed position.

3. Loosen the fasteners of the shoe and pull back the tongue to allow the AFO to fit into the shoe; unfasten the Velcro fastener on the AFO. Place the AFO in the shoe.

4. Using the stronger hand, hold the heel of the shoe and work the shoe over the toes of the affected foot and leg. Once the toes are in the shoe, work the top part of the AFO around the calf.

5. Pull the heel of the shoe onto the foot with the stronger hand, or place the foot on the floor, put pressure on the knee, and push the heel down into the shoe.

6. Fasten the Velcro calf strap on the AFO and then fasten the shoes.

Removing an ankle-foot orthosis

Variation 1

1. While seated as for putting on an AFO, cross the affected leg over the stronger leg.

2. Unfasten the straps of the AFO and the fasteners of the shoe with the stronger hand.

3. Push down on the calf part of the AFO until the shoe is off the foot.

Variation 2

1. Unfasten the straps of the AFO and the fasteners of the shoe with the stronger hand.

2. Straighten the affected leg by putting the stronger foot behind the heel of the shoe on the affected leg and pushing the affected leg forward.

3. Push down on the AFO upright with the stronger hand, and at the same time, push forward on the heel of the AFO shoe with the stronger foot.

Feeding Activities

A primary problem for individuals with only one functional hand is inability or difficulty using one hand to stabilize an object while using that same hand to perform another task. An example in feeding is a person with one functional hand trying to cut food, such as meat, using a knife while stabilizing the food at the same time. This problem can be resolved by the use of a rocker knife (Fig. 10.31) for cutting meat and other foods. This knife cuts with a rocking motion rather than a back-and-forth slicing action. Use of a rocking motion with a standard table knife or a sharp paring knife may be adequate to cut tender meats and soft foods. If such a knife is used, the client is taught to hold the knife handle between the thumb and the third, fourth, and fifth fingers, and the index finger is extended along the top of the knife blade. The knife point is placed in the food in a vertical position, and then the blade is brought down to cut the food. The rocking motion, using wrist flexion and extension, is continued until the food is cut. To stabilize a plate or bowl, a product such as foam-padded shelf liner or Dycem can be placed under it. There are many other adaptive devices, such as a plate guard (see Fig. 10.22), that the person who eats with only one fully functional hand can use.

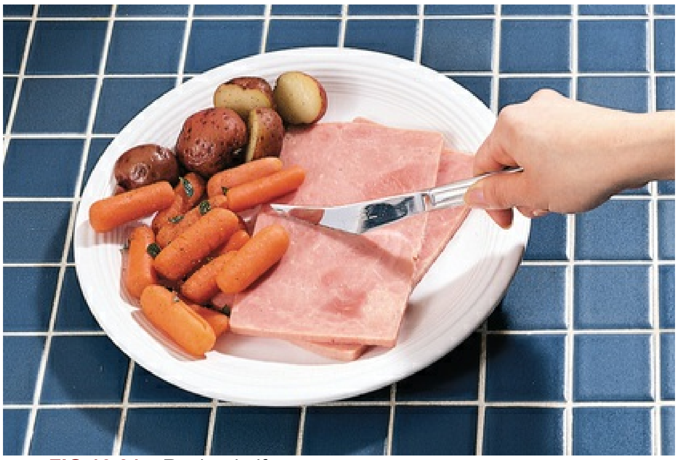

FIG 10.31 Rocker knife. (Courtesy Patterson Medical, Warrenville, IL.)

Another feeding issue that may arise is opening packages such as yogurt containers, drink bottles, and milk cartons, in addition to containers such as margarine tubs and ketchup holders. These tasks require practice, and the less functional hand should be incorporated into the task, if appropriate.

Personal Hygiene and Grooming Activities

Clients with the use of one hand or one side of the body can accomplish personal hygiene and grooming activities by using assistive devices and alternative methods. The following are suggestions for achieving hygiene and grooming with one hand.

1. Use an electric razor rather than a razor with a blade.

2. Use a shower seat in the shower stall or a transfer tub bench in a bathtub-shower combination. Other helpful devices include a bath mat, wash mitt, long-handled bath sponge, safety rails on the bathtub or wall, soap on a rope or a suction soap holder, and a suction brush for fingernail care.

3. Take a sponge bath while sitting at the lavatory using the wash mitt, suction brush, and suction soap holder. The stronger forearm and hand may be washed by placing a soaped washcloth on the thigh and rubbing the hand and forearm on the cloth.

4. Consider an easily accomplished hairstyle. Or, use a wall-mounted hair dryer, which frees the stronger upper extremity to hold a brush or comb to style the hair during blow-drying.[28]

5. As described previously for clients with incoordination, an emery board or small piece of wood with fine sandpaper glued to it can be fastened to the tabletop for filing nails, and a nail clipper can be stabilized in the same manner. For toenails, a large nail file can be used. If circulatory issues or diminished sensation is a problem, a podiatrist may need to be consulted or should perform this important but often neglected ADL.

6. Use a suction denture brush (see Fig. 10.24) for care of dentures. The suction fingernail brush may also serve this purpose.

Toileting

Clients with the use of one hand or one side of the body can accomplish toileting activities by using assistive devices and alternative methods. The following are suggestions for achieving independent and safe toileting with one hand.

1. Use a bedside commode with or without drop arms if unable to get to the bathroom quickly or safely (Fig. 10.32). Commodes can be placed over the toilet, with use of a splash guard (looks like a bucket without the bottom). Toilet safety frames and raised toilet seats can also facilitate safe transfers for toileting.

FIG 10.32 Drop-arm commode. (Courtesy North Coast Medical, Gilroy, CA.)

2. Use a urinal instead of transferring to the toilet. Female- and male-designed urinals are available, but female urinals are not always effective, depending on the client's body size. Spill-proof urinals are also available.

3. Grab bars can be strategically placed to assist with sit-to-stand or stand-to-sit movements.

4. Place toilet paper on the unaffected side.

5. Bidets or specialty toilets with wash, dry, and other features can be useful to optimize and facilitate cleansing.

6. Incontinence supplies may need to be considered, especially for community outings.

Communication Management and Environmental Adaptations

1. The primary problem with writing is stabilization of the paper or tablet. This problem can be overcome by using a clipboard, paperweight, or nonskid surface (eg, Dycem) or by taping the paper to the writing surface. In some instances, the affected arm may be positioned on the tabletop to stabilize the paper.

2. If dominance must be shifted to the nondominant extremity, writing practice may be necessary to improve speed and coordination. One-handed writing and keyboarding instruction manuals are available.

3. Book holders may be used to stabilize a book while reading or holding copy for typing and writing practice. A soft pillow placed on the lap easily stabilizes a book while the client is seated in a chair. Clients who enjoy reading may want to consider an electronic book reader (eg, Kindle), which allows touch page turning and options to increase the font size to the reader's preference.

4. Dialing numbers on a telephone with one hand requires several motions, including lifting the receiver to listen for the dial tone, setting it down, pressing the keys, and lifting the receiver to the ear. A speakerphone or headset can also leave the hands free to take messages. For writing while using the telephone, a stand or shoulder telephone receiver holder can be used for classic older model receivers. One-touch or voice-activated dialing using preprogrammed phone numbers eliminates or reduces the need to press as many keys, simplifies sequencing, and may help compensate for memory deficits.

Functional Mobility

Principles of transfer techniques for clients with hemiplegia are described in Chapter 11.

Home Management, Meal Preparation, and Cleanup Activities

Many assistive devices are available to facilitate home management and meal activities. Various factors determine how many home management and meal activities can realistically be performed, which methods can be used, and how many assistive devices can be managed. These factors include whether the client is disabled by the loss of function of one arm and hand, as in amputation or a peripheral neuropathic condition, or whether both arm and leg are affected, along with possible sensory, visual, perceptual, and cognitive dysfunctions, as in hemiplegia. The following are some suggestions for home management and meal activities for the client with the use of one hand.[49]

1. Stabilizing items is a major problem for the one-handed homemaker. Stabilize foods for cutting and peeling by using a cutting board with two stainless steel or aluminum nails in it. A raised corner on the board stabilizes bread for making sandwiches or spreading butter. Suction cups or a rubber mat under the board will keep it from slipping. A nonskid surface or rubber feet may be glued to the bottom of the board.

2. Use nonskid mats or pads, wet dishcloths, or suction devices to keep pots, bowls, and dishes from turning or sliding during food preparation.

3. To open a jar, stabilize it between the knees or in a partially opened drawer while leaning against the drawer. Break the air seal by sliding a pop bottle opener under the lid until the air is released, then use a Zim jar opener (Fig. 10.33).


FIG 10.33 Zim jar opener. (Courtesy ZIM Manufacturing, Chicago, IL.)

4. Open boxes, sealed paper, and plastic bags by stabilizing between the knees or in a drawer as just described and cut open with household shears. Special box and bag openers are also available from ADL equipment vendors.

5. Crack an egg by holding it firmly in the palm of the hand. Hit it in the center against the edge of the bowl. Then, using the thumb and index finger, push the top half of the shell up and use the ring and little fingers to push the lower half down. Separate whites from yolks by using an egg separator, funnel, or large slotted spoon.

6. Eliminate the need to stabilize the standard grater by using a grater with suction feet, or use an electric countertop food processor instead.

7. Stabilize pots on the counter or range for mixing or stirring by using a pan holder with suction feet (Fig. 10.34).


FIG 10.34 Pan stabilizer. (Courtesy SP Ableware–Maddak, Inc., Wayne, NJ.)

8. Eliminate the need to use hand-cranked or electric can openers, which necessitate the use of two hands, by using a one-handed electric can opener.

9. Use a utility cart to transfer items from one place to another. For some clients, a cart that is weighted or constructed of wood may be used as a minimal support during ambulation.

10. Transfer clothes to and from the washer or dryer by using a clothes carrier on wheels.

11. Use electrical appliances (eg, lightweight electrical hand mixer, immersion blender, traditional blender, and food processor) that can be managed with one hand and that save time and energy. Safety factors and judgment need to be evaluated carefully when electrical appliances are considered.

12. Floor care becomes a greater problem if, in addition to one arm, ambulation and balance are affected. For clients with involvement of only one arm, a standard dust mop, carpet sweeper, or upright vacuum cleaner should present no problem. A self-wringing mop may be used if the mop handle is stabilized under the arm and the wringing lever operated with the stronger arm. Clients with balance and ambulation problems may manage some floor care from a sitting position. Dust mopping or using a carpet sweeper may be possible if gait and balance are fairly good without the aid of a cane. Some people may benefit from a programmable robotic vacuum cleaner (Roomba) or floor scrubber (Scooba) from iRobot[45] (*http://store.irobot.com/home/index.jsp*). However, careful consideration must be used for these devices because they can also be a safety or tripping hazard if they do not return to the docking station.

These are just a few of the possibilities for solving homemaking problems for one-handed individuals. The occupational therapist must evaluate each client to determine how the dysfunction affects the performance of homemaking activities. One-handed techniques take more time and may be difficult for some clients to master. Activities should be paced to accommodate the client's physical endurance and tolerance for one-handed performance and use of special devices. Fatigue management techniques should be used. New techniques and devices should be introduced on a graded basis as the client masters first one technique and device and then another. Family members need to be oriented to the client's skills, special methods used, and schedule. The therapist, with the family and client, may facilitate the planning of homemaking responsibilities to be shared by other family members, in addition to the supervision of the client, if that is needed. If special equipment and assistive devices are needed for IADLs, it is advisable for the client to practice using the devices in the clinic if possible. The therapist can then train the client and demonstrate use of the equipment to a family member before these items are purchased and used at home. After training, the occupational therapist should provide the client with sources for replacing items independently, such as a consumer catalog of adaptive equipment or websites.

ADLs for the Person With Paraplegia

Clients who must use a wheelchair for mobility need to find ways to perform ADLs from a seated position, to transport objects, and to adapt to an environment designed for standing and walking. Given normal function in the upper extremities and otherwise good health, the wheelchair user can probably perform ADLs independently. The client should have a stable spine or use an appropriate orthotic or stabilization device, and the healthcare provider should clearly identify mobility precautions.

Dressing Activities

It is recommended that clients who must use wheelchairs put on clothing in this order: stockings or socks, undergarments, braces (if worn), slacks, shoes, and then shirt or dress. Underwear may be eliminated because it is an extra step, has the potential to contribute to skin breakdown, and results in greater difficulty for toileting. During the initial rehabilitation, the client with paraplegia will likely begin dressing training in bed; as his or her strength, endurance, and balance improve, the client will progress to dressing in the wheelchair. The ability to dress in the wheelchair simplifies toileting by eliminating the need to go back to bed to manage clothing.

Slacks

Putting on slacks.

Slacks are easier to fasten if they button or zip in front. If braces are worn, zippers in side seams may be helpful. Wide-bottom slacks of stretch fabric are recommended. The following steps comprise the procedure for putting on shorts, slacks, and underwear.

1. Use side rails, a trapeze, or other adaptive technique to pull up to a sitting position, with the back supported by pillows or the headboard of the bed. If side rails or a trapeze is not required, the client props up on the elbows in a semireclined position and generates momentum by alternately pushing with one elbow and then the other until the elbow comes up high enough for the client to prop the hands on the bed.[48]

2. Sit on the bed and reach forward to the feet, or sit on the bed and pull the knees into flexed position.

3. Holding the top of the slacks, flip the pant legs down to the feet.

4. Work the pant legs over the feet, and pull the slacks up to the hips. Crossing the ankles may help get the slacks over the heels.

5. In a semireclining position, using rotation and momentum by typically transferring momentum from the arms to the trunk, to the pelvis, and then to the lower extremities,[48] roll to one side, hike up the slacks, and then roll to the other side and pull up the pant leg.

6. A long-handled reacher may be helpful for pulling the slacks up or positioning them on the feet if the client has impaired balance or ROM in the lower extremities or trunk.

Removing slacks.

Remove slacks and underwear by reversing the procedure for putting them on. Dressing sticks may be helpful for pushing slacks off the feet.

Socks or stockings.

Soft stretch socks or stockings are recommended. Pantyhose that are slightly larger may be useful. Elastic garters or stockings with elastic tops should be avoided because of potential skin breakdown. Dressing sticks or a stocking device may be helpful to some clients.

Donning socks or stockings

1. Put on socks or stockings while sitting up in bed with the legs extended (long-sitting).

2. While propped up when long-sitting with the legs initially extended, pull one leg into flexion with one hand and cross the leg over onto the other extended leg.

3. Use the other hand to slip the sock or stocking over the foot, and pull on the sock or stocking. To prevent pressure skin breakdown, make sure there are no wrinkles or creases in the socks.

Removing socks or stockings.

Remove socks or stockings by flexing the leg as described for putting them on, and then push the sock or stocking down over the heel. A dressing stick may be needed to push the sock or stocking off the heel and toe and to retrieve the sock. This is a good time to perform a skin check on the feet and lower legs to detect any skin breakdown or red areas.

Slips and skirts.

Slips and skirts slightly larger than usually worn are recommended. **A**-line, wraparound, and full skirts are easier to manage and may drape better on a person seated in a wheelchair than narrow skirts, which can ride up.

Putting on slips and skirts

1. Sit on the bed, slip the garment over the head, and let it drop to the waist.

2. In a semireclining position, roll from hip to hip and pull the garment down over the hips and thighs.

Removing slips and skirts

1. In a sitting or semireclining position, unfasten the garment.

2. Roll from hip to hip, pulling the garment up to waist level.

3. Pull the garment off over the head.

Shirts.

Fabrics should be wrinkle resistant, smooth, and durable. Roomy sleeves and backs and full shirts may make this clothing easier to put on and take off than closely fitted garments.

Donning a shirt.

Shirts, pajamas, jackets, robes, and dresses that open completely down the front may be put on while the client is seated in a wheelchair. If it is necessary to dress while in bed, the following procedure can be used.

1. Balance the body by putting the palms of the hands on the mattress on either side of the body. If the client's balance is poor, assistance may be needed, or the backboard or head of the bed may need to be elevated. (If the backboard cannot be elevated, one or two pillows may be used to support the back.) With the backboard or head of the bed elevated, both hands are available.

2. If difficulty occurs with the customary methods of putting on the garment, open it on the lap with the collar toward the chest. Put the arms into the sleeves and pull them up over the elbows. Then, holding on to the shirttail or back of the dress, pull the garment over the head, adjust it, and button it.

Removing a shirt

1. Sitting in a wheelchair or on the bed, open the fasteners.

2. Remove the garment in the usual manner.

3. If the usual manner is not feasible, grasp the collar with one hand while balancing with the other hand. Gather up the material from collar to hem.

4. Lean forward, duck the head, and pull the shirt over the head.

5. Remove the arms from the sleeves, first the supporting arm and then the working arm.

Shoes

Donning shoes.

If an individual has sensory loss and is at risk for injury during transfers, shoes should be put on in bed.

Variation 1

1. Sit on the bed, on the edge of the bed (requires good balance, high skill), or in a wheelchair for back support. Pull one knee at a time into the flexed position with the hands.

2. While supporting the leg in the flexed position with one hand, use the free hand to put on the shoe.

Variation 2

1. Sit on the edge of the bed or in a wheelchair for back support.

2. Cross one leg over the other and slip the shoe onto the foot.

3. If sitting in a wheelchair, put the foot on the floor or footrest and press down on the knee to push the foot into the shoe.

Removing shoes

1. Flex or cross the leg as described for the appropriate variation.

2. For variation 1: Remove the shoe with one hand while supporting the flexed leg with the other hand.

3. For variation 2: Remove the shoe from the crossed leg with one hand while maintaining balance with the other hand, if necessary.

Feeding Activities

Eating activities should present no problem for the person who uses a wheelchair but has good to normal arm function. Wheelchairs with desk-style armrests and footrests that fit under tabletops are recommended so that the client can sit close to the table. Footrests on the wheelchair may be detachable or fixed but need to function within the client's environment for maximum independence.

Personal Hygiene and Grooming Activities

Facial and oral hygiene and arm and upper body care should present no problem. Reachers may be helpful for getting towels, washcloths, makeup, deodorant, and shaving supplies from storage areas. Special equipment is needed for tub baths and showers. (Transfer techniques for the toilet and bathtub are discussed in Chapter 11.) The following are suggestions for facilitating safety and independence during bathing activities.

1. Use a handheld shower hose and keep a finger over the spray to determine sudden temperature changes in the water. Make sure the water heater is set at a safe temperature (120°F [49°C]) to prevent scald burns.[87]

2. Use a long-handled bath brush with a soap insert for ease in reaching all parts of the body.

3. Use soap bars attached to a cord around the neck, or use liquid soap.

4. Use a padded shower chair or padded transfer tub bench. Consider a commode cutout if the bowel program is performed in the shower.

5. Increase safety during transfers by installing grab bars on the wall near the bathtub or shower and on the bathtub to provide a balance point during transfers and when bending to wash the legs and buttocks.

6. Fit a bathtub or shower floor with a nonskid mat or adhesive material.

7. Remove doors on the bathtub and replace with a shower curtain to increase safety and ease of transfers.

Skin integrity and hygiene.

Because sensory loss increases the risk of skin breakdown, regular skin checks and weight shifts should be considered a normal part of the ADL routine. Clients should be instructed in the following procedures.

1. Checking for potential areas of skin breakdown and signs of developing skin problems, and

practicing methods to maintain good skin integrity.

2. How and when to perform proper weight shifts while up in the wheelchair and how to position oneself in bed to prevent skin breakdown.

3. Performing skin checks and complying with the recommended frequency. The client can use a long-handled mirror (Fig. 10.35) to see areas that are otherwise difficult to observe.

FIG 10.35 Long-handled mirrors. (Courtesy North Coast Medical, Gilroy, CA.)

4. Maintaining all equipment to ensure that disrepair is not contributing to skin breakdown. For example, a tear in a padded tub bench could tear the skin on the buttocks, resulting in skin breakdown.

Bowel and bladder management.

The physician customarily is responsible for prescribing the bowel and bladder program, but the OT and other team members can provide valuable insight into adaptations and routines that may be ideal or most suitable.[76] For example, an occupational therapist, along with nursing staff members, may be involved in instructing the client about digital stimulation or the use of intermittent catheterization for elimination. Helping the client establish a routine for this ADL is important because ineffective bowel and bladder management may lead to significant limitations in other activities, if the client is experiencing accidents or infections. Significant time and close monitoring may be required to perform this crucial ADL, which can affect many aspects of life. An interdisciplinary approach is critical for health maintenance in bowel and bladder care. The following are some areas in which an occupational therapist may be helpful.

1. Determining the optimal DME for performing a task (eg, a padded commode, padded raised toilet seat, or padded roll-in-shower chair) and practicing transfers on and off toileting surfaces.

2. Assisting the interdisciplinary team in determining a client's readiness and cognitive/physical/emotional capacity to learn and perform the required skills.[76]

3. Determining the appropriate adaptive equipment and/or techniques for performing tasks such as inserting a suppository or an adaptive digital stimulator for bowel management, and emptying leg bags and inserting catheters for bladder management. Clothing management and perineal hygiene tasks may also be determined and practiced,[76] and the OT may make recommendations for adaptive equipment such as pants holders and electric bag openers.

4. Developing strategies to manage intermittent catheterization in public bathrooms, homes of friends, and the workplace; determining conveniences, such as using a waist pack to hold items; and establishing methods to sanitize the hands.[47,76]

5. Considering the importance of how the prescribed bowel and bladder programs can be integrated into a client's and family's life, and helping to figure out a routine.[76]

6. Educating the client and family on the health risks that arise with poor follow-through or noncompliance, such as constipation, urinary tract infections, and accidents and autonomic dysreflexia for a client with quadriplegia/tetraplegia or a higher thoracic spinal cord injury (SCI).[76]

Communication Management and Environmental Adaptations

With the exception of reaching difficulties in some situations, use of the telephone should present no problem. Short-handled reachers may be used to grasp the receiver from the cradle. A cordless telephone can eliminate reaching, except when the phone needs recharging. A mobile phone or smart phones can also be used. The use of writing implements and a personal computer should be possible. Managing doors may present some difficulties. If the door opens toward the person, it can be opened using the following procedure (Fig. 10.36).

1. If the doorknob or handle is on the right, approach the door from the right and turn the doorknob or pull the handle with the left hand.

2. Open the door as far as possible and move the wheelchair close enough so that it helps keep the door open.

3. Holding the door open with the left hand, turn the wheelchair with the right hand and wheel through the door.

4. Start closing the door when halfway through.

FIG 10.36 Independent navigation through an open door with the door opening toward the client. A, As the door is pulled open, the wheelchair is angled and ready to pivot. B, The client turns and begins to move the wheelchair through the doorway. C, The client pulls on the door frame with one hand and pushes the door farther open with the other. D, The client then quickly propels the wheelchair through the doorway. If the door closes before the client is all the way through, the client allows the door to bump against the wheelchair (first moving his or her hand out of the way) and then applies an additional push to the door. (From Fairchild SL: *Pierson and Fairchild's principles and techniques of patient care,* ed 5, St Louis, 2013, Saunders.)

If the door is very heavy and opens out or away from the person, the following procedure is recommended.

1. Back up to the door so that the knob can be turned or the handle operated with the right hand.
2. Open the door and back through it so that the large drive (rear) wheels keep it open.
3. Also use the left elbow to keep the door open.
4. Propel backward with the right hand.

Functional Mobility

Principles of transfer techniques are discussed in Chapter 11.

Home Management, Meal Preparation, and Cleanup Activities

When homemaking activities are performed from a wheelchair, the major problems are work heights, adequate space for maneuverability, access to storage areas, and transport of supplies, equipment, and materials from place to place. If funds are available for kitchen remodeling, recommendations include lowering the counters to a comfortable height for wheelchair use and opening the space under the counters and the range. Such extensive adaptation is often not feasible, however. The following are some suggestions for homemaking activities.[49]

1. Remove cabinet doors to eliminate the need to maneuver around them for opening and closing. Frequently used items should be stored toward the front of easy to reach cabinets above and below the counter surfaces.

2. If entrance and inside doors are not wide enough, make doors slightly wider by removing the strips along the doorjambs. Offset hinges can replace standard door hinges and increase the doorjamb width by 2 inches (Fig. 10.37).

FIG 10.37 A, Offset door hinges allow for a wider doorway for wheelchair users. B, Close-up of offset hinges. (**A** courtesy How to Adapt: *www.howtoadapt.com*; **B** courtesy Brigs Healthcare, West Des Moines, IA.)

3. Use a wheelchair cushion to increase the user's height so that standard-height counters may be used. This recommendation may or may not work for some because changing cushions takes energy and/or may have consequences for skin care or safety.

4. Detachable, desk-style armrests allow wheelchair users to get closer to counters and tables than is possible with detachable (or fixed) full-length armrests. Swing-away detachable footrests should be removed to allow the client to get closer to counters and tables, and also to stand at counters if possible.

5. Transport items safely and easily with a wheelchair lapboard. The lapboard may also serve as a work surface for writing, preparing food, or drying dishes (Fig. 10.38). It protects the lap from injury from hot pans and prevents utensils from falling into the lap. Use silicone pads as nonslip surfaces and to prevent burning.

FIG 10.38 Wheelchair with lapboard. (Courtesy North Coast Medical, Gilroy, CA.)

6. Fasten a drop-leaf board to a bare wall, or install a slide-out board under a counter to provide a work surface that is a comfortable height in a kitchen that is otherwise standard. When not in use, the drop-leaf board can be securely fastened to the wall to increase accessibility to the kitchen space.

7. Place a cutting board on an open drawer to set up a workstation. The drawer should be stable when pulled out and should be at a height that allows the wheelchair user to roll under it and reach with a comfortable arm position.

8. Fit cabinets with custom or prefabricated pullout shelves for ease in reaching back spaces.

9. Pull-down cupboards can be installed for reaching stored items.[24]

10. A commercially available wooden or plastic round turntable, commonly known as a lazy Susan, can be used to store items for easy access by just rotating the device.

11. Cook tops that are open underneath to accommodate wheelchairs and front-panel stove controls are easier to access.[24]

12. Tilted or angled mirrors over the range can allow cooks to see the contents of pots.

13. A small electric toaster oven with a microwave oven or a microwave convection oven can be substituted for the range if the range is not safely manageable.

14. Ovens that have doors that swing sideways (instead of the standard doors that open down) can make it safer to put items into an oven and take them out.[24]

15. Use front-loading washers and dryers. Use a reacher for items that are difficult to access in the washer and dryer.

16. Vacuum carpets with a carpet sweeper or tank-type cleaner that rolls easily and is lightweight or self-propelled. A retractable cord may prevent the cord from tangling in the wheels.

17. Sweep and mop floors with lightweight swivel head cleaners that allow easier reach.

ADLs for the Person With Quadriplegia/Tetraplegia

For an overview of expected functional outcomes for ADLs and IADLs for each level of SCI, refer to the detailed tables in Chapter 36. Expected outcomes depend in part on whether a complete or incomplete injury occurred. Persons with C1-4 injuries will require assistance for all ADLs except communication and mobility, if appropriate equipment is available. A person with a C5 injury will require considerable special equipment and assistance. (Externally powered orthotics and arm braces or mobile arm supports are recommended for C3, C4, and C5 levels of muscle function; see Chapter 30, Section 2, and Chapter 36.) Individuals with muscle function from C6 can be relatively independent with adaptations and assistive devices and may benefit from the use of a wrist-driven flexor hinge hand splint (also known as a tenodesis hand splint).

It is important to consider that some people, such as those with high-level quadriplegia/tetraplegia (eg, C1-4 injury), may be physically dependent in performing an ADL or IADL but independent in directing others to assist in those areas. It is within the purview of the OT to ensure that such clients can independently direct others, such as personal care attendants, in ADLs and IADLs as needed.[6]

Dressing Activities

Training in dressing can be commenced when the spine is stable and precautions, if present, are followed. The minimum criteria for upper extremity dressing are:

1. Fair to good muscle strength in the deltoids, upper and middle trapezii, shoulder rotators, rhomboids, biceps, supinators, and radial wrist extensors.

2. ROM of 0 degrees to 90 degrees in shoulder flexion and abduction, 0 degrees to 80 degrees in shoulder internal rotation, 0 degrees to 30 degrees in external rotation, and 15 degrees to 140 degrees in elbow flexion.

3. Sitting balance in bed or wheelchair, which may be achieved with the assistance of bed rails, an electric hospital bed, or a wheelchair safety belt.

4. Finger prehension achieved with adequate tenodesis grasp or wrist-driven flexor hinge orthosis.

Additional criteria for dressing the lower extremities are:

1. Fair to good muscle strength in the pectoralis major and minor, serratus anterior, and rhomboid major and minor.

2. ROM of 0 degrees to 120 degrees in knee flexion, 0 degrees to 110 degrees in hip flexion, and 0 degrees to 80 degrees in hip external rotation.

3. Body control for transfer from bed to wheelchair with minimal assistance.

4. Ability to roll from side to side, turn from supine position to prone position and back, and balance in side-lying.

5. Vital capacity must be greater than 50%.

Dressing is contraindicated if any of the following factors are present[17,68]:

1. Unstable spine at the site of injury

2. Pressure sores or a tendency for skin breakdown during rolling, scooting, and transferring

3. Uncontrollable muscle spasms in the legs

4. Less than 50% vital capacity

Sequence of dressing.

The recommended sequence for training to dress is to put on slacks while still in bed, then transfer to a wheelchair and put on shirt, socks, and shoes.[68] Some clients may want to put on their socks before their pants because socks may help the feet slip through the pant legs more easily. They may also want to put on their shoes in bed, after putting on their slacks, to prevent injury during the transfer.

Expected proficiency.

Clients with spinal cord lesions at C7 and below can achieve independence with dressing for both the upper and lower extremities. Clients with lesions at C6 can also achieve independence with dressing, but lower extremity dressing may be difficult or impractical in terms of time and energy for these clients. Clients with lesions at C5 to C6 can achieve independence in upper extremity dressing, with some exceptions. It is difficult or impossible for these clients to put on a bra, tuck a shirt or blouse into a waistband, or fasten buttons on shirt fronts and cuffs. Factors such as age, physical proportions, coordination, secondary medical conditions, and motivation affect the degree of proficiency in dressing skills that any client can achieve.[17] Many people with various injuries, including quadriplegia/tetraplegia, now post educational videos on sites such as YouTube to share how they perform ADLs such as dressing. Others post on websites such as the SCI Video Blog (*http://www.scivideoblog.com*) to demonstrate techniques and share them with others who have similar injuries. However, it is important for the information to be vetted by more experienced therapists and sources to ensure that the techniques are appropriate.

Types of clothing.

Clothing should be loose and have front openings. Slacks need to be a size larger than usually worn to accommodate the urine collection device or leg braces if worn. Wraparound skirts and incontinence pads are helpful for women. The fasteners that are easiest to manage are zippers and Velcro closures. Because the client with quadriplegia often uses the thumb as a hook to manage clothing, loops attached to zipper pulls, undershorts, and even the back of the shoes can be helpful. Belt loops sewn onto the waistbands of slacks with reinforced stitching are used for pulling. Bras should have stretch straps and no wires. Front-opening bra styles can be adapted by fastening loops and adding Velcro closures; back-opening styles can have loops added at each side of the fastening. Underwear may be eliminated because it is an extra step, has the potential to contribute to skin breakdown, and results in greater difficulty in toileting.

Shoes can be one-half to one size larger than normally worn to accommodate edema and spasticity and to prevent pressure sores and even autonomic dysreflexia. Shoe fasteners can be adapted with Velcro, elastic shoelaces, large buckles, or flip-back tongue closures. Some people use shoes with zippers and looped draw cords with adjustable stoppers. Loose woolen or cotton socks without elastic cuffs should be used initially. Nylon socks, which tend to stick to the skin, may be used as skill is gained. If neckties are used, the clip-on type or a regular tie that has been preknotted and can be slipped over the head may be manageable for some clients.

Slacks

Donning slacks (SCI level C6-7).

Setup—pants, socks, shoes, and adaptive devices (if needed) can be placed in the wheelchair, which is placed next to the bed the night before for easier access when the client gets dressed in the morning.

Method 1 (no assistive device)

1. Long-sit on the bed with the bed rails up and, if needed, the head of the bed elevated (if using a full electric bed). Position the slacks at the foot of the bed with the pant legs over the end of the bed and front side up.[68] Sit up and lift one knee at a time by hooking the right hand under the right knee to pull the leg into flexion; put pants over the right foot. Return the right leg to extension or semiextended position and repeat the procedure with the left hand and left knee. Work the slacks up the legs, using patting and sliding motions with the palms of the hands. While still long-sitting, with the pants to midcalf height, insert a dressing stick into a front belt loop. Grip the stick by

slipping its loop over the wrist. Pull on the dressing stick while extending the trunk, returning to the supine position. Return to the sitting position and repeat this procedure, pulling on the dressing sticks and maneuvering the slacks up to thigh level. Remain long-sitting, lean on the left elbow, and pull the slacks over the right buttock; reverse the process for the other side.

Alternatively, remain in the supine position and roll to one side; place the opposite arm behind the back; hook the thumb in the waistband, belt loop, or pocket, and pull the slacks up over the hips. These maneuvers can be repeated as often as necessary to get the slacks over the buttock. (YouTube videos demonstrating this technique have been posted by individuals who have been injured, such as Beau Vernon.[91]) Using the palms of the hands in pushing and smoothing motions, straighten the slack legs.

2. In the supine position, fasten the slacks by hooking the thumb in the loop on zipper pull, patting the Velcro closed, or using hand splints and buttonhooks for buttons or a zipper pull.[17,64]

Method 2—assistive device

1. Follow steps 1 and 2 in method 1.

2. If unable to maintain the leg in flexion by holding it with one arm or through advantageous use of spasticity, use a dressing band. This device is a piece of elasticized webbing that has been sewn into a figure-eight pattern, with a small loop and a large loop. The small loop is hooked around the foot, and the large loop is anchored over the knee. The band is measured for the individual client so that its length is appropriate to maintain the desired amount of knee flexion. Once the slacks are in place, the knee loop is pushed off the knee and the dressing band is removed from the foot with a dressing stick.

3. Work the slacks up the legs, using patting and sliding motions with the palms of the hands. While still long-sitting, with the pants to midcalf height, insert the dressing stick into a front belt loop. Grip the dressing stick by slipping its loop over the wrist. Pull on the dressing stick while extending the trunk, returning to the supine position. Return to the sitting position and repeat this procedure, pulling on the dressing sticks and maneuvering the slacks up to thigh level.

4. Follow steps 5 and 6 in method 1.

Variation.

Substitute the following for step 2: Sit up and lift one knee at a time by hooking the right hand under the right knee to pull the leg into flexion, then cross the foot over the opposite leg (which is extended) above the knee. This position frees the foot so that the slacks can be placed more easily, and it requires less trunk balance. Continue with all other steps.

Removing slacks (SCI level C6-7)

1. Lying supine in the bed (a flat bed is easier than if the head of the bed is up) with the bed rails up, unfasten the belt and fasteners.

2. Placing the thumbs in the belt loops, waistband, or pockets, work the slacks past the hips by stabilizing the arms in shoulder extension and scooting the body toward the head of the bed.

3. Use the arms as described in step 2 and roll from side to side to get the slacks past the buttocks.

4. Coming to a sitting position and alternately pulling the legs into flexion, push the slacks down the legs.

5. Slacks can be pushed off over the feet with a dressing stick or by hooking the thumbs in the waistband.

Front-opening and pullover garments (SCI level C5-7).

Front-opening and pullover garments include blouses, jackets, vests, sweaters, skirts, and front-opening dresses.[17,64] Upper extremity dressing is frequently performed in the wheelchair for greater trunk stability.

Donning front-opening or pullover garments (SCI level C5-7)

1. Position the garment across the thighs with the back facing up and the neck toward the knees.

2. Place both arms under the back of the garment and in the armholes.

3. Push the sleeves up onto the arms, past the elbows.

4. Using a wrist extension grip, hook the thumbs under the garment back and gather up the material from the neck to the hem.

5. To pass the garment over the head, adduct and externally rotate the shoulders and flex the elbows while flexing the head forward.

6. When the garment is over the head, relax the shoulders and wrists and remove the hands from the back of the garment. Most of the material will be gathered up at the neck, across the shoulders, and under the arms.

7. To work the garment down over the body, shrug the shoulders, lean forward, and use elbow flexion and wrist extension. Use the wheelchair arms for balance if necessary. Additional maneuvers to accomplish this task are to hook the wrists into the sleeves and pull the material free from the underarms, or lean forward, reach back, and slide the hand against the material to help pull the garment down.

8. If hand function is inadequate, the garment can be buttoned from bottom to top with the aid of a buttonhook and a wrist-driven flexor hinge splint.

Removing front-opening or pullover garments (SCI level C5-7)

1. Sit in the wheelchair and wear wrist-driven flexor hinge splints. Unfasten the buttons (if any) while wearing orthotics and using a buttonhook. Remove the splints for the remaining steps.

2. For pullover garments, hook the thumb in back of the neckline, extend the wrist, and pull the garment over the head while turning the head toward the side of the raised arm. Maintain balance by resting against the opposite wheelchair armrest or pushing on the thigh with an extended arm.[91]

3. For stretchy front-opening clothing, hook the thumb in the opposite armhole and push the sleeve down the arm. Elevation and depression of the shoulders with trunk rotation can be used to get the garment to slip down the arms as far as possible.

4. Hold one cuff with the opposite thumb while the elbow is flexed to pull the arm out of the sleeve.

Bra (back opening)

Putting on a bra (SCI level C5-7).

A back-opening bra fastens at the back with a hook and eye. The bra is adapted and has loop extenders attached on both the right and left sides of the fasteners. The bra is fastened around the body in the front first and then twisted around into position. The arms are placed in the straps last.

1. Place the bra across the lap with the straps toward the knees and the inside facing up.

2. Using a right-to-left procedure, hold the end of the bra closest to the right side with the hand or a reacher and pass the bra around the back from right to left side. Lean against the bra at the back to hold it in place while hooking the thumb of the left hand in a loop attached near the bra fastener. Hook the right thumb in a similar loop on the right side, and fasten the bra in front at waist level.

3. Hook the right thumb in the edge of the bra. Using wrist extension, elbow flexion, shoulder

adduction, and internal rotation, rotate the bra around the body so that the front of the bra is in the front of the body.

4. While leaning on one forearm, hook the opposite thumb in the front end of the strap and pull the strap over the shoulder; repeat procedure on the other side.[17,64]

Removing a bra

1. Hook the thumb under the opposite bra strap, and push the strap down over the shoulder while elevating shoulder.

2. Pull the arm out of the strap and repeat the procedure for other arm.

3. Push the bra down to waist level and turn it around as described previously to bring the fasteners to the front.

4. Unfasten the bra by hooking the thumbs into the adapted loops near the fasteners.

Alternatives for a back-opening bra are (1) a front-opening bra with loops for using a wrist extension grip or (2) a stretchable bra that has no fasteners (eg, sports bra), which can be put on like a pullover sweater.

Socks

Putting on socks (SCI level C6-7)

Method 1

1. Sit in a wheelchair (or on the bed if balance is adequate) in cross-legged position with one ankle crossed over the opposite knee.

2. Pull the sock over the foot using wrist extension and patting movements with the palm of the hand.[17,64] To prevent pressure areas, check to make sure there are no creases or thickened areas on the socks.

Method 2

1. Sitting in a wheelchair with the seat belt fastened, hook one arm at the elbow around the wheelchair push handle. This allows for improved stability while reaching.

2. Position the foot on a stool, chair, or stable open drawer to elevate it enough to reach easily. Unhook the arm from the push handle once stable.

3. Pull the sock over the foot using wrist extension and patting movements with the palm of the hand.[17,64] To prevent pressure areas, check to make sure there are no creases or thickened areas on the socks.

Method 3 (using an adaptive device)

1. Use a sock aid or sock cone (see Fig. 10.8) to assist in putting on socks while seated in a wheelchair. Powder sock cone (to reduce friction) and put the sock on the cone, using the thumbs and the palms of the hands to smooth out the sock on the cone.

2. With the cord loops of the sock cone around the wrist or thumb, throw the cone beyond the foot.

3. Maneuver the cone over the toes by pulling the cords, using elbow flexion. Insert the foot as far as possible into the cone.

4. To remove the cone from the sock after the foot has been inserted, move the heel forward off the wheelchair's footrest. Use wrist extension (of the free hand) behind the knee and continue pulling the cords of the cone until it is removed and the sock is in place on the foot. Use the palms to

smooth the sock with patting and stroking motions.[17] Two loops can be sewn on either side of the top of the sock so that the thumbs can be hooked into the loops and the socks pulled on.

Removing socks (SCI level C6-7)

Method 1 (no adaptive device)

1. While long-sitting in the bed and with the hips flexed forward, slide the hands into the sock with the wrist extended, gradually working the sock off the feet and toes.

2. If seated in a wheelchair, hook the thumb in the sock and use wrist extension to slide it off.

Method 2 (using an adaptive device).

While sitting in a wheelchair or long-sitting in the bed with the hips flexed forward, use a dressing stick with a coated end or a long-handled shoehorn to push the sock down over the heel. Cross the legs if needed.

Shoes

Putting on shoes (SCI level C6-7)

1. Use the same position as for putting on socks.

2. Use the thumbs, or if needed a long-handled dressing stick, and insert the aid into the tongue of the shoe. Place the shoe opening over the toes. Remove the dressing aid from the shoe and dangle the shoe on the toes.

3. Place the palm of the hand on the sole of the shoe and pull the shoe toward the heel of the foot. One hand is used to stabilize the leg while the other hand pushes against the sole of the shoe to work the shoe onto the foot. Use the palms and sides of the hand to push the shoe on.

4. With the feet flat on the floor or on a wheelchair footrest and the knees flexed 90 degrees, place a long-handled shoehorn in the heel of the shoe and press down on the flexed knee until the heel is in the shoe. Fasten the shoe.

Removing shoes (SCI level C6-7)

1. Sitting in a wheelchair with the legs crossed as described previously, unfasten the shoes.

2. Use a shoehorn or dressing stick, if needed, to push on the heel counter of the shoe, dislodging it from the heel. The shoe will drop, or it can be pushed to the floor with the dressing stick.

Feeding Activities

Feeding may be assisted by a variety of devices, depending on the level of the client's muscle function. Someone with a C1-4 injury will likely need assistance to eat unless an electrical self-feeding device is used. These devices allow independence because the client uses head movement to hit a switch that turns the plate and then brings the spoon down to the plate and back up to mouth level.

An injury at C5 may require mobile arm supports or externally powered splints and braces. A wrist splint and a universal cuff (see Fig. 10.12) may be used together if a wrist-driven flexor hinge splint is not used. The universal cuff holds the eating utensil, and the splint stabilizes the wrist. A nonskid mat and a plate with a plate guard may adequately stabilize the plate for pushing and picking up food (C5-7).

A regular or swivel spoon-fork combination with a universal cuff can be used when there is minimal muscle function (C5). A long plastic straw with a straw clip to stabilize it in the cup or glass eliminates the need for picking up cups. A bilateral or unilateral clip-type holder on a glass or cup makes it possible for many individuals with hand and arm weakness to manage liquids without a straw.

Built-up utensils may be useful for those with some functional grasp or tenodesis grasp. Food may be cut with an adapted knife if arm strength is adequate to manage the device. Food may also be cut with a sharp knife if a wrist-driven flexor hinge splint is used.

Personal Hygiene and Grooming

1. Use a padded shower seat or padded transfer tub bench and transfer board for transfers (SCI level C1-7).

2. Extend reach by using a long-handled bath sponge with a loop handle or a built-up handle (SCI level C6-7).

3. Eliminate the need to grasp a washcloth by using bath mitts or bath gloves (SCI level C5-7).

4. Hold a toothbrush with a universal cuff[1] (SCI level C5-7).

5. Use a wall-mounted hair dryer. Use a universal cuff to hold a brush or comb for hair styling while using the mounted hair dryer[28] (SCI level C5-7) (Fig. 10.39).

FIG 10.39 Hair dryer holder. (Courtesy Patterson Medical, Warrenville, IL.)

6. Use a clip-type holder for an electric razor (SCI level C5-7).

7. Individuals with quadriplegia can use suppository inserters to manage bowel care independently (SCI level C6-7).

8. Use a skin inspection mirror with a long stem and looped handle (see Fig. 10.35) for independent skin inspection. Devices and methods selected must be adapted to the degree of weakness of each client (SCI level C6-7).

9. Adapted leg bag clamps for emptying catheter leg bags are also available for individuals with limited hand function. Elastic leg bag straps may be replaced with Velcro straps (SCI level C5-7).

10. If the client is unable to reach the leg bag clamp, a commercially available electric leg bag clamp allows the individual to drive up to a urinal or bathroom drain and empty the leg bag with the switch of a button (Richardson Products) (SCI level C1-7).

Communication Management and Environmental Adaptations

1. Turn pages with an electric page turner, mouth stick (Fig. 10.40), or head wand if hand and arm function is inadequate (SCI level C4-5).

FIG 10.40 Mouth wand. (Courtesy Patterson Medical, Warrenville, IL.)

2. For keyboarding, writing, and painting, insert a pen, pencil, typing stick, or paintbrush into a universal cuff that has been positioned with the opening on the ulnar side of the palm (Fig. 10.41) (SCI level C5-7).

FIG 10.41 Typing with a keyboard aid. (Courtesy Patterson Medical, Warrenville, IL.)

3. Touch telephone keys with the universal cuff and a pencil positioned with the eraser down (SCI level C5-7). The receiver may need to be positioned for listening. For clients with no arm function, a speakerphone can be used, along with a mouth stick to push the button to initiate a call. Set any frequently used numbers for speed-dial. An operator can also assist with dialing (SCI level C1-5).

4. Mobile phones allow many functions with voice activation including calling out, automatic answering that goes to an earpiece, music functions, Web searches, calendar programs, contact directories, and global positioning systems (GPSs). A touch-screen phone with multiple functions can eliminate the need for multiple devices to organize information (SCI level C1-7).

5. Use personal computers or smart phones. A computer mouse or voice recognition program may be substituted for use of the keyboard. A variety of different mouse and keyboard designs and sizes are available (SCI level C1-7).

6. Clients with hand weakness can use built-up pencils and pens or special pencil holders. The Wanchik writer (see Fig. 10.17) is an effective adaptive writing device (SCI level C5-7).

7. Sophisticated electronic communication devices operated by mouth, pneumatic controls, and head controls are available for clients with no function in the upper extremities. Other communication devices are available that rely on eye blinks and gazes (SCI level C1-5).

8. MP3 (a digital audio recording format) players are capable of playing digitally available music and podcasts and can be used with a universal cuff and a pencil positioned with the eraser down or other adapted pointer to press buttons (SCI level C5-7).

9. Environmental controls allow easy operation from a panel designed to run multiple devices, such as televisions, radios, lights, telephones, intercoms, and hospital beds (see Chapter 17) (SCI level C1-7).

Functional Mobility

The principles of wheelchair transfer techniques for the individual with quadriplegia are discussed in Chapter 11. Mobility depends on the degree of weakness. Electric wheelchairs operated by hand, chin, head, or pneumatic controls have greatly increased the mobility of individuals with severe upper and lower extremity weakness. Vans fitted with wheelchair lifts and stabilizing devices provide transportation for these clients, allowing them to pursue community, vocational, educational, and leisure activities with the help of an assistant. In addition, adaptations for hand controls have made it possible for many clients with function of at least the C6 level to drive independently.

Home Management, Meal Preparation, and Cleanup Activities

Clients with muscle function of C6 or better may be independent for light homemaking with appropriate devices, adaptations, and safety awareness. Many of the suggestions for wheelchair maneuverability and environmental adaptation for a person with paraplegia also apply here. In addition, clients with upper extremity weakness need to use lightweight equipment and special devices. A classic book that is still available, *The Mealtime Manual for People with Disability and the Aging*, compiled by Klinger,[49] contains many excellent specific suggestions that apply to homemakers with weak upper extremities. Specialty suppliers for cooking devices to make meal preparation and cooking easier and more efficient are an excellent source for new ideas. The kitchen and home sections of general national and international stores are other good resources for ideas and products. As mentioned, in this age of digital information sharing, many people with various disabilities post themselves online performing ADLs and IADLs.

1. Use extended lever-type faucets for easier reach and control or motion sensor faucets (SCI level C5-7).

2. To eliminate the need for grasp and release, use pump bottles for cleaners and soaps or motion sensor dispensers (SCI level C5-7).

3. For cooking utensils, use universal cuff adaptations, a tenodesis splint, or adapted long-handled utensils (SCI level C5-7).

4. For opening cans, use one-touch can openers.

5. For opening jars, use electric jar openers.

6. To wash dishes, use a combination soap dispenser/sponge.

7. To wash and rinse lettuce, use a salad spinner with a push-button center.

ADLs for the Person With Low Vision

Many people with or without physical disabilities also have low vision as a result of advancing age or age-related eye diseases, or as a complication of diabetes.[52] Occupational therapists specialize in the area of vision rehabilitation itself. However, OTs who work with clients with physical disabilities frequently see individuals with visual impairment; therefore, it is important for OTs to be knowledgeable about this condition so they can help promote independence in occupations.[70,95]

Low vision is defined as a visual impairment that cannot be corrected by regular eyeglasses or other corrective lenses, or by surgery or medication, and that negatively affects the performance of daily occupations.[52,60,61] Research indicates that for older people, low vision is a greater threat to independence than hearing loss.[18,52]

Visual changes are considered part of a comprehensive OT evaluation. Evaluation of the person with low vision should initially involve understanding the specific condition that has caused the low vision, such as whether visual acuity is affected or whether a specific field of vision is impaired. (For more information on visual loss in the aging, see Chapter 46.) The type of visual loss, along with any other physical or cognitive deficits, influences treatment and adaptive equipment choices. Providing low vision devices is not sufficient in itself to optimize performance in ADLs and IADLs. A review of the OT literature in older adults with low vision has shown that multiple components are crucial, such as education, use of low vision devices, problem-solving strategies, and community resources.[52]

In addition to assistive technology, adaptive equipment, and environmental modifications, reorganization and task restructuring may be needed. Weisser-Pike and Kaldenberg[96] provided a framework of intervention strategies that the OT can consider when addressing functional activities for the person with low vision. Box 10.6 presents the modified version of this framework, which has nine categories, and provides some examples for each category. The OT may use this model in combination with interventions under the specific functional activity.

Box 10.6

Framework for Low Vision Interventions

Use of Corrective Lenses

Have client wear glasses for activities as needed. Some people use multiple pairs of glasses, depending on the task performed (eg, writing, reading, use of the computer, or driving). Ask about the client's most recent eye examination to make sure he or she has the most recent prescription.

Adequate Lighting

Examples include adding light that shines from behind the client onto the work area, avoiding glare and shadows on writing areas, and using natural light behind work area.

Good Ergonomic Positioning

Examples include raising reading material within field of vision and moving closer to an object, such as the television or a person. Ideal positions include upright, midline, comfortable postures.

Increase Contrast Enhancement

Examples include using black ink on white or yellow paper in an easy-to-read font (eg, Times New Roman or Arial) if providing printed materials. Mark edges of doorways or stairs with contrasting strip.

Simplification of Environment

An example is using a pill organizer, which can eliminate many pill bottles that create clutter and require numerous steps to manage.

Resize Written Materials

Examples include larger print, larger television, and larger label on pill bottles. For people with peripheral vision loss, enlargement of print may be contraindicated. Provide resources for large print materials.

Provide Sensory Substitutes

Use tactile or auditory cues, such as rubber bands on doorknobs and on frozen meals, to indicate how many minutes an item should be cooked; also, talking books and TV ears.

Restructure Routines

Use the time of day when vision is the best to perform difficult activities; use pill organizer.

Visual Skills/Referrals

Refer to vision specialist or low-vision rehab specialist.

Data from Weisser-Pike O, Kaldenberg J: Occupational therapy approaches to facilitate productive aging for individuals with low vision, *OT Practice* 15:CE1–CE8, 2010.

Adequate training and choosing the appropriate intervention and adaptive equipment are essential. Allow the client to touch and explore the piece of adaptive equipment before beginning practical teaching; break the steps down into small chunks of information; have the client practice a few days before doing the functional activity with the adaptive equipment; and request a return demonstration after the client has practiced.[43]

The modifications described in the following sections are appropriate for all people with low vision for performing ADLs.

Dressing Activities

1. Light the closet to improve acuity. Hang matching outfits together on the same hanger.

2. Place a safety pin on the label of the backs of shirts, pants, and dresses so that clothing is oriented correctly when worn.

3. Pin socks together before placing them in the washer and dryer so they stay matched.

Feeding Activities

1. Provide high contrast. Ensure that plates contrast with the table surface or place mats. Avoid patterned tablecloths.

2. Arrange food on the plate in a clockwise fashion and orient the person with low vision to the arrangement.

Personal Hygiene and Grooming Activities

1. Reduce clutter in bathroom drawers and cabinets.

2. Use an electric razor.

3. Use magnified mirrors.

4. Use a high-contrast bath mat in the bathtub.

5. Install high-contrast grab bars in the shower.

6. Use a high-contrast bath chair in the bathtub.

7. Train the client and other caregivers to keep supplies organized by replacing and storing them in the same location.

Communication Management and Environmental Adaptations

1. Use talking watches or clocks to tell time.

2. Use a talking scale to determine weight.

3. Use a large-print magnification screen on the computer.

4. Use large-print books, menus, and pharmacy labels.[82]

5. Use high-contrast doorknobs. Paint the doorframe a color that contrasts highly with the door to improve ease of identifying the door.

6. Use speakerphones, preprogrammed phone numbers, or a phone with large print and high-contrast numbers. Identify phone buttons with contrasting tape or a Velcro dot to teach the client how to turn the phone on and the correct buttons to push. Use a mobile phone with voice recognition commands.

7. Use writing guides to write letters, checks, or signatures.

8. To read, use books on tape, talking books, electronic books, and digital books (eg, Kindle) or an iPad. Screens can be magnified, and some of the devices have "reading" capability so the reader can listen to a story or newspaper article. Software is available, such as the JAWS screen reader, which reads aloud information on a computer screen.

9. To promote verbal communication, provide specific information when giving directions, avoid gestures, and offer to read educational materials out loud.[82]

10. When ending a conversation or leaving the room, notify the client and offer to help guide him or her out of a room because novel environments may be difficult.[82]

11. Do not have clients with low vision "guess" your identity by your voice (eg, "Do you remember me?"). Clearly introduce yourself.

Lighting and magnifiers

1. Improve lighting by aiming light at the work area, not into the eyes.

2. Reduce glare by having adjustable blinds, sheer curtains, or tinted windows. Wearing dark glasses indoors may also reduce glare.[82]

3. Maximize contrast by providing a work surface that is in contrast to the task. For example, serve a meal on a white plate if the table is dark. Paint a white edge on a dark step. Replace white wall switches with black to contrast with the wall.

4. Simplify figure-ground perception by clearing pathways and eliminating clutter.

5. Work in natural light by placing a chair by a window with the back toward the window.

6. Use magnifiers with lights. These come in a variety of sizes and degrees of magnification. Specialists in low vision can determine the appropriate degree of magnification needed. Some magnifiers are portable, others are attached to stands to do needlework or fine work, and others are sheets of plastic used to magnify an entire page of print.[40]

Functional Mobility

1. Mobility is eased with the clearing of pathways and the minimizing of clutter and furniture. Furniture can be used as guides for going from one place to another.

2. Lighting in hallways and entryways is also needed.

3. The person with low vision needs to optimize visual scanning abilities by learning to turn and position the head frequently when mobile or participating in an activity.[98]

4. Use scan courses (paths), which consist of letters and numbers that are placed systematically along a hallway to encourage those with peripheral vision loss to use visual search and scanning patterns[82] (also see Chapter 24).

5. The OT practitioner may need to refer a client with severe vision loss to an orientation and mobility specialist who is specifically trained in teaching mobility in the community, such as human guide techniques, use of a white cane, and use of service animals by people with low vision or those who are legally blind.

Home Management, Meal Preparation, and Cleanup Activities

Various devices are available to compensate for low vision while managing the home. Organization and consistency are critical to the safe and efficient performance of home management tasks. Family members need to remember to replace items where they were found and to refrain from reorganizing them without the assistance of the person with low vision. Suggestions include the following.[49]

1. For safety, cleaning supplies should be kept in a separate location from the food supplies.

2. Eliminate extra hazardous cleaning supplies and replace them with one multipurpose cleanser. Place this cleaning agent in a uniquely shaped bottle or in a specific location.

3. Mark appliance controls with high-contrast tape or paint to identify start and stop buttons or positions. Place Velcro tabs to mark frequently used positions on dials (eg, on the 350°F position for the stove or for the wash-and-wear cycle on the washer or dryer).

4. Label cans by using rubber bands to attach index cards with bold, dark print to each can. When the can is used, the card may be placed into a stack to create a shopping list.

5. Indicate the number of minutes needed for microwave cooking by placing rubber bands on the items. Two rubber bands would indicate that the item should be cooked for 2 minutes. Assistance will be needed for the initial setup.

6. Use a liquid level indicator to determine when hot liquid reaches 1 inch from top of a cup or container.

7. Use cutting guides or specially designed knives to cut meat or bread.[40]

8. Audio-record reminder lists or grocery lists.

9. Discourage the wearing of long, flowing gowns with flowing sleeves (eg, kimono style) while performing cooking tasks at the stove.

Medication management

1. Use a medication organizer to organize pills.

2. For diabetic management, many products are available for individualized evaluation of the client (eg, syringe magnifiers, talking or large-print glucometers, and a device to count the insulin dosages).

3. Use talking scales to evaluate weight.

Money management

1. Use a consistent method of folding money to identify denominations, as in the following example:

$1	Keep flat
$5	Fold in square half
$10	Fold lengthwise
$20	Fold in half and then lengthwise

2. Keep different denominations in different sections of the wallet. Learn to recognize coins by size and type of edge (smooth or rough).[98]

Leisure

1. Use low vision playing cards with large letters and symbols.

2. Search for resources in the community for activities aimed at people with low vision[71] (see Chapters 16 and 46).

ADLs for the Person of Large Size/Body Mass

The terms *morbidly obese* and *bariatrics* both are used to describe the population that is exceptionally large. Morbidly obese is defined as a body mass index (BMI) of 40 or greater. This population is to be separated from individuals who fall into the overweight or obese category because overweight and obese individuals most likely do not have functional deficits because of body size. *Bariatrics* is defined as the medical investigation, prevention, and treatment of obesity with interventions such as diet, nutrition, exercise, behavior modification, lifestyle changes, surgical alternatives, and appropriate medications. It is an area of practice that is continuing to expand.[4,33,34]

Individuals who are exceptionally large experience difficulty performing ADLs and IADLs.[2,67,83] They may have difficulty with ADLs and IADLs because of limitations in reach, strength, pain, and endurance. They may also experience neuropathies that require increased safety awareness to prevent skin breakdown. As with all clients, a comprehensive evaluation of the exceptionally large individual should include primary and secondary medical problems that result in additional functional deficits.

Adaptive techniques, adaptive equipment, and home modifications may allow for increased independence and safety. When recommending adaptive equipment and DME, the OT must consider the size and durability of equipment. For example, the standard molded sock aid may not fit around the exceptionally large client's calf, whereas softer fabric or flexible plastic sock aids likely will accommodate larger calf sizes.[33,34]

The standard DME issued may have maximal weight limits for safe use. For example, a bath chair or even a transfer (sliding) board may accommodate only individuals up to 250 pounds. Issuing adaptive equipment and DME that are inadequate for a client's weight may put the client at risk of injury.

Dressing Activities

Provide resources for clothing available in larger sizes that may help the client feel more comfortable in the community and help with self-esteem. Some manufacturers have designed exercise clothing, swimsuits, and work attire in larger sizes. Many resources can be found on the Internet that offer sizes up to at least 7X.

Lower extremity dressing activities

1. Use dressing sticks with a neoprene-covered coat hook on one end and a small hook on the other (see Fig. 10.7) for pushing and pulling garments off and on the feet and legs.

2. For socks, use a large, flexible, commercially available sock aid (see Fig. 10.8). The rigid sock aids available may not fit around larger calves.

3. Compensate for the need to bend to tie shoelaces by using elastic shoelaces or other adapted shoe fasteners, such as Velcro-fastened shoes or secure slip-on shoes. Edema is frequently a problem with this population and should be taken into account when shoes are selected.

4. Use reachers (see Fig. 10.9) for picking up socks and shoes, arranging clothes, removing clothes from hangers, picking up objects on the floor, and putting on pants, to avoid bending or unsafe reaching.

Upper extremity dressing activities

1. Use front-opening or pullover garments that are one size larger than needed and are made of fabrics that have some stretch.

2. Use dressing sticks (see Fig. 10.7) to push a shirt or blouse over the head and reach around shoulders. Some exceptionally large individuals are not able to touch the shoulder with the opposite hand because of the girth of the trunk.

Personal Hygiene and Grooming Activities

Bathing

1. A handheld flexible shower hose for bathing and shampooing the hair can eliminate the need to stand in the shower and offers the user control of the direction of the spray.

2. A long-handled bath brush or sponge with a soap holder (see Fig. 10.14) or long cloth scrubber can allow the user to reach the legs, feet, and back. If the standard long-handled bath brush/sponge is not long enough, add an extension with PVC pipe and a bend about one third of the distance from the handle to improve reach.

3. Safety rails that can accommodate the larger individual's weight (see Fig. 10.16) can be used for bathtub transfers, and safety mats or strips can be placed on the bathtub bottom to prevent slipping.

4. A bariatric transfer tub bench (similar to the transfer tub bench in Fig. 10.6) or a shower stool set in the bathtub or shower stall can eliminate the need to stand to shower, thus increasing safety and conserving energy. The bench should be built to accommodate the user's weight. The larger equipment may not be easily obtainable and may need to be special ordered. It is usually more functional to remove the back on the shower equipment to allow for increased sitting surface and room for the posterior buttocks to shift back on the seat and allow the user to lean back as legs are lifted into the shower or over the edge of the tub. The user must have adequate sitting balance before removing the back of the bench or stool.

5. Evaluate issues with water spillage from the tub or shower when using a transfer tub bench. A large person using a transfer tub bench that fits into the standard tub may need to plan ahead to manage water overflow because the width of the hips may cover the area on the bench originally designed for placement of the shower curtain. Water on the floor can lead to a fall and create extra cleanup. Extra towels may be required when setting up the shower.

6. Grab bars can be installed to prevent falls and ease transfers. A licensed contractor must securely mount these into the studs of the wall. The suction grab bars commercially available would not be safe for this population because the amount of pull and weight would cause the suction to release from the wall.

7. Use a hair dryer to thoroughly dry the skin in hard-to-reach areas (eg, buttocks, crotch, and abdominal folds) to prevent rashes and fungal infections in the folds.

Grooming

1. Use a long-handled mirror for regular skin checks of the feet to detect skin breakdown.

2. Over-the-counter spray products, such as deodorant, hair spray, and spray powder, can compensate for limited reach because the user does not need to make direct skin contact with the product. The spray can be aimed in the general direction (eg, the underarms) to provide adequate coverage.

Toileting

1. Use toilet paper holders/extenders for toilet hygiene because reach is often difficult for optimal hygiene. Several types of toilet aids are available in catalogs that sell assistive devices.

2. Use a bidet mounted on the toilet for toilet hygiene. Select one on which the controls are not mounted to the seat and likely to be covered by the user's wide hips. Many options are available, ranging from one as simple as a pump with a handheld spray to deluxe models that include front

and rear wash, warm-air drying, and water pressure control.

3. Dressing sticks can be used to pull garments up after using the toilet.

4. Bariatric bedside commodes can be used over the toilet, if there is enough room, or at the bedside. The commode should be built to accommodate the user's weight. The sitting surfaces should be smooth to prevent skin tears or pressure areas. Because body size may push the large person forward, the standard hole size is not in the correct location for toileting. The commode hole should be larger than that for a standard commode to allow space to reach for toilet hygiene and proper alignment for elimination. If the user is not able to stand and pivot to the commode, drop-arm commodes are available for the bariatric population (Fig. 10.42).

FIG 10.42 Bariatric commode. (Courtesy North Coast Medical, Gilroy, CA.)

5. Adapt male urinals with a PVC pipe handle to allow for independent use. This allows the client to use one hand to hold the urinal and the other hand to lift abdominal folds to place the urinal.

Functional Mobility

1. Set up furniture at an appropriate height by raising it on blocks to elevate it or by shortening leg rests to lower it. Multiple sitting surfaces allow the large individual to alter sitting pressures during the day; elevate lower extremities, which may be prone to edema; and provide alternatives to staying in bed. Several manufacturers make electrical lifts for furniture or chairs that accommodate individuals weighing up to 1000 pounds.

2. A glider/office chair that is operated by the feet can facilitate transportation if lower extremity endurance is limited. It should be built to accommodate the user's weight, and the user should be able to demonstrate a safe sit-to-stand technique because the chair is mobile, without brakes to secure it during transfers.

3. Encourage the use of mobility aids for safety. A physical therapist can assess whether a four-wheeled walker with a seat may improve mobility and function because the seat can be used as an energy-conservation method to carry items when moving from room to room. The user can sit on the four-wheeled walker seat to conserve energy while cooking, brushing teeth, shaving, and washing.

4. For the exceptionally large individual with limited functional mobility, a manual wheelchair is generally not functional because it is too wide for most doorways in the home. If the client is discharged home with a wheelchair that has a seat width greater than 24 inches, the user is likely to use it in only one room because doorways in most homes are too narrow to accommodate such a

large wheelchair. The OT and team should consider alternatives if a bariatric wheelchair is needed but access is limited.

Home Management, Meal Preparation, and Cleanup Activities

The exceptionally large person may be unable to reach faucet handles, reach into lower cabinets or a clothes dryer, be safe on step stools, or carry heavy items with proper body mechanics because of obstructions caused by abdomen size, limited endurance, and limited reaching and bending.[33] Home management activities can be facilitated by a wide variety of environmental adaptations, assistive devices, and fatigue management techniques.[33] The following are suggestions to facilitate home management for the exceptionally large individual.[33,34]

1. Store frequently used items on the first shelves of cabinets, just above and below counters, or on counters where possible. Eliminate unnecessary items.

2. If the individual is unable to reach faucet handles, add an extension onto the handle.

3. Use a high, stable stool to work comfortably at counter height, with the feet firmly placed on the ground; or, if a wheelchair is used, attach a drop-leaf table to the wall for a planning and meal preparation area.

4. Use a utility cart of comfortable height or a four-wheeled walker to transport several items at once.

5. Use reachers to get lightweight items (eg, a cereal box) from high shelves. Place frequently used items on shelves in cabinets and in the refrigerator where the items are easily accessible and reachable.

6. Eliminate bending by using extended and flexible plastic handles on dust mops, brooms, and dustpans. Sit to do cleaning and move the chair as needed.

7. Use pullout shelves or lazy Susans to organize cupboards to eliminate bending and to ease access to items.

8. Eliminate bending by using a wall oven, countertop broiler, microwave oven, and convection oven.

9. Use a metal kitchen spatula to pull out and push in oven racks. There also are commercially available tools for this purpose.

10. Eliminate leaning and bending by using a top-loading automatic washer and elevated dryer. Wheelchair users or people of shorter stature can benefit from front-loading appliances. Use a reacher or other extended tool to obtain clothes from the washer or dryer.

11. Use an adjustable ironing board to make it possible to sit while ironing, or eliminate ironing with the use of permanently pressed clothing.[2,33,34,83]

Threaded Case Study

Anna, Part 2

At the beginning of this chapter, Anna's case introduced questions regarding ADL and IADL participation. Anna identified many ADLs and IADLs that she wanted to engage in as independently as possible, such as self-care, childrearing, spiritual activities, sexual function and fertility, community mobility, financial management, home management, meal preparation and cleanup, and shopping. All of these areas are in the domain of occupational therapy and can be addressed while Anna is in the inpatient setting and further along in the continuum of care. The topic of sexual function and fertility were not addressed in this chapter. However, it is an important ADL that OTs can and should discuss with clients such as Anna[36] (also see Chapter 12, Sexuality and Physical Dysfunction). With the many areas that must be addressed, an occupational therapist, along with the client, family, and rehabilitation team, must prioritize which areas to address at each stage. Prior to discharge home, a home evaluation is indicated for safety and accessibility, as is an assessment for appropriate DME such as a wheelchair and padded bath bench. Other equipment and adaptive techniques in ADLs and IADLs may also be recommended to foster Anna's independence and return to her roles as wife, mother, worker, and active community member.

Summary

ADLs and IADLs are areas of occupation that include activities that enable a person to function independently and assume important occupational roles. ADLs include self-care tasks such as bathing and showering; bowel and bladder management; dressing and undressing; eating (or swallowing), feeding; functional mobility (eg, transfers and bed mobility); sexual activity; toilet hygiene; and the care of personal devices (eg. hearing aids, orthotics, and splints). IADL tasks include care of others and of pets; childrearing; communication management (eg, use of telephones, smart phones, and computers); community mobility (eg, driving and use of public transportation); financial management (eg, use of cash and check writing); and health management and maintenance.

Occupational therapists routinely assess performance in ADLs and IADLs to determine a client's level of functional independence. Interviews and performance analysis are used to carry out the assessment. OTs also assess and take into consideration the client's performance skills, performance patterns, environment, and cultural, personal, temporal, and virtual contexts when they evaluate and establish the treatment goals.

The results of the assessment and ongoing progress are recorded on one of the many available ADL checklists or with a standardized assessment, the content of which is summarized for the permanent medical record (see Chapter 8 for further information on documentation). Intervention is client centered and directed at training in independent living skills or at teaching a caregiver to assist the client with ADLs and IADLs. The OT can include in the intervention plan compensatory strategies, home modification, adaptive equipment, DME, work simplification, and energy conservation techniques to improve ADL and IADL performance.

Review Questions

1. Define ADLs and IADLs. List three classifications of tasks that may be considered in each category.
2. What is the role of OT in restoring ADL and IADL independence?
3. List at least three activities considered self-care skills, three functional mobility skills, three functional communication skills, and three home management or meal preparation and cleanup skills.
4. List three factors the occupational therapist must consider before commencing ADL performance assessment and training. Describe how each could limit or affect ADL performance.
5. What is the ultimate goal of the ADL and IADL training program?
6. Discuss the concept of maximal independence as defined in the text.
7. List the general steps in the procedure for ADL assessment.
8. Describe how the occupational therapist can use the ADL checklist.
9. List the steps in the activities of IADL assessment.
10. What is the purpose of the home evaluation?
11. List the steps in the home evaluation.
12. What kinds of things are observed in a home assessment?
13. How does the therapist record and report the results of the home evaluation and make the necessary recommendations?
14. How does the occupational therapist, with the client, select ADL and IADL training objectives after an assessment?
15. Describe three approaches to teaching ADL skills to a client with perception or memory deficits.
16. List the important factors to include in an ADL or IADL progress report.
17. Describe the levels of independence as defined in the text.
18. Give an example of a health management and maintenance issue.
19. Give three examples of adaptations that may be helpful for the person with low vision.

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11

Mobility

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CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Define functional ambulation.
2. Discuss the roles of physical and occupational therapists and other caregivers in functional ambulation.
3. Identify safety issues in functional ambulation.
4. Recognize basic lower extremity orthotics and ambulation aids.
5. Develop goals and plans that can help ambulatory clients resume occupational roles.
6. Identify the components necessary to perform a wheelchair evaluation.
7. Explain the process of wheelchair measurement and prescription completion.
8. Identify wheelchair safety considerations.
9. Follow guidelines for proper body mechanics.

). Apply principles of proper body positioning.

1. Identify the steps necessary for performing various transfer techniques.
2. Identify considerations necessary to determine the appropriate transfer method based on the client's clinical presentation.
3. Identify different transportation systems and contexts and the treatment implications each system presents.
4. Discuss the multilevel role of the therapist in the occupation of community mobility.
5. List performance skills and client factors that should be assessed in a comprehensive driver evaluation.
6. Discuss the value of driving within this society and how loss of license or mobility affects participation in occupation.
7. Develop awareness of the complexities involved in a driver referral and evaluation.
8. Define primary and secondary controls.
9. Discuss why driver competency assessment is a specialty practice area requiring advanced training.

KEY TERMS

Ambulation aids
Americans with Disabilities Act (ADA)
Body mechanics
Community mobility
Driver competence
Driver training
Driving
Driving retirement
Durable medical equipment (DME)
Fixed-route system
Follow-up services
Functional ambulation
Gait training
Medical necessity
Older drivers
On-road assessment
Paratransit
Pelvic tilt
Positioning mass
Primary controls
Private transportation
Rehabilitation technology supplier

Secondary controls

Skin breakdown

Vital capacity

Walking, climbing stairs, traveling within one's neighborhood, and **driving** a car are so universal and customary that most people would not consider these to be complex activities. The basic capacities to move within the environment, to reach objects of interest, to explore one's surroundings, and to come and go at will appear natural and easy. For persons with disabilities, however, mobility is rarely taken for granted or thought of as automatic. A disability may prevent a person from using the legs to walk or using the hands to operate controls of motor vehicles. Cardiopulmonary and medical conditions may limit aerobic capacity or endurance, requiring the person to take frequent rests and to curtail walking to cover only the most basic of needs, such as toileting. Deficits in motor coordination, flexibility, and strength may seriously compromise movement and may make difficult any activities that require a combination of mobility (eg, walking or moving in the environment) and stability (eg, holding the hands steady when carrying a cup of coffee or a watering can).

Occupational therapy (OT) practitioners assist persons with mobility restrictions to achieve maximum access to environments and objects of interest to them. Typically, OT practitioners provide remediation and compensatory training. In so doing, therapists must analyze the activities most valued and the environments most often used by their clients and must consider any future changes that can be predicted from an individual's medical history, prognosis, and developmental status.

This chapter guides the practitioner in evaluation and intervention for persons with mobility restrictions. Three main topics are explored. The first section addresses functional ambulation, which combines the act of walking within one's immediate environment (eg, home, workplace) with other activities chosen by the individual. Feeding pets, preparing a meal and carrying it to a table, and doing simple housework are tasks that may involve functional ambulation. Functional ambulation may be conducted with aids such as walkers, canes, or crutches.

The second section is focused on wheelchairs and their selection, measurement, fitting, and use. For many persons with disabilities, mobility becomes possible only with a wheelchair and specific positioning devices. Consequently, individual evaluation is needed to select and fit this essential piece of personal medical equipment. Proper training in ergonomic use allows the person who is dependent on the use of a wheelchair many years of safe and comfortable mobility. Safe and efficient transfer techniques based on the individual's clinical status are introduced in this chapter. Attention also is given to the **body mechanics** required to safely assist an individual.

The third section covers **community mobility**, which for many in the United States is synonymous with driving. Increased advocacy by and for persons with disabilities has improved access and has yielded an increasing range of options for adapting motor vehicles to meet individual needs. Public transportation also has become increasingly accessible. Driving is a complex activity that requires multiple cognitive and perceptual skills. Evaluation of individuals with medical conditions and physical limitations is thus important for the safety of the disabled person and the public at large.

Mobility is an area of OT practice that requires close coordination with other healthcare providers, particularly physical therapists (PTs) and providers of **durable medical equipment (DME)**. Improving and maintaining the functional and community mobility of persons with disabilities can be one of the most gratifying practice areas. Clients experience tremendous energy and empowerment when they are able to access and explore wider and more interesting environments.

Section 1 Functional Ambulation

Deborah Bolding

Section 1 Threaded Case Study

Pyia, Part 1

Pyia is a 75-year-old woman who was treated for breast cancer 8 years earlier. She developed spinal metastases, with an onset of acute, bilateral lower extremity weakness and loss of sensation. For 2 days she felt “unsteady” when she was walking, and she had one fall. By the time she was admitted to the hospital, she was unable to walk. She underwent a laminectomy and decompression of the spinal cord, with debulking of the tumor, followed by CyberKnife treatment.

Pyia was hospitalized for 1 day before her surgery and for 4 days after the surgery. Postoperatively she learned to ambulate 50 feet with a front-wheeled walker and minimal assistance and to get on and off a commode chair. She required an ankle-foot orthosis (AFO) for her left foot. Pyia was discharged from the hospital to stay with her daughter and had a rental wheelchair for community mobility. A referral for home-based occupational and physical therapy was made through a home care agency.

An occupational profile provided the following information about Pyia. Pyia was widowed and lived alone in a three-bedroom house with three steps by which to enter the home. She retired from retail sales when she was 62. She was independent in driving, was active in her church, and attended occasional programs at the local senior citizens' center. She volunteered 3 hours per week at a thrift shop that benefits the local children's hospital. Pyia has two close friends with whom she would go to lunch each Tuesday. Pyia has three children, two sons who live in other states and the daughter who lives in the same town. She has two grandchildren, ages 10 and 13, who live nearby. Two or three times per year she would fly to visit her sons.

An important part of Pyia's life for the past few years has been going to her daughter's home one or two afternoons per week. She would help watch the grandchildren after school or drive them to activities while their parents worked. She would also help her daughter with laundry and dinner preparation.

After 3 weeks at her daughter's home, Pyia was asked to identify what areas of occupational performance were still problematic for her, what she could do well, and what her goals were. She replied that she was happy to be walking better but felt endurance was still a problem. She used the walker independently in the home but still needed assistance to get up and down stairs. The PT felt that she soon would be independent with stairs and may be able to transition to a cane because her lower extremity strength, especially in her right leg, had improved. Pyia was able to walk to the bathroom and to use a toilet independently and was independent in dressing. Her daughter helped her into and out of the tub for safety reasons, and she used a stool in the tub for bathing. She was able to prepare a simple breakfast and lunch but needed a rest period each morning and afternoon.

Pyia felt like a burden to her daughter and son-in-law. She felt guilty that her daughter had taken a week off work after her hospitalization to be with her at home and that her son had to visit to help her for the second week. She was happy that she could now take care of herself during the day but would like to be able to help with household chores. She had to rely on her family and friends to drive her to doctors' appointments, and she will need them to drive her to therapy appointments the following week as she transitions to outpatient care. Pyia wished that she could return to her home but recognized that she was not yet ready. Her old friends brought lunch to her daughter's home the previous Tuesday, and she was grateful for their support and the support she received from her pastor and church.

Critical Thinking Questions

1. How did Pyia's needs, goals, and occupational roles change during the course of her illness and recuperation?

2. Where would you start your intervention plan, considering her current goals?

3. What are safety issues, and how would you address them?

Occupational therapists (OTs) work with many types of clients who may have impaired ambulation due to congenital conditions, disease, or trauma. These impairments may be temporary or long term. For example, an elderly person with a hip fracture may require the use of a walker for several weeks or months until the bone is healed and strength is regained. Persons with a spinal cord injury may have permanent motor and sensory losses that require lower extremity bracing and the use of crutches for walking, or they may require a wheelchair for mobility. They may be ambulatory only part of the time and may use a wheelchair part of the time. The ability to ambulate involves many factors, including the condition or type of disability, the amount of energy required for ambulation, balance, and the person's occupational roles.

Functional ambulation, a component of functional mobility, is the term used to describe how a person walks while achieving a goal, such as carrying a plate to the table or carrying groceries from the car to the house. Functional ambulation training is applicable for all individuals with safety or functional impairments and for a variety of diagnoses, such as lower extremity amputation, cerebrovascular accident, brain trauma or tumor, neurological disease, spinal cord injury, orthopedic injury, and total hip or knee replacement. Older adults and persons with neurological diagnoses are at higher risk for falls, and training may be important to prevent injuries as a result of falls. Intervention goals should focus on the ability of individuals to engage in occupations and to promote wellness and safety during those occupations.

Ambulation evaluation, **gait training** (treatments used to improve walking and ameliorate deviations from normal gait), and recommendations for bracing and **ambulation aids** are included in the professional role of the physical therapist. The PT makes recommendations that can be followed by the client, families, hospital staff, or other caregivers. The OT works closely with colleagues in physical therapy to determine when clients may be ready to advance to the next levels of functional performance. For example, the OT may begin having a client walk to the bathroom for toileting instead of using a bedside commode. The PT may recommend techniques, equipment, or cueing to improve safety. Mutual respect and good communication between all professionals help coordinate care and maximize client outcomes. For example, a client with Parkinson's disease may walk well with the PT immediately after taking his medication in the morning but may have difficulty walking to the refrigerator to select items to prepare lunch a few hours later when the effects of medication are waning. Client-centered care, with strong interprofessional communication, will help with meeting the client's identified goals.

The following section is meant to provide an introduction to the OT about the basics of ambulation and aids (eg, crutches, canes, walkers, and braces) to assist with the teaching of activities of daily living (ADLs). It is not meant as a substitute for close collaboration with a physical therapist. A basic introduction will also be provided to fall prevention and safety.

Basics of Ambulation

Normal walking is a method of using two legs, alternately, to provide support and propulsion. The terms gait and walking are often used interchangeably, but gait more accurately describes the style of walking. The “normal” pattern of walking includes components of body support on each leg alternately (stance phase), advancement of the swinging leg to allow it to take over a supporting role (swing phase), balance, and power to move the legs and trunk. Normal walking is achieved without difficulty and with minimal energy consumption. During normal walking the person has more time in the stance phase compared to the swing phase.

Descriptors of the events of walking include loading response, midstance, terminal stance and preswing, and midswing and terminal swing; the duration of the complete cycle is called cycle time. Cadence is the average step rate. Stride length is the distance between two placements of the same foot. It may be shortened in people with a variety of diseases. Walking base is the distance between the line of the two feet. It may be wider than normal for people with balance deficits.[212]

Abnormal gait is caused by disorders of the complex interaction between neuromuscular and structural elements of the body. It may result from problems with the brain, spinal cord, nerves, muscles, joints, or skeleton, or from pain. Problems may include weakness, paralysis, ataxia, spasticity, loss of sensation, and inability to bear weight through the limb or pelvis. Deficits may include decreased velocity, decreased weight bearing, increased swing time of the affected leg, an abnormal base of support, and balance problems. Functional deficits may include loss of mobility, decreased safety (increased fall risk), and insufficient endurance. The OT should reinforce gait training by following the recommendations of the PT.

Orthotics

As the PT evaluates the causes of gait problems, orthotics and ambulatory aids may be recommended. The OT should be familiar with basic lower extremity (LE) orthotics, including the reason for bracing. The OT may teach clients to put on the orthotics as part of dressing training.

Orthotics, or braces, are used to provide support and stability for a joint, to prevent deformity, or to replace lost function. They should be comfortable, easy to apply, and lightweight, if possible. The more joints of the lower extremity require bracing, the higher is the energy cost of ambulation.

Orthotics are named by the part of the body that is supported. A supramalleolar orthosis (SMO), or supramalleolar ankle-foot orthosis (SMAFO), is made of plastic and fits into a shoe. It provides medial-lateral stability at the ankle, provides rear foot alignment during gait, supports midfoot laxity, and can control pronation/supination positions of the forefoot. It is not useful in cases of high tone or limited dorsiflexion. An ankle-foot orthosis (AFO) is usually made of plastic; it inserts into a shoe and extends up the back of the lower leg. It is sometimes called a foot drop splint because it is used in cases of central or peripheral nerve lesions, which cause weakness of ankle dorsiflexors. An AFO may consist of one piece or may be hinged to permit ankle dorsiflexion. A knee-ankle-foot orthosis (KAFO) may be recommended for clients with knee weakness or hyperextension, or with foot problems. The KAFO might be used with diagnoses such as paraplegia, cerebral palsy, or spina bifida. For clients with spinal cord lesions or spina bifida involving the hip muscles, a hip-knee-ankle-foot orthosis (HKAFO) might be used. A reciprocating gait orthosis (RGO) is a type of HKAFO that may be used to help advance the hip in the presence of hip flexor weakness. High energy costs are associated with use of HKAFOs, and clients' upper extremities are used for support on walkers and crutches. This makes functional ambulation tasks extremely challenging for these clients, and it may be more energy efficient and safer to perform some tasks while seated in a chair or wheelchair.

Walking Aids

Ambulation aids may be used to compensate for deficits in balance and strength, to decrease pain, and to decrease weight bearing on involved joints and help with fracture healing, or in the absence of a lower extremity. Walking aids are generally classified as canes, crutches, and walkers. All three help support part of the body weight through the arm or arms during gait. They may also be sensory cues for balance and may enhance stability by increasing the size of the base of support.

A single-point cane may be used with clients who have minor balance problems to widen the base of support or provide sensory feedback through the upper extremity about position. For clients with a painful hip or knee, a cane is most commonly used on the contralateral side to reduce loading on the painful joint. The cane is advanced during the swing phase of the leg it is protecting. Variations of cane designs include quad canes and hemiwalkers, which are heavier and bulkier than single-point canes but provide greater stability.

Crutches are able to transmit forces in a horizontal plane because two points of attachment exist —one at the hand and the other higher on the arm. Clients should be cautioned not to lean on crutches at the axilla because this may cause damage to blood vessels or nerves. The lever between the axilla and the hand is long, and enough horizontal force can be generated to permit walking when one leg has restricted weight-bearing capacity or when both legs are straight and have limited or no weight-bearing capacity. Crutches are suitable for short-term use, such as for a fractured leg.

Forearm crutches may also be called Lofstrand or Canadian crutches. The points of contact are on the hand and forearm. Forearm crutches are lighter than the axillary type, and the lever arm is shorter. For most people mobility is easier with forearm crutches than with the axillary type, and forearm crutches are useful for active people with severe leg weakness. All crutches require good upper body strength.

Walkers are more stable than canes or crutches. With a pick-up–style walker, the walker is moved first; the client takes a short step with each foot and then moves the walker again. This type of walking can be slow. Most clients who need a walker are able to use a front-wheeled walker, which has two wheels on the front, making it lighter and easier to advance. Another variation is to have four wheels, along with a braking system. Some walkers have seats so that clients can rest when they become fatigued. Walkers require the use of both arms but do not require as much upper body strength or balance as crutches. Forearm platforms can be added to forearm crutches or walkers when clients are unable to bear weight through their hands or wrists, perhaps because of fracture or arthritis. For example, the client in the case study, Pyia, is currently using a walker that supplies substantial support during ambulation but requires additional energy to use compared with a cane. The PT may recommend a cane as Pyia progresses, but a walker may still be necessary in some situations within the home environment.

Ambulation Techniques

Basic ambulation techniques recommended by the PT vary from client to client, depending on the individual's goals, strengths, and weaknesses, and may be more complex than the descriptions provided previously. The OT reinforces the PT's recommendations and incorporates them into functional ambulation activities.

During functional ambulation on a level surface, the OT is positioned slightly behind and to one side of the client. The therapist may be on the client's stronger or weaker side, based on the recommendations and preference of the PT or the goals of the activity. The OT moves in tandem with the client when providing support during ambulation. The OT's outermost lower extremity moves with the ambulation aid, and the OT's inside foot moves forward with the client's lower extremity. Of course, some clients may be independent with basic ambulation and may need guarding or assistance only when practicing new activities, such as transporting hot foods, mopping a floor, or reaching into a dryer.

Safety

OT Practice Notes

Safety for Functional Ambulation

1. Know the client (eg, status, orthotics and aids, precautions).

2. Use appropriate footwear.

3. Monitor physiological responses.

4. Use a gait belt to guide the client. Do not use the client's clothes or upper extremity to guide the client.

5. Think ahead for the unexpected.

6. Do not leave the client unattended.

7. Clear potential hazards.

Safety is the number one priority for clients during functional ambulation. Before beginning an evaluation of ADLs, the OT should know basic client information. The therapist reviews the medical record, especially the current status and precautions. Does the client use oxygen? Does it need to be increased during activity? In the hospital setting it may be useful to be aware of the client's hematocrit level, if available, to help predict how much activity the client may be able to tolerate. The therapist should review PT reports and confer with the PT as needed about gait techniques, aids, orthotics, and ambulatory status. To prepare the client for functional ambulation, the therapist and the client should have safe and appropriate footwear. Soft-soled shoes or shoes with a slippery sole should be avoided, and slippers or shoes without a heel support can compromise safety and stability for the client.

Another key to safe and successful ADLs is awareness of the client's endurance level, including the distance the client is able to ambulate. It is very important to plan ahead for the activity. The therapist should have a wheelchair, a chair, or a stool readily available for use at appropriate intervals or in case of need caused by client fatigue. The area should be free of potential safety hazards, such as throw rugs or other objects on the floor. In certain cases, however, as with a client with unilateral neglect, hemianopsia, or visual or perceptual deficits, the therapist may want to challenge the client to manage in a complex environment.

The client's physiological responses should be monitored during the activity. The therapist should be aware of the client's precautions and should respond appropriately. Physiological responses may include a change in breathing patterns, perspiration, reddened or pale skin, a change in mental status, and decreased responsiveness. These changes may require termination of the activity to allow the client a period of rest. Recall that Pyia continues to experience limited endurance and easily fatigues. Activities that require sustained standing or walking may be too challenging at this time.

Elderly clients who use assistive devices for ambulation before hospitalization are particularly at risk for loss of ADL and instrumental activities of daily living (IADLs) function after hospitalization. A history of use of assistive devices may be a marker for decreased ability to recover.[120] It may be important to target these elderly individuals for intensive therapy to maintain function.

Falls represent a major problem in the elderly. Studies suggest that one-fourth of persons aged 65 to 79 and half of those older than 80 fall every year.[60] Falls result from many factors, including both intrinsic (eg, health, existence of balance disorders) and external, or environmental, factors. Home hazards include poor lighting, inadequate bathroom grab rails, inadequate stair rails, exposed electrical cords, items on the floors, and throw rugs. Elderly people with health problems such as cardiac disease, stroke, and degenerative neurological conditions have an even greater risk of falling.[110,171] OTs may visit the client's home while the client is hospitalized or may work through home health agencies, fall prevention programs, or senior citizen centers to help evaluate homes for potential hazards.[148] All reasonable efforts should be made to decrease the risk of falls.

If a client loses his or her balance or stumbles, the therapist will have better control of the client if he or she is holding onto the client's trunk. Therapists may be less prone to injure their own backs if they use their legs to support or lower the client to the floor instead of pulling or twisting with the upper body. For a client who feels faint or develops sudden leg weakness, the therapist lowers the client onto the therapist's flexed leg, as if onto a chair, and then down to the floor.

OT Practice Notes

All clients who are at risk for falling and who are alone for significant periods of time should be connected to a lifeline-type phone system by which help can be summoned in the event of a fall or other emergency. Local hospitals or senior citizen centers will have further information about lifeline services.

Functional Ambulation Activities

OT Practice Notes

The therapist must develop a good working relationship with the equipment supplier and reimbursement sources to facilitate payment of the most appropriate mobility system for the client. The therapist must have the oral and written documentation skills needed to clearly communicate the medical necessity, appropriateness, and cost-effectiveness of each item throughout the assessment and recommendation process.

Functional ambulation integrates ambulation into ADLs and IADLs. By using an occupationally based approach, the OT assesses the client's abilities within the performance context and with an understanding of the client's habits, routines, and roles. What role or roles does the client have or want to have? What tasks does this role require? The OT plans for functional mobility activities with the goal of helping the client achieve valued roles and activities. Several typical functional ambulation activities follow. These activities must be individualized for clients. Functional ambulation may be incorporated during ADLs, IADLs, work, play, or leisure activities.

Kitchen Ambulation

Meal preparation and cleanup involve many different tasks, such as opening and reaching into a refrigerator, dishwasher, stove, microwave, and cupboards. This often involves transporting items within the kitchen and to a table. If something is dropped, the item will need to be retrieved from the floor. The task may be relatively quick and easy, such as heating food in a microwave, or may require someone to stand while chopping, stirring, or cooking food. The OT can help the client engage in problem-solving strategies on how to safely accomplish these tasks. For example, clients with left hemiplegia who ambulate with a quad cane may be guided to the left of the oven so that they can open the oven door by using the unaffected right upper extremity. The same concept should be kept in mind for opening cabinet doors or drawers or refrigerator doors. The therapist can help assess the client's safety during these tasks and can recommend alternatives as needed. If the client is unable to successfully balance and reach into the oven, a toaster oven on the counter may be a safer alternative. Clients can place frequently needed items in convenient locations, or equipment such as a reacher may be needed. If the reacher is applied to a walker with Velcro, it is usually available when the client needs it. Clients may be able to pick up items from the floor by kicking or pushing the item close to a counter, where they can hold on to the counter while bending to pick up the item. If they have had a total hip replacement and have hip flexion precautions, they can position the affected leg behind them, being careful to not internally rotate the hip, while they reach down to the floor.

Transporting items such as food, plates, and eating utensils during functional ambulation invites creative problem solving on the part of the OT, particularly when the client is using an ambulation aid (Figs. 11.1 and 11.2). Baskets attached to a walker, rolling carts, or countertops on which to slide the item may be appropriate in these situations. Clients must clearly desire the equipment or adaptations, and care should be taken not to provide unwanted or unnecessary equipment. A client who does not live alone may prefer to share jobs with other family members; that is, the client may do the cooking while a family member sets and clears the table. Although Pyia was able to prepare a simple meal, she still experiences fatigue after doing so and is unable to assist her daughter in meal preparation. Suggestions regarding adaptations and energy conservation techniques may support Pyia's goal of being able to help with this activity while still living with her daughter.

FIG 11.1 Functional ambulation with an active walker and serving tray. (©2016 Problem Solvers.)

FIG 11.2 Functional ambulation with a straight cane.

Bathroom Ambulation

Functional ambulation to the sink, toilet, bathtub, or shower is an important concern for the client. Care should be taken during activities in the bathroom because of the many risks associated with water and hard surfaces. Spills on the floor are slipping hazards, and loose bath mats are tripping hazards. Clients must be educated about these dangers. Nonslip surfaces or mats should be used on tub and shower floors.

Functional ambulation to the sink using a walker may be performed by having the client approach the sink as closely as possible. If the walker has a walker basket, the client can position the walker at the side of the sink; then, while holding on to the walker with one hand and the sink or countertop with the other, the patient can turn to face the sink.

The importance of helping the client become as independent as possible in toileting cannot be overemphasized. People who are unsure about their abilities to safely use a toilet in friends' or families' homes, in restaurants, in the mall, or at gas stations may become homebound as a result. When safe to do so, practice toileting in a variety of settings and with and without equipment such as commodes or elevating toilet seats and grab bars. One limiting factor may be postoperative precautions; a tall client who has had a total hip replacement may not be able to sit safely on a regular toilet while observing the postsurgical precaution of no hip flexion greater than 90 degrees. A shorter client may be able to sit successfully on a toilet of regular height without difficulty. If a client is unable to get up and down from the toilet without assistance or if he or she does so with difficulty, consult the PT, who can provide the client with lower extremity strengthening exercises.

When the client is ambulating to a tub or shower, make sure the equipment and supplies are in position for the client to use. While stepping into a shower stall with a low rim, clients use the same technique that they would use to go up a curb or step, using their walking aid if it fits into the door of the shower. If the walking aid does not fit, the therapist can evaluate the client's ability to safely step in without the equipment. A client who has non–weight-bearing precautions on a leg will not be able to step into a shower without walking aids and will not step into a tub. A tub bench must be used for non–weight-bearing clients who have access only to tubs. Pyia is able to negotiate her daughter's home and to use the toilet but still requires assistance to transfer into and out of the tub. These skills will have to be addressed before Pyia can return to her own home.

Grab bars are important safety items for clients in the shower and tub. The therapist may want to practice shower or tub transfers under trial conditions before practicing an actual shower or bath. Some older persons have become accustomed to taking sponge baths because of a fear of falling in the bathroom. The therapist should determine whether the client is satisfied with this system or would like to work toward independent showering.

Home Management Ambulation

The ability to live alone is closely tied to the ability to perform IADLs.[118] Home management activities include cleaning, laundry, and household maintenance. Cleaning includes tidying, vacuuming, sweeping and mopping floors, dusting, and making beds. Clients may balance with one hand and hold onto a counter or a sturdy piece of furniture while cleaning floors if they are not stable independently or are using a walking aid. Lightweight duster-style sweepers, which come with dry or wet replaceable pads, are easy to handle and use. When making the bed, the client can stabilize himself or herself on the bed or walking aid while straightening and pulling up sheets and bedcovers. The client then moves around the bed to the other side to repeat the process. Some clients find that carrying items in a small fanny pack or shoulder bag slung over the neck is an easy way to transport small items such as cordless phones, bottled water, and books. Moving clothes to or from a laundry room may present a challenge for people with mobility impairments, particularly if they use a walking aid. Rolling carts may be useful to transport items to the laundry and in the kitchen. Some clients carry items over the front of their walkers, in a bag attached to the walker, or in a bag that they hold while walking with crutches or a cane. Whichever method is safe for the client is acceptable. Watch to make sure that the clothes do not shift while clients carry them; this may throw them off balance.

Other home management activities may include maintenance of the yard, garden, appliances, and vehicles. The client should be consulted to determine the home management activity most valued by him or her before the functional activity is begun. Sometimes the client has goals that the therapist does not believe are safe for the client to perform. For example, the client who has had a mild stroke who wants to climb a ladder and trim tree branches with his power saw may need to be persuaded to wait until his balance and strength are improved. Although this is a valued activity, it may be incompatible with the client's functional abilities at the time. Gardening is an area in which the PT and the OT may wish to collaborate. The PT helps the client learn to maneuver over uneven surfaces and get up and down from the ground, whereas the OT helps the client learn how to carry tools and other equipment and how to dispose of clippings and weeds.

In case of falls clients should learn how to get up and down from the floor or ground during physical therapy sessions. It may be a functional activity with the OT when clients want to be able to get to the bottom of a tub, reach objects stored under a bed, or sit on the floor to play with their grandchildren.

Therapists should listen to clients about the techniques that clients have developed to be independent and safe. Some clients with fall risks manage to walk to the bathroom from their bed every night without putting on braces and/or using equipment. They will say things such as, “I lean against the wall as I walk,” or “There is a couch there, and I brace myself on the back.” If the technique is safe and if the client has not had falls, the routine may not need modification.

Section 1 Summary

Functional ambulation may be incorporated during ADLs, IADLs, work and productive activities, and play or leisure. OTs and PTs have an opportunity to collaborate, with the PT providing gait training, exercises, and ambulation aid recommendations, and the OT reinforcing training and integrating it during purposeful activities.

Section 1: Threaded Case Study

Pyia, Part 2

Pyia's roles as homemaker, caregiver, grandmother, mother, and volunteer changed with her illness. Her role became more passive as others became her caregivers. Initially, she was very concerned about her disease, whether and how long she would live, and if she would ever be able to walk again. After surgery, her goals were to be able to walk and to go to her daughter's home. Once this was achieved, she began to experience loss about her change in roles and to plan for the future: taking care of herself during the day, resuming homemaking activities, planning a return to her own home, visiting with her friends, and becoming more independent in the community.

Pyia is home alone during the day. She would like to be more active with homemaking, both to help her daughter and to prepare for the return to her own home. The therapist could begin practice on laundry and cleaning. Pyia is already able to do basic meal preparation. The therapist could help assess safety in Pyia's home, make recommendations for equipment or modifications, and refer the family for lifeline services. Pyia might arrange transportation services for the disabled through her county, or she could have a driver's evaluation to determine whether she could start to drive again. She would need to be able to get into and out of the car safely and to put her walker and other items in the car.

Section 2 Wheelchair Assessment and Transfers

Michelle Tipton-Burton, with contributions from Carol Adler

Wheelchairs

Section 2: Threaded Case Study

William, Part 1

William is a 17-year-old male who sustained a C6 spinal cord injury after a diving accident approximately 2 weeks ago. Sensation and motor function are absent below the level of the lesion. He is medically stable, receiving rehabilitation services, and has been referred for a wheelchair assessment. William has a halo vest for stabilization and is able to tolerate sitting upright for 1 hour before he complains of getting dizzy. He still asks the rehabilitation therapists, nurses, and his physician when he will be able to move his legs. He has been told that because he has had no return of function during the past 2 weeks, it is unlikely that he will have significant changes in his current level of motor and sensory function.

Upon discharge from the inpatient rehabilitation unit, William will be returning to his home, where he lives with his parents and younger brother. The home is two stories high, and William's bedroom is located on the second floor. A bathroom is located on the first floor.

Before his injury William was very physically active and was on the track and field team at his high school. He was also an avid hiker and often would go camping with his family and friends. William is a high school senior and received early acceptance to a university located within 2 hours of his home. He was very excited about attending this university because of the track and field program, in addition to his interest in becoming a marine biologist. Although William's friends have come to visit him, his girlfriend of 2 years has not visited.

Critical Thinking Questions

1. How would you anticipate that William would respond to being fitted for a wheelchair? What emotional responses may be evoked in William by this experience? How could you minimize his potential distress?
2. What decisions could William make regarding selection of the wheelchair?
3. Considering William's needs across several contexts, what type of wheelchair would you recommend?
4. What client factors must be considered when a wheelchair is selected for William?

A wheelchair can be the primary means of mobility for someone with a permanent or progressive disability, such as cerebral palsy, brain injury, spinal cord injury, multiple sclerosis, or muscular dystrophy. Someone with a short-term illness or orthopedic problem may need it as a temporary means of mobility. In addition to mobility, the wheelchair can substantially influence total body positioning, skin integrity, overall function, and the general well-being of the client. Regardless of the diagnosis of the client's condition, the OT must understand the complexity of wheelchair technology; available options and modifications; the evaluation and measuring process; the use, care, and cost of the wheelchair; and the process by which this equipment is funded.

Wheelchairs have evolved considerably in recent years, and significant advances have been made in powered and manual wheelchair technology by manufacturers and service providers. Products are constantly changing. Many improvements are the result of user and therapist recommendations. Durable medical equipment reimbursement (DME benefit) has also changed, and clients' benefits should be explored prior to initiating a wheelchair assessment.

OTs and PTs, depending on their respective roles at their treatment facilities, are usually responsible for evaluation, measurement, and selection of a wheelchair and seating system for the client. They also teach wheelchair safety and mobility skills to clients and their caregivers. The constant evolution of technology and the variety of manufacturers' products make it advisable to include an experienced, knowledgeable, and certified assistive technology professional (ATP) on the ordering team. The ATP is a supplier of DME who is proficient in ordering custom items and can offer an objective and a broad mechanical perspective on the availability and appropriateness of the options being considered. The ATP will serve as the client's resource for insurance billing, repairs, and reordering upon returning to the community.

Whether the client requires a noncustom rental wheelchair for temporary use or a custom wheelchair for use over many years, an individualized prescription clearly outlining the specific features of the wheelchair is needed to ensure optimal performance, safety, mobility, and enhancement of function. A wheelchair that has been prescribed by an inexperienced or nonclinical person is potentially hazardous and can cause undue financial harm to the client. Once a wheelchair has been purchased, the DME benefit has been used, and therefore another wheelchair may not be purchased. Typically payer sources do not authorize another wheelchair for at least 5 years unless there has been a significant change in physical status. An ill-fitting wheelchair can, in fact, contribute to unnecessary fatigue, **skin breakdown**, and trunk or extremity deformity, and it can inhibit function.[62] A wheelchair is an extension of the client's body and should facilitate rather than inhibit good alignment, mobility, and, most importantly, function.

Wheelchair Assessment

The therapist has considerable responsibility in recommending the wheelchair appropriate to meet immediate and long-term needs. When evaluating for a wheelchair, the therapist must know the client and have a broad perspective on the client's clinical, functional, and environmental needs. Careful assessment of physical status must include the specific diagnosis, the prognosis, and current and future problems (eg, age, spasticity, loss of range of motion [ROM], muscle weakness, reduced endurance) that may affect wheelchair use. Additional client factors to be considered in assessment of wheelchair use are sensation, cognitive function, and visual and perceptual skills. Functional use of the wheelchair in a variety of environments must be considered, along with how the wheelchair will be transported. For instance, if a power wheelchair is being considered, there must be a means of transporting the patient and the wheelchair safely. Collaboration with representatives of other disciplines treating the client is important. Box 11.1 lists questions to consider before making specific recommendations.

Box 11.1

Questions to Ask Before Making Specific Recommendations for a Wheelchair

- Who will pay for the wheelchair?
- Who will determine the preferred durable medical equipment (DME) provider: the insurance company, the client, or the therapist?
- What is the specific disability?
- What is the prognosis?
- Is range of motion limited?
- Is strength or endurance limited?
- How will the client propel the chair?
- How old is the client?
- How long is the client expected to use the wheelchair?

- What was the client's lifestyle, and how has it changed?
- Is the client active or sedentary?
- How will the dimensions of the chair affect the client's ability to transfer to various surfaces?
- What is the maneuverability of the wheelchair in the client's home or in the community (eg, entrances and egress, door width, turning radius in bathroom and hallways, floor surfaces)?
- What is the ratio of indoor to outdoor activities?
- Where will the wheelchair be primarily used—in the home, at school, at work, or in the community?
- Which mode of transportation will be used? Will the client be driving a van from the wheelchair? How will it be loaded and unloaded from the car?
- Which special needs (eg, work heights, available assistance, accessibility of toilet facilities, parking facilities) are recognized in the work or school environment?
- Does the client participate in indoor or outdoor sports activities?
- How will the wheelchair affect the client psychologically?
- Can accessories and custom modifications be medically justified, or are they luxury items?
- What resources does the client have for equipment maintenance (eg, self, family, caregivers)?

Before the final prescription is prepared, collected information must be analyzed for an understanding of advantages and disadvantages of recommendations based on the client's condition and how all specifics will integrate to provide an optimally effective mobility system.

To ensure that payment for the wheelchair is authorized, therapists should have an in-depth awareness of the client's insurance DME benefits and should provide documentation with thorough justification of the **medical necessity** of the wheelchair and any additional modifications. Therapists must explain clearly why particular features of a wheelchair are being recommended. They must be aware of standard versus “up charge” items, the cost of each item, and the effects of these items on the end product.

Wheelchair Ordering Considerations

Before selecting a specific manufacturer and the wheelchair's specifications, the therapist should carefully analyze the following sequence of evaluation considerations.[6,152,210]

Propelling the Wheelchair

The wheelchair may be propelled in a variety of ways, depending on the physical capacities of the user. If the client is capable of self-propulsion by using his or her arms on the rear wheels of the wheelchair, sufficient and symmetric grasp, arm strength, and physical endurance may be assumed to be present to maneuver the chair independently over varied terrain throughout the day.[210] An assortment of push rims are available to facilitate self-propelling, depending on the user's arm and grip strength. A client with hemiplegia may propel a wheelchair using the extremities on the unaffected side for maneuvering. A client with tetraplegia may have functional use of only one arm and may be able to propel a one-arm drive wheelchair, or a power chair may be more appropriate. Although William, the 17-year-old in the case study who has a C6 spinal cord injury, has functional strength in both biceps, energy and potential injury in the future must be considered if he is to use only a manual wheelchair.

If independence in mobility is desired, a power wheelchair should be considered for those who have minimal or no use of the upper extremities, limited endurance, or shoulder dysfunction. Power chairs are also preferred in situations involving inaccessible outdoor terrain.[210] Power wheelchairs have a wide variety of features and can be programmed; driven by foot, arm, head, or neck; or pneumatically controlled (sip and puff), or even controlled by eye gaze or tongue driven. Given current sophisticated technology, assuming intact cognition and perception, even a person with the most severe physical limitations is capable of independently driving a power wheelchair.

If the chair is to be propelled by the caregiver, consideration must be given to ease of maneuverability, lifting, and handling, in addition to the positioning and mobility needs of the client.

Regardless of the method of propulsion, serious consideration must be given to the effect the chair has on the client's current and future mobility and positioning needs. In addition, lifestyle and the home environment; available resources, such as the ability to maintain the chair; transportation options; and available reimbursement sources are major determining factors.

Although William is physically fit, his upper body strength has been compromised by the spinal cord injury. If he is interested in engaging in outdoor activities, he may lack the physical strength to propel a manual wheelchair on varied terrains. A powered wheelchair seemed an appropriate option for William, but the therapist also considered his previous occupations of camping and hiking when selecting a wheelchair that could potentially be used in outdoor terrain.

Rental vs. Purchase

The therapist should estimate how long the client will need the chair and whether the chair should be rented or purchased; this will affect the type of chair being considered. This decision is based on several clinical and functional issues. A rental chair is appropriate for short-term or temporary use, such as when the client's clinical picture, functional status, or body size is changing. Rental chairs may be necessary when the permanent wheelchair is being repaired. A rental wheelchair also may be useful when the prognosis and expected outcome are unclear or when the client has difficulty accepting the idea of using a wheelchair and needs to experience it initially as a temporary piece of equipment. Often the eventual functional outcome is unknown. In this case a chair can be rented for several months until a reevaluation determines whether a permanent chair will be necessary.[6]

A permanent wheelchair is indicated for the full-time user and for the client with a progressive need for a wheelchair over a long period. It may be indicated when custom features are required or when body size is changing, such as in the growing child.[6]

Frame Style

Once the method of propulsion and the permanence of the chair have been determined, several wheelchair frame styles are available for consideration. The frame style must be selected before specific dimensions and brand names can be determined. The therapist needs to be aware of the various features, the advantages and disadvantages of each, and the effects of these features on the client in every aspect of his of her life, from a short-term and a long-term perspective.

William is still in emotional shock that he no longer has motor control of his legs and hands. These variables must be considered when William is approached about wheelchair selection. Although a power wheelchair seemed the most appropriate choice for William, the therapist was concerned about the appearance of the wheelchair. The therapist actively engaged William in making choices regarding the type, model, and options available on various wheelchairs.

Wheelchair Selection

The questions in the following sections regarding client needs should be considered carefully before the specific type of chair is determined.[6]

Manual vs. Electric/Power Wheelchairs

Manual Wheelchair (Fig. 11.3A)

- Does the user have sufficient strength and endurance to propel the chair at home and in the community over varied terrain?
- Does manual mobility enhance functional independence and cardiovascular conditioning of the wheelchair user?
- Will the caregiver be propelling the chair at any time?
- What will be the long-term effects of the propulsion choice?

A

B

FIG 11.3 Manual vs. electric wheelchair. A, Rigid-frame chair with swing-away footrests. B, Power-driven wheelchair with hand control. (A, Courtesy Quickie Designs, Phoenix, AZ; B, Courtesy Invacare, Elyria, OH.)

Power Chairs

Power chair controls come in a number of designs and allow for varying degrees of customization and programming. Most power chair users drive using a joystick control mounted on the armrest. For those without upper extremity function, several other types of controls are available, such as head controls, chin drives, and breath controls (sip and puff). New technology even accommodates a client with only eye or tongue movement that can be used to operate a power wheelchair (Fig. 11.3B).

- Does the user demonstrate insufficient endurance and functional ability to propel a manual wheelchair independently?
- Does the user demonstrate progressive functional loss, making powered mobility an energy-conserving option?
- Is powered mobility needed to enhance independence at school, at work, and in the community?
- Does the user demonstrate cognitive, visual, and perceptual ability to safely operate a power-driven system?

- Does the user or caregiver demonstrate responsibility for care and maintenance of equipment?
- Is a van available for transportation?
- Is the user's home accessible for use of a power wheelchair?
- Has the user been educated regarding rear, mid, and front wheel drive systems, and has he or she been guided objectively in making the appropriate selection?

Manual Recline vs. Power Recline vs. Tilt-in-Space Wheelchairs

Manual Recline Wheelchair (Fig. 11.4A)

- Is the client unable to sit upright because of hip contractures, poor balance, or fatigue?
- Is a caregiver available to assist with weight shifts and position changes?
- Is relative ease of maintenance a concern?
- Is cost a consideration?

FIG 11.4 Manual recline vs. power recline wheelchair. A, Reclining back on folding frame. B, Low-shear power recline with collar mount chin control on electric wheelchair. C, Tilt system with head control on electric wheelchair. (A, Courtesy Medline Industries, Inc., 2016; B and C, Courtesy Luis Gonzalez.)

Power Recline vs. Tilt (Fig. 11.4B–C)

- Does the client have the potential to operate independently?
- Are independent weight shifts and position changes indicated for skin care and increased sitting

tolerance?
- Does the user demonstrate safe and independent use of controls?
- Are resources available for care and maintenance of the equipment?
- Does the user have significant spasticity that is facilitated by hip and knee extension during the recline phase?
- Does the user have hip or knee contractures that prohibit his or her ability to recline fully?
- Will a power recline or tilt-in-space decrease or make more efficient use of caregiver time?
- Will a power recline or tilt-in-space feature on the wheelchair reduce the need for transfers to the bed for catheterizations and rest periods throughout the day?
- Will the client require quick position changes in the event of hypotension and/or dysreflexia?
- Has a reimbursement source been identified for this add-on feature?

Folding vs. Rigid Manual Wheelchairs

Folding Wheelchairs (Fig. 11.5A)

- Is the folding frame needed for transport, storage, or home accessibility?
- Which footrest style is necessary for transfers, desk clearance, and other daily living skills? (Elevating footrests are available only on folding frames.)
- Is the client or caregiver able to lift, load, and fit the chair into necessary vehicles?

A

FIG 11.5 Folding vs. rigid wheelchair. A, Lightweight folding frame with swing-away footrests. B, Rigid aluminum frame with tapered front end and solid foot cradle. (A, Courtesy Quickie Designs, Phoenix, AZ; B, Courtesy Invacare, Elyria, OH.)

Equipment suppliers should have a variety of brands available and be knowledgeable about each. Frame weight can range approximately from 28 to 50 pounds (lb), depending on size and accessories. Frame adjustments and custom options vary with the model.

Rigid Wheelchairs (Fig. 11.5B)

- Does the user or caregiver have the upper extremity function and balance needed to load and unload the nonfolding frame from a vehicle if driving independently?
- Will the user benefit from the improved energy efficiency and performance of a rigid frame?

Footrest options are limited, and the frame is lighter (20 to 35 lb). Features include an adjustable seat angle, rear axle, caster mount, and back height. Efficient frame design maximizes performance. Options are available for frame material composition, frame colors, and aesthetics. These chairs are usually custom ordered; availability and expertise are generally limited to custom **rehabilitation technology suppliers**.

Lightweight (Folding or Nonfolding) vs. Standard-Weight (Folding) Wheelchairs

Lightweight Wheelchairs: Under 35 Pounds (See Fig. 11.5A)

- Does the user have the trunk balance and equilibrium necessary to handle a lighter frame weight?
- Does the lighter weight enhance mobility by reducing the user's fatigue?
- Will the user's ability to propel the chair or handle parts be enhanced by a lighter weight frame?
- Are custom features (eg, adjustable height back, seat angle, axle mount) necessary?

Standard-Weight Wheelchairs: More Than 35 Pounds (Fig. 11.6)

- Does the user need the stability of a standard-weight chair?
- Does the user have the ability to propel a standard-weight chair?
- Can the caregiver manage the increased weight when loading the wheelchair and fitting into a vehicle?
- Will the increased weight of parts be unimportant during daily living skills?

FIG 11.6 Standard folding frame (>35 lb) with swing-away footrests. (Courtesy iStock.com.)

Custom options are limited, and these wheelchairs are usually less expensive (except for the heavy-duty models required for users weighing more than 250 lb).

Standard Available Features vs. Custom, Top-of-the-Line Models

The price range, durability, and warranty within a specific manufacturer's model line must be considered.

Standard Available Features

- Is the chair required only for part-time use?
- Does the user have a limited life expectancy?
- Is the chair needed as a second or transportation chair, used only 10% to 20% of the time?
- Will the chair be primarily for indoor or sedentary use?
- Is the user dependent on caregivers for propulsion?
- Will the chair be propelled only by the caregiver?
- Are custom features or specifications not necessary?
- Is substantial durability unimportant?

For standard wheelchairs, a limited warranty is available on the frame. These chairs may be indicated because of reimbursement limitations. Limited sizes and options and adjustability are available. These cost considerably less than custom wheelchairs.

Custom and Top-of-the-Line Models

- Will the client be a full-time user?
- Is long-term use of the wheelchair a likely prognosis?
- Will this be the primary wheelchair?
- Is the user active indoors and outdoors?
- Will this frame style improve the prognosis for independent mobility?
- Is the user a growing adolescent, or does he or she have a progressive disorder requiring later modification of the chair?
- Are custom features, specifications, or positioning devices required?

Top-of-the-line wheelchair frames usually have a lifelong warranty on the frame. A variety of specifications, options, and adjustments are available. Many manufacturers will work with therapists and providers to solve a specific fitting problem. Experience is essential in ordering top-of-the-line and custom equipment.

Wheelchair Measurement Procedures

The client is measured in the style of chair and with the seat cushion that most closely resembles those being ordered. If the client will wear a brace or body jacket or will need any additional devices in the chair, these should be in place during the measurement. Observation skills are important during this process. Measurements alone should not be used. The therapist should visually assess and monitor the client's entire body position throughout the measurement process.[6,209]

Seat Width (Fig. 11.7A)

Objectives

1. To distribute the client's weight over the widest possible surface.

2. To keep the overall width of the chair as narrow as possible.

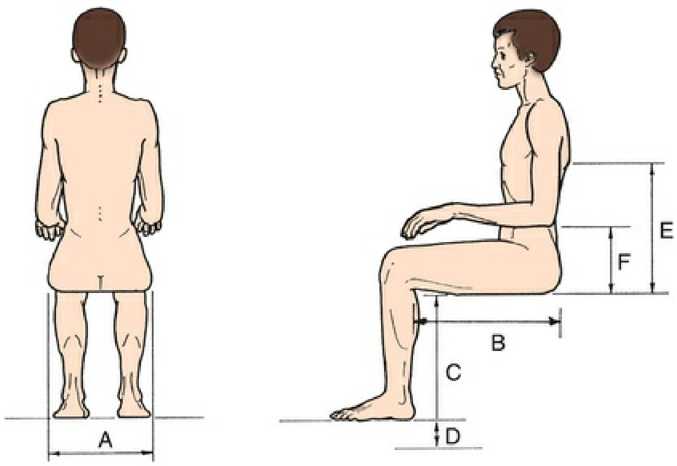

FIG 11.7 Measurements for wheelchairs. A, Seat width. B, Seat depth. C, Seat height from floor. D, Footrest clearance. E, Back height. F, Armrest height. (Adapted from Wilson A, McFarland SR: *Wheelchairs: a prescription guide,* Charlottesville, VA, 1986, Rehabilitation Press.)

Measurements

Measure the individual across the widest part of the thighs or hips while the client is sitting in a chair comparable to the anticipated wheelchair.

Wheelchair Clearance

Add ½ to 1 inch on each side of the hip or thigh measurement taken. Consider how an increase in the overall width of the chair will affect accessibility.

Checking clearance.

Place the flat palm of the hand between the client's hip or thigh and the wheelchair skirt and armrest. The wheelchair skirt is attached to the armrests in many models, and clearance should be sufficient between the user's thigh and the skirt to avoid rubbing or pressure.

Considerations

- User's potential weight gain or loss (ie, gender tendencies—male [abdominal weight gain] and female [hips and buttocks])
- Accessibility of varied environments

- Overall width of wheelchair. Camber, axle mounting position, rim style, and wheel style can also affect overall wheelchair width.

Seat Depth (Fig. 11.7B)

Objective

The objective is to distribute the body weight along the sitting surface by bearing weight along the entire length of the thigh to just behind the knee. This approach is necessary to help prevent pressure sores on the buttocks and the lower back and to attain optimal muscle tone normalization to assist in prevention of pressure sores throughout the body.

Measurements

Measure from the base of the back (the posterior buttocks region touching the chair back) to the inside of the bent knee; the seat edge clearance needs to be 1 to 2 inches less than this measurement.

Checking clearance.

Check clearance behind the knees to prevent contact of the front edge of the seat upholstery with the popliteal space. (Consider front angle of leg rest or foot cradle.)

Considerations

- Braces or back inserts may push the client forward.
- Postural changes may occur throughout the day from fatigue or spasticity.
- Thigh length discrepancy: the depth of the seat may be different for each leg.
- If considering a power recliner, assume that the client will slide forward slightly throughout the day and make depth adjustments accordingly.
- Seat depth may need to be shortened to allow independent propulsion with the lower extremities.

Seat Height From Floor and Foot Adjustment

Objectives

1. To support the client's body while maintaining the thighs parallel to the floor (Fig. 11.7C).

2. To elevate the foot plates to provide ground clearance over varied surfaces and curb cuts (Fig. 11.7D).

Measurements

The seat height is determined by measuring from the top of the wheelchair frame supporting the seat (the post supporting the seat) to the floor, and from the client's popliteal fossa to the bottom of the heel.

Wheelchair Clearance

The client's thighs are kept parallel to the floor, so the body weight is distributed evenly along the entire depth of the seat. The lowest point of the foot plates must clear the floor by at least 2 inches.

Checking clearance.

Slip fingers under the client's thighs at the front edge of the seat upholstery. *Note:* A custom seat height may be needed to obtain footrest clearance. One inch of increased seat height raises the foot plate 1 inch.

Considerations

If the knees are too high, increased pressure at the ischial tuberosities puts the client at risk for skin breakdown and pelvic deformity. This position also impedes the client's ability to maneuver the wheelchair using the lower extremities.

Posterior **pelvic tilt** makes it difficult to shift weight forward as needed to propel the wheelchair, especially with uphill grades.

Sitting too high off the ground can impair the client's center of gravity, seat height for transfers, and visibility if he or she is driving a van from the wheelchair.

Back Height (Fig. 11.7E)

Objective

Back support consistent with physical and functional needs must be provided. The chair back should be low enough for maximal function and high enough for maximal support.

Measurements

For full trunk support for the client, the back must be of sufficient height. Full support height is obtained by measuring from the top of the seat frame on the wheelchair (seat post) to the top of the user's shoulders. For minimum trunk support, the top of the back upholstery is below the inferior angle of the client's scapulae; this should permit free arm movement, should not irritate the skin or scapulae, and should provide good total body alignment.

Checking back height.

Ensure that the client is not being pushed forward because the back of the chair is too high or is not leaning backward over the top of the upholstery because the back is too low.

Considerations

- Adjustable-height backs (usually offer a 4-inch range)
- Adjustable upholstery
- Lumbar support or another commercially available or custom back insert to prevent kyphosis, scoliosis, or other long-term trunk deformity

Armrest Height (Fig. 11.7F)

Objectives

1. To maintain posture and balance.

2. To provide support and alignment for upper extremities.

3. To allow change in position by pushing down on armrests.

Measurements

With the client in a comfortable position, measure from the wheelchair seat frame (seat post) to the bottom of the user's bent elbow.

Wheelchair Clearance

The height of the top of the armrest should be 1 inch higher than the height from the seat post to the user's elbow.

Checking armrest height.

The client's posture should look appropriately aligned. The shoulders should not slouch forward or be subluxed or forced into elevation when the client is in a relaxed sitting posture, with flexed elbows resting slightly forward on armrests.

Considerations

- Armrests may have other uses, such as increasing functional reach or holding a cushion in place.
- Certain styles of armrests can increase the overall width of the chair.
- Are armrests necessary?
- Is the client able to remove and replace the armrest from the chair independently?

- Review all measurements against standards for a particular model of chair.
- Manufacturers have lists of the standard dimensions available and the costs of custom modifications.

Pediatric Wheelchairs

The goals of pediatric wheelchair ordering, as with all wheelchair ordering, should be to obtain a proper fit and to facilitate optimal function. Rarely does a standard wheelchair meet the fitting requirements of a child. The selection of size is variable; therefore, custom seating systems specific to the pediatric population are available. A secondary goal is to consider a chair that will accommodate the child's growth.

For children younger than 5 years of age, a decision must be made about whether to use a stroller base or a standard wheelchair base. Considerations include the child's ability to propel the chair relative to his or her developmental level and the parents' preference for a stroller or a wheelchair.

Many variables must be considered when a wheelchair frame is customized. An experienced ATP or the wheelchair manufacturer should be consulted to ensure that a custom request will be filled successfully.

Bariatric Wheelchairs

According to the latest data from the National Center for Health Statistics, more than 30% of American adults 20 years of age or older (more than 60 million people) and more than 16% of children and adolescents aged 2 to 19 years are obese.[53] The average wheelchair is rated to hold up to 250 pounds, and most bariatric wheelchairs can accommodate 500 pounds. It is imperative that the therapist order a wheelchair that not only meets the client's functional needs, but also will safely accommodate his or her weight. Using a wheelchair for patients who exceed the weight limit has potential safety issues, such as skin breakdown and the risk of the wheelchair bending or buckling, which may cause injury to the client. Bariatric wheelchairs feature heavy-duty frames, reinforced padded upholstery, and heavy-duty wheels. An experienced DME supplier should be able to guide the therapist and the client to the most appropriate and safe wheelchair.

Additional Seating and Positioning Considerations

A wheelchair evaluation is not complete until the seat cushion, the back support, and any other positioning devices—in addition to the integration of those parts—have been carefully thought out, regardless of the diagnosis. The therapist must appreciate the effect that optimal body alignment has on skin integrity, tone normalization, overall functional ability, and general well-being (Fig. 11.8).[6]

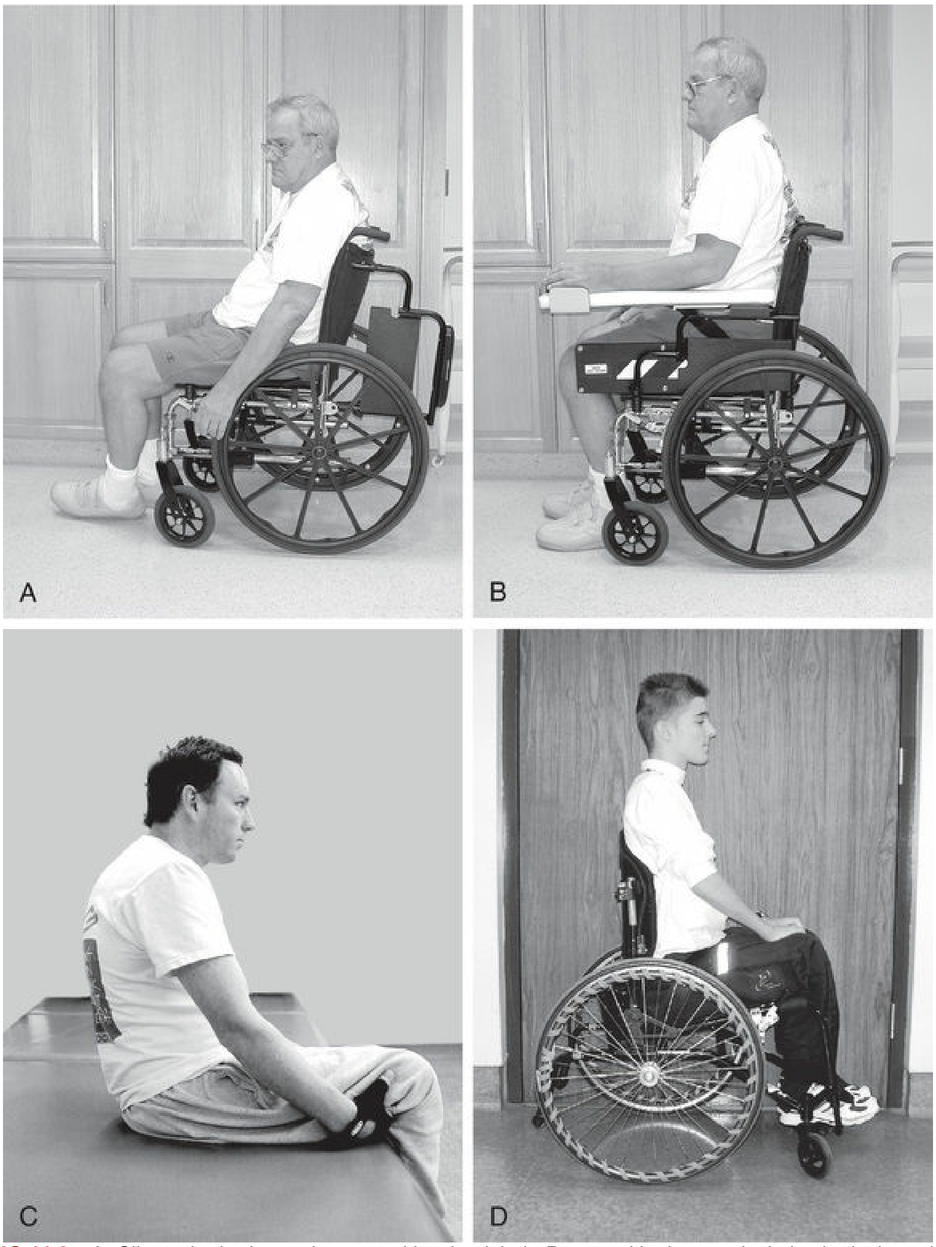

FIG 11.8 A, Client who had a stroke, seated in wheelchair. Poor positioning results in kyphotic thoracic spine, posterior pelvic tilt, and unsupported affected side. B, Same client now seated in wheelchair with appropriate positioning devices. Seat and back inserts facilitate upright midline position with neutral pelvic tilt and equal weight bearing throughout. C, Client who sustained a spinal cord injury, sitting with back poorly supported; this results in posterior pelvic tilt, kyphotic thoracic spine, and absence of lumbar curve. D, Client seated with rigid back support and pressure-relief seat cushion, resulting in erect thoracic spine, lumbar curve, and anterior tilted pelvis.

Consider William's potential need for a wheelchair seat cushion that will distribute weight evenly and avoid excessive pressure on his ischial tuberosities while sitting. He lacks sensory awareness in the buttocks region, and that places him at risk for developing decubitus ulcers. He should develop sitting tolerance that extends beyond the current 1-hour time period to help him pursue his educational goals of attending college. An appropriate seat cushion that distributes weight evenly will help William remain seated for a longer period of time. He will also need to develop the habit of shifting his weight while seated. This can be done by having William position his arm around the upright posts of the wheelchair back and pulling his body slightly to one side and then repeating the process on the other side. This shifting of the body from side to side reduces the risk of developing decubitus ulcers.

The following seven sections present the goals of a comprehensive seating and positioning assessment.

Prevention of Deformity

Providing a symmetric base of support preserves proper skeletal alignment and discourages spinal curvature and other body deformities.

Tone Normalization

With proper body alignment, in addition to bilateral weight bearing and adaptive devices as needed, tone normalization can be maximized.

Pressure Management

Pressure sores can be caused by improper alignment and an inappropriate sitting surface. The proper seat cushion can provide comfort, assist in trunk and pelvic alignment, and create a surface that minimizes pressure, heat, moisture, and shearing—the primary causes of skin breakdown.

Promotion of Function

Pelvic and trunk stability is necessary to free the upper extremities for participation in all functional activities, including wheelchair mobility and daily living skills.

Maximum Sitting Tolerance

Wheelchair sitting tolerance will increase as support, comfort, and symmetric weight bearing are provided.

Optimal Respiratory Function

Support in an erect, well-aligned position can decrease compression of the diaphragm, thus increasing **vital capacity**.

Provision for Proper Body Alignment

Good body alignment is necessary for prevention of deformity, normalization of tone, and promotion of movement. The client should be able to propel the wheelchair and to move around within the wheelchair. Positioning starts with the pelvis, then progresses to the trunk and finally to the head. If the pelvis isn't properly positioned, the trunk and head will not be aligned in a neutral and midline position. Spending time addressing the trunk and head positions, rather than starting at the pelvis, will often address the symptoms, but not the root problem.

A wide variety of seating and positioning equipment is available for all levels of disability. Custom modifications are continually being designed to meet a variety of client needs. In addition, technology in this area is ever growing, as is interest in wheelchair technology as a professional specialty. However, the skill of clinicians in this field ranges from extensive to negligible. Although it is an integral aspect of any wheelchair evaluation, the scope of seating and positioning equipment is much greater than can be addressed in this chapter. The Suggested Readings list at the end of this chapter provides additional resources.

Accessories

Once the measurements and the need for additional positioning devices have been determined, a wide variety of accessories are available to meet a client's individual needs. It is extremely important for the therapist to understand the function of each accessory and how an accessory interacts with the complete design and function of the chair and with seating and positioning equipment.[6,210]

Armrests come in fixed, flip-back, detachable, desk, standard, reclining, adjustable height, and tubular styles. The fixed armrest is a continuous part of the frame and is not detachable. It limits proximity to table, counter, and desk surfaces and prohibits side transfers. Flip-back, detachable desk, and standard-length arms are removable and allow side-approach transfers. Reclining arms are attached to the back post and recline with the back of the chair. Tubular arms are available on lightweight frames.

Footrests may be fixed, swing-away detachable, solid cradle, and elevating. Fixed footrests are attached to the wheelchair frame and are not removable. These footrests prevent the person from getting close to counters and may make some types of transfers more difficult. Swing-away detachable footrests can be moved to the side of the chair or removed entirely. This allows a closer approach to bed, bathtub, and counters, and, when the footrests are removed, reduces the overall wheelchair length and weight for easy loading into a car. Detachable footrests lock into place on the chair with a locking device.[210] A solid cradle footrest is found on rigid, lightweight chairs and is not removable. Elevating leg rests are available for clients with such conditions as lower extremity edema, blood pressure changes, and orthopedic problems.

Foot plates may have heel loops and toe straps to aid in securing the foot to the foot plate.[210] The angle of the foot plate itself can be fixed or adjustable, raising or lowering toes relative to heels. A calf strap can be used on a solid cradle, or when additional support behind the calf is necessary. Other accessories can include seat belts, various brake styles, brake extensions, anti-tip devices, caster locks, arm supports, and head supports.

Preparing the Justification/Prescription

Once specific measurements and the need for modifications and accessories have been determined, the wheelchair prescription must be completed. It should be concise and specific so that everything requested can be accurately interpreted by the DME supplier, who will be submitting a sales contract for payment authorization. Before-and-after pictures can be helpful to illustrate medical necessity. The requirements for payment authorization from a particular reimbursement source must be known, so that medical necessity can be demonstrated. The therapist must be aware of the cost of every item being requested and must provide a reason and justification for each item. Payment may be denied if clear reasons are not given to substantiate the necessity for every item and modification requested.

Before the wheelchair is delivered to the client, the therapist should check the chair against the specific prescription and should ensure that all specifications and accessories are correct. When a custom chair has been ordered, the client should be fitted by the ordering therapist to ensure that the chair fits and that it provides all the elements expected when the prescription was generated.

Often there are many adjustments that need to be made to ensure that the patient is properly positioned, supported, and most importantly, symmetrically aligned in order to participate in wheelchair propulsion and functional activities. Even the smallest misalignment of the body can affect the client's ability to operate his or her wheelchair or, most importantly, could cause future skin breakdown.

Wheelchair Safety

Wheelchair parts tend to loosen over time and should be inspected and tightened on a regular basis. Elements of safety for the wheelchair user and the caregiver are as follows:

1. Brakes should be locked during all transfers.

2. The client should never weight bear or stand on the foot plates, which are placed in the “up” position during most transfers.

3. In most transfers it is an advantage to have footrests removed or swung away if possible.

4. If a caregiver is pushing the chair, he or she should be sure that the client's elbows are not protruding from the armrests and that the client's hands are not on the hand rims. If approaching from behind to assist in moving the wheelchair, the caregiver should inform the client of this intent and should check the position of the client's feet and arms before proceeding.

- To push the client up a ramp, the caregiver should move in a normal, forward direction.

- If the ramp is negotiated independently, the client should lean slightly forward while propelling the wheelchair up the incline.[211]

- To push the client down a ramp, the caretaker should tilt the wheelchair backward by pushing his or her foot down on the anti-tippers to its balance position, which is a tilt of approximately 30 degrees. Then the caregiver should ease the wheelchair down the ramp in a forward direction, while maintaining the chair in its balance position. The caregiver should keep his or her knees slightly bent and the back straight.[211] The caregiver may also move down the ramp backward while the client maintains some control of the large wheels to prevent rapid backward motion. This approach is useful if the grade is relatively steep. Ramps with only a slight grade can be managed in a forward direction if the caregiver maintains grasp and pull on the hand grips, and the client again maintains some control of the big wheels to prevent rapid forward motion.

- If the ramp is negotiated independently, the client should move down the ramp facing forward, while leaning backward slightly and maintaining control of speed by grasping the hand rims. The client can descend a steep grade by traversing the ramp slightly back and forth to slow the chair. Push gloves may be helpful to reduce the effects of friction.[211]

5. A caregiver can manage ascending curbs by approaching them forward, tipping the wheelchair back, and pushing the foot down on the anti-tipper levers, thus lifting the front casters onto the curb and pushing forward. The large wheels then are in contact with the curb and roll on with ease as the chair is lifted slightly onto the curb.

6. The curb should be descended using a backward approach. A caregiver can move himself or herself and the chair around as the curb is approached and can pull the wheelchair to the edge of the curb. Standing below the curb, the caregiver can guide the large wheels off the curb by slowly pulling the wheelchair backward until it begins to descend. After the large wheels are safely on the street surface, the assistant can tilt the chair back to clear the casters, move backward, lower the casters to the street surface, and turn around.[211]

With good strength and coordination, many clients can be trained to manage curbs independently. To mount and descend a curb, the client must have good bilateral grip, arm strength, and balance. To mount the curb, the client tilts the chair onto the rear wheels and pushes forward until the front wheels hang over the curb, then lowers them gently. The client then leans forward and forcefully pushes forward on the hand rims to bring the rear wheels up on the pavement. To descend a curb, the client should lean forward and push slowly backward until the rear and then the front wheels roll down the curb.[48]

The ability to lift the front casters off the ground and balance on the rear wheels (“pop a wheelie”) is a beneficial skill that expands the client's independence in the community with curb management and in rural settings with movement over grassy, sandy, or rough terrain. The chair will have to be properly adjusted so that the axle is not too far forward, which makes the wheelchair tip over backward too easily. Clients who have good grip, arm strength, and balance usually can master this skill and perform safely. The technique involves being able to tilt the chair on the rear wheels, balance the chair on the rear wheels, and move and turn the chair on the rear wheels. Wheelies make it possible to wheel up or down (jump) curbs. The client should not attempt to perform these maneuvers without instruction and training in the proper techniques, which are beyond the scope of this chapter. Specific instructions on teaching these skills can be found in the sources cited at the end of the chapter.[48]

Transfer Techniques

Transferring is the movement of a client from one surface to another. This process includes the sequence of events that must occur both before and after the move, such as the pretransfer sequence of bed mobility and the posttransfer phase of wheelchair positioning. If it is assumed that a client has some physical or cognitive limitations, it will be necessary for the therapist to assist in or supervise a transfer. Many therapists are unsure of the transfer type and technique to use or feel perplexed when a particular technique does not succeed with the client. Each client, therapist, and situation is different. This chapter does not include an outline of all techniques but presents the basic techniques with generalized principles. Each transfer must be adapted for the particular client and his or her needs. If there is a team involved, it is best to discuss with the physical therapist the most appropriate and safe transfer technique for the client. Discussion in this chapter includes directions for some transfer techniques that are most commonly used in practice. These techniques include the stand pivot, the bent pivot, and one person– and two person–dependent transfers.

Preliminary Concepts

The therapist must be aware of the following concepts when selecting and carrying out transfer techniques to ensure the safety of both the client and the therapist:

1. The client's status, especially his or her physical, cognitive, perceptual, and behavioral abilities and limitations

2. The therapist's own physical abilities and limitations and whether he or she can communicate clear, sequential instructions to the client (and if necessary to the long-term caregiver of the client)

3. The use of correct moving and lifting techniques

Guidelines for Using Proper Body Mechanics

The therapist should be aware of the following principles of basic body mechanics[7]:

1. Get close to the client or move the client close to you.

2. Position your body to face the client (face head on).

3. Bend the knees; use your legs, not your back.

4. Keep a neutral spine (not a bent or arched back).

5. Keep a wide base of support.

6. Keep your heels down.

7. Don't tackle more than you can handle; ask for help.

8. Don't combine movements. Avoid rotating at the same time as bending forward or backward.

The therapist should consider the following questions before performing a transfer:

1. What medical precautions affect the client's mobility or method of transfer?

2. Can the transfer be performed safely by one person or is assistance required?

3. Has enough time been allotted for safe execution of a transfer? Are you in a hurry?

4. Does the client understand what is going to happen? If not, does he or she demonstrate fear or confusion? Are you prepared for this limitation?

5. Is the equipment (wheelchair, bed) that the client is being transferred to and from in good working order and in a locked position? Is it the appropriate size and type?

6. What is the height of the bed (or surface) in relation to the wheelchair? Can the heights be adjusted so that they are similar? (Transferring downhill is easier than uphill.)

7. Has all equipment been placed in the correct position?

8. Have all unnecessary bedding and equipment (eg, footrests, armrests) been moved out of the way so that you are working without obstruction?

9. Is the client dressed properly in case you need to use a waistband to assist? If not, do you need a transfer belt or other assistance?

10. What are the other components of the transfer, such as leg management and bed mobility?

The therapist should be familiar with as many types of transfers as possible so that each situation can be resolved as it arises. It is also important to consult other team members, such as the physical therapist, to discuss the client's condition and the appropriate technique. It is best to start with basic, even-level transfers (eg, mat table to wheelchair) and then progress to more complex transfers (eg, toilet and car) because these have more variables and are more challenging.

Many classifications of transfers exist, based on the extent of the therapist's participation. Classifications range from dependent, in which the client is unable to participate and the therapist moves the client, to independent, in which the client moves independently while the therapist merely supervises, observes, or provides input for appropriate technique related to the client's disabling condition.

Before attempting to move a client, the therapist must understand the biomechanics of movement and the effect the client's center of **positioning mass** has on transfers.

Principles of Body Positioning

Pelvic Tilt

Generally, after the acute onset of a disability or prolonged time spent in bed, clients assume a posterior pelvic tilt (ie, a slouched position with lumbar flexion). In turn, this posture moves the center of mass back toward the buttocks. The therapist may need to verbally cue or manually assist the client into a neutral or slightly anterior pelvic tilt position to move the center of mass forward over the center of the client's body and over the feet in preparation for the transfer.[170]

Trunk Alignment

It may be observed that the client's trunk alignment is shifted to the right or the left side. If the therapist assists in moving the client while the client's weight is shifted to one side, this movement could throw the client and the therapist off balance. The client may need verbal cues or physical assistance to come to and maintain a midline trunk position before and during the transfer.

Weight Shifting

Transfer is initiated by shifting the client's weight forward, thus removing weight from the buttocks. This movement allows the client to stand, partially stand, or be pivoted by the therapist. This step must be performed regardless of the type of transfer.

Lower Extremity Positioning

The client's feet must be placed firmly on the floor with the ankles stabilized and with the knees aligned at 90 degrees of flexion over the feet. This position allows the weight to be shifted easily onto and over the feet. The heels should be pointing toward the surface to which the client is transferring. The client should be barefoot or should have shoes on to prevent slipping out of position. Shoes with proper ankle support are beneficial for patients who have weakness or instability in the ankles or feet. The feet can easily pivot in this position, and the risk of twisting or injuring an ankle or a knee is minimized.

Upper Extremity Positioning

The client's arms must be in a safe position or in a position in which he or she can assist in the transfer. If one or both of the upper extremities are nonfunctional, the arms should be placed in a safe position that will not be in the way during the transfer (eg, in the client's lap). If the client has partial or full movement, motor control, or strength, he or she can assist in the transfer by reaching toward the surface to be reached or by pushing off from the surface to be left. The decision to request the client to use the arms during the transfer is based on the therapist's prior knowledge of the client's motor function. The client should be encouraged to not reach or grab for the therapist during the transfer because this could throw both the therapist and the client off balance.

Preparing Equipment and Client for Transfer

The transfer process includes setting up the environment, positioning the wheelchair, and helping the client into a pretransfer position. The following four sections present a general overview of these steps.

Positioning the Wheelchair

1. Place the wheelchair at approximately a 0- to 30-degree angle to the surface to which the client is transferring. **The angle depends on the type of transfer and the client's level of assist.**

2. Lock the brakes on the wheelchair and the bed.

3. Place both of the client's feet firmly on the floor, hip width apart, with the knees over the feet.

4. Remove the wheelchair armrest closest to the bed.

5. Remove the wheelchair pelvic seat belt.

6. Remove the wheelchair chest belt and trunk or lateral supports if present.

Bed Mobility in Preparation for Transfer

Rolling the Client Who Has Hemiplegia

1. Before rolling the client, you may need to put your hand under the client's scapula on the weaker side and gently mobilize it forward (into protraction) to prevent the client from rolling onto the shoulder, potentially causing pain and injury.

2. Assist the client in clasping the strong hand around the wrist of the weak arm, and lift the upper extremities upward toward the ceiling.

3. Assist the client in flexing his or her knees.

4. You may assist the client to roll onto his or her side by moving first the arms toward the side, then the legs, and finally by placing one of your hands at the scapular area and the other hand at the hip, guiding the roll.

Side-Lying to Sit Up at the Edge of the Bed

1. Bring the client's feet off the edge of the bed.

2. Stabilize the client's lower extremities with your knees.

3. Shift the client's body to an upright sitting position.

4. Place the client's hands on the bed at the sides of his or her body to help maintain balance.

Scooting to the Edge of the Bed

When working with a client who has sustained a stroke or a traumatic brain injury, the therapist should "walk" the client's hips toward the edge of the bed. Shift the client's weight to the less affected or unaffected side, position your hand behind the opposite buttock, and guide the client forward. Then shift the client's weight to the more affected side and repeat the procedure if necessary. Move forward until the client's feet are flat on the floor.

In the case of an individual with a spinal cord injury, grasp the client's legs from behind the knees and gently pull the client forward, placing the client's feet firmly on the floor and making sure that the ankles are in a neutral position.

Stand Pivot Transfers

The standing pivot transfer requires the client to be able to come to a standing position and pivot on both feet. It is most commonly used with clients who have hemiplegia, hemiparesis, or general loss of strength or balance. If the client has significant hemiparesis, stand pivot transfers encourage the less affected or the unaffected side to accommodate most of the body weight and may put the more affected limb (ankle) at risk while pivoting.

Transfer From Wheelchair to Bed or to Mat Table

1. Facilitate the client's scoot to the edge of the surface and put his or her feet flat on the floor. The client's heels should be pointed toward the surface to which the client is transferring. The feet should not be perpendicular to the transfer surface, but the heel should be angled toward the surface.

2. Stand on the client's affected side with your hands on the client's scapulae or around the client's trunk, waist, or hips. Stabilize the client's involved foot and knee with your own foot and knee. Provide assistance by guiding the client forward as the buttocks are lifted up from the present surface and toward the transfer surface (Fig. 11.9A).

FIG 11.9 Standing pivot transfer—wheelchair to bed, assisted. A to C, Therapist stands on client's affected side and stabilizes client's foot and knee. He or she assists by guiding client forward and initiates lifting the buttocks up. D, Client reaches toward transfer surface. E and F, Therapist guides the client toward transfer surface. (Courtesy Luis Gonzalez.)

3. The client may reach toward the surface to which he or she is transferring or may push off the surface from which he or she is transferring (Fig. 11.9B).

4. Guide the client toward the transfer surface and gently help him or her down to a sitting position (Fig. 11.9C).

Variations: Stand Pivot and/or Stand/Step Transfer

A stand pivot and/or stand/step transfer is generally used when a client can take small steps toward the surface goal and not just pivot toward the transfer surface (Fig. 11.9D, 11.9E, and 11.9F). The therapist's intervention may range from physical assistance to accommodation for potential loss of balance to facilitation of near normal movement, equal weight bearing, and maintenance of appropriate posture for clients with hemiplegia or hemiparesis. If a client demonstrates impaired cognition or a behavior deficit, including impulsiveness and poor safety judgment, the therapist may need to provide verbal cues or physical guidance.

Sliding Board Transfers

Sliding board transfers are best used with those who cannot adequately bear weight on the lower extremities and who have paralysis, weakness, or poor endurance in their upper extremities. If the client is going to assist the caregiver in this transfer, the client should have good upper extremity strength. This transfer is most often used with persons who have lower extremity amputations, individuals with spinal cord injuries, and bariatric clients.

Method (Fig. 11.10)

1. Position and set up the wheelchair as previously outlined.

2. Lift the leg closer to the transfer surface and place the board under this leg, at midthigh between the buttocks and the knee, angled toward the opposite hip. The board must be firmly under the thigh and firmly on the surface to which the client is transferring.

3. Block the client's knees with your own knees.

4. Instruct the client to place one hand toward the edge of the board and the other hand on the wheelchair seat.

5. Instruct the client to lean forward and slightly away from the transferring surface.

6. The client should transfer his or her upper body weight in the direction opposite to which he or she is going. The client should use both arms to lift or slide the buttocks along the board.

7. Assist the client where needed to shift weight and support the trunk while moving to the intended surface.

FIG 11.10 Positioning sliding board. Lift leg closest to transfer surface. Place board midthigh between buttocks and knee, angled toward opposite hip. (Courtesy Luis Gonzalez.)

Bent Pivot Transfer—Bed to Wheelchair

The bent pivot transfer is used when the client cannot initiate or maintain a standing position. A therapist often prefers to keep a client in the bent knee position to maintain equal weight bearing, provide optimal trunk and lower extremity support, and perform a safer and easier therapist-assisted transfer.

Procedure

1. Assist the client to scoot to the edge of the bed until both of the client's feet are flat on the floor. Grasp the client around the waist, trunk, or hips, or even under the buttocks, if a moderate or maximal amount of assistance is required.

2. Facilitate the client's trunk into a midline position.

3. Shift the weight forward from the buttocks toward and over the client's feet (Fig. 11.11A).

FIG 11.11 Bent pivot transfer—bed to wheelchair. A, Therapist grasps client around trunk and assists in shifting client's weight forward over feet. B, Client reaches toward wheelchair. C, Therapist assists client down toward sitting position. (Courtesy Luis Gonzalez.)

4. Have the client reach toward the surface he or she is transferring to or push from the surface he or she is transferring from (Fig. 11.11B).

5. Provide assistance by guiding and pivoting the client around toward the transfer surface (Fig. 11.11C).

Depending on the amount of assistance required, the pivoting portion can be done in two or three steps, with the therapist repositioning himself or herself and the client's lower extremities between steps. The therapist has a variety of choices regarding where to hold or grasp the client during the bent pivot transfer, depending on the weight and height of the client in relation to the therapist and the client's ability to assist in the transfer. Variations include using both hands and arms at the waist or trunk, or one or both hands under the buttocks. The therapist never grasps under the client's weak arm or grasps the weak arm—such an action could cause significant injury because of weak musculature and poor stability around the shoulder girdle. The choice is made with consideration of proper body mechanics. Trial and error in technique is advised to allow for optimal facilitation of client independence and safety, and the therapist's proper body mechanics.

Dependent Transfers

The dependent transfer is designed for use with the client who has minimal to no functional ability. If this transfer is performed incorrectly, it is potentially hazardous for therapist and client. This transfer should be practiced with able-bodied persons and should be used first with the client only when another person is available to assist.[7]

The purpose of the dependent transfer is to move the client from surface to surface. The requirements are that the client must be cooperative and willing to follow instructions and the therapist must be keenly aware of correct body mechanics and his or her own physical limitations. With heavy clients it is always best to use the two-person transfer, or at least to have a second person available to spot the transfer.

One Person–Dependent Sliding Board Transfer (Fig. 11.12)

The procedure for transferring the client from wheelchair to bed is as follows:

1. Set up the wheelchair and bed as described previously.

2. Position the client's feet together on the floor, directly under the knees, and swing the outside footrest away. Grasp the client's legs from behind the knees and pull the client slightly forward in the wheelchair, so the buttocks will clear the large wheel when the transfer is made (Fig. 11.12A).

3. Place a sliding board under the client's inside thigh, midway between the buttocks and the knee, to form a bridge from the bed to the wheelchair. The sliding board is angled toward the client's opposite hip.

4. Stabilize the client's feet by placing your feet laterally around the client's feet.

5. Stabilize the client's knees by placing your own knees firmly against the anterolateral aspect of the client's knees (Fig. 11.12B).

6. Facilitate the client's lean over the knees by guiding him or her forward from the shoulders. The client's head and trunk should lean opposite the direction of the transfer. The client's hands can rest on the lap.

7. Reach under the client's outside arm and grasp the waistband of the trousers or under the buttock. On the other side, reach over the client's back and grasp the waistband or under the buttock (Fig. 11.12C).

8. After your arms are positioned correctly, lock them to stabilize the client's trunk. Keep your knees slightly bent and brace them firmly against the client's knees.

9. Gently rock with the client to gain some momentum and prepare to move after the count of three. Count to three aloud with the client. On three, holding your knees tightly against the client's knees, transfer the client's weight over his or her feet. You must keep your back straight and your knees bent to maintain good body mechanics (Fig. 11.12D).

10. Pivot with the client and move him or her onto the sliding board (Fig. 11.12E). Reposition yourself and the client's feet and repeat the pivot until the client is firmly seated on the bed surface, perpendicular to the edge of the mattress and as far back as possible. This step usually can be achieved in two or three stages (Fig. 11.12F).

11. You can secure the client onto the bed by easing him or her against the back of an elevated bed or onto the mattress in a side-lying position and then lifting the legs onto the bed.

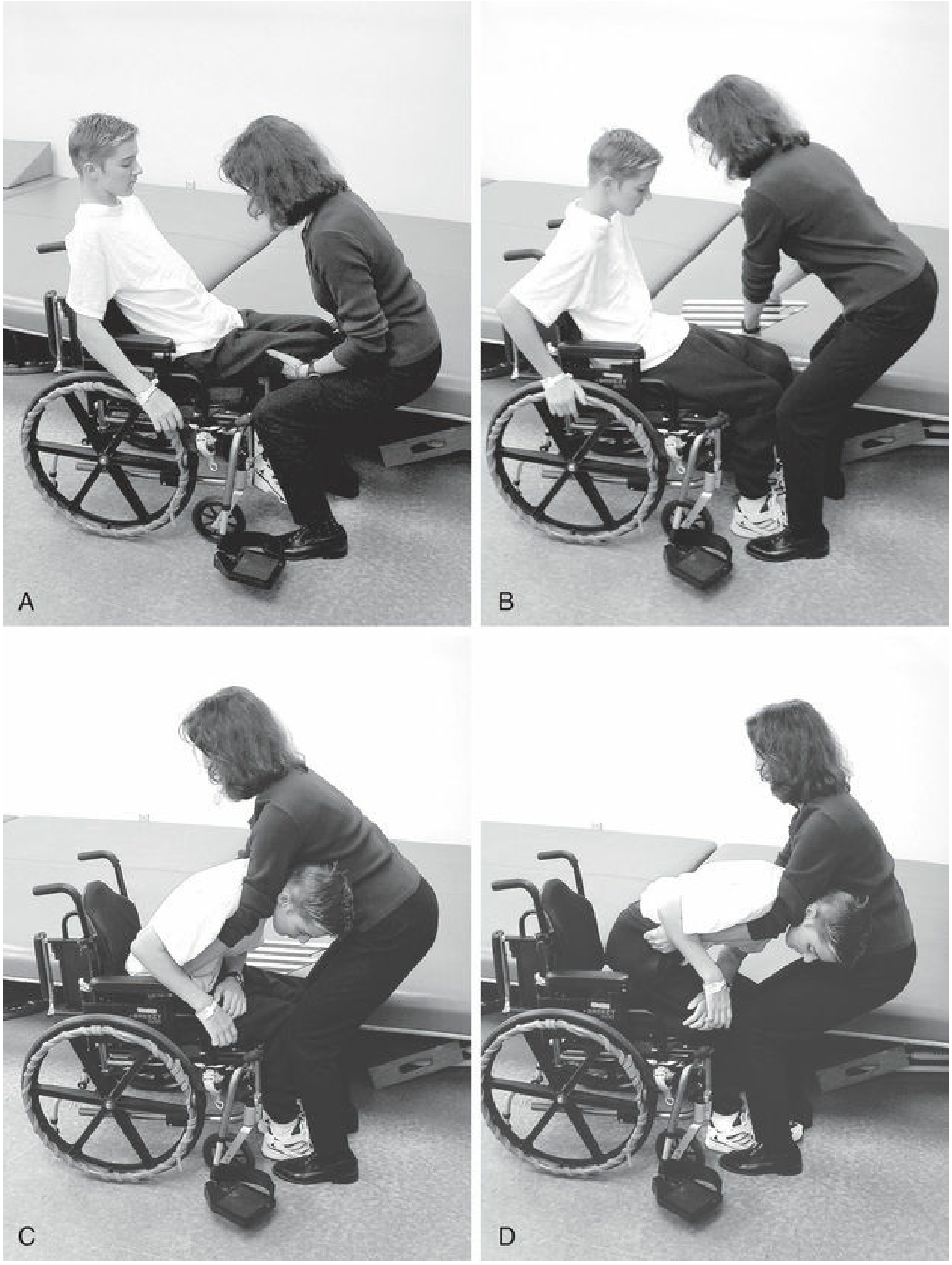
A
B
C
D

FIG 11.12 One person–dependent sliding board transfer. A, Therapist positions wheelchair and client and pulls client forward in chair. B, Therapist stabilizes client's knees and feet after placing sliding board. C, Therapist grasps client's pants at lowest point of buttocks. D, Therapist rocks with client and shifts client's weight over client's feet, making sure client's back remains straight. E, Therapist pivots with client and moves client onto sliding board. F, Client is stabilized on the bed. (Courtesy Luis Gonzales.)

The one person–dependent sliding board transfer can be adapted to move the client to other surfaces. It should be attempted only when therapist and client feel secure with the wheelchair-to-bed transfer.

Two Person–Dependent Transfers (Fig. 11.13)

Bent Pivot: With or Without a Sliding Board, Bed to Wheelchair

A bent pivot transfer is used to allow increased therapist interaction and support. It provides the therapist with greater control of the client's trunk and buttocks during the transfer. It is often used with neurologically involved clients because trunk flexion and equal weight bearing are often desirable with this diagnosis. The steps in this two-person procedure are as follows:

1. Set up the wheelchair and bed as described previously.

2. One therapist assumes a position in front of the client and the other in back.

3. The therapist in front assists in walking the client's hips forward until the feet are flat on the floor.

4. The same therapist stabilizes the client's knees and feet by placing his or her knees and feet lateral to each of those of the client.

5. The therapist in back positions himself or herself squarely behind the client's buttocks, grasping the client's waistband, grasping the sides of the client's pants, or placing his or her hands under the buttocks. Maintain proper body mechanics (Fig. 11.13A).

FIG 11.13 Two person–dependent transfer—bed to wheelchair. A, One therapist positions self in front of client, blocking feet and knees. The therapist in back positions self behind client's buttocks and assists by lifting. B, Person in front rocks client forward and unweights buttocks as the back therapist shifts buttocks toward wheelchair. C, Both therapists position client in upright, midline position in wheelchair. Seat belt is secured, and positioning devices are added. (Courtesy Luis Gonzales.)

6. The therapist in front moves the client's trunk into a midline position, grasps the client around the back of the shoulders, waist, or hips, and guides the client to lean forward and shift his or her weight forward, over the feet and off the buttocks. The client's head and trunk should lean in the direction opposite the transfer. The client's hands can rest on the lap (Fig. 11.13B).

7. As the therapist in front shifts the client's weight forward, the therapist in back shifts the client's buttocks in the direction of the transfer. This can be done in two or three steps, making sure the client's buttocks land on a safe, solid surface. The therapists reposition themselves and the client to maintain safe and proper body mechanics (Fig. 11.13C).

8. The therapists should be sure they coordinate the time of the transfer with the client and one another by counting to three aloud and instructing the team to initiate the transfer on three.

9. Transfer or gait belts may be used to offer a place to grasp while assisting the client in a transfer. The belt is placed securely around the waist and often is used instead of the client's waistband. The belt should not be allowed to slide up the client's trunk because leverage will be compromised.

Mechanical Lift Transfers (Fig. 11.14)

Some clients, because of body size, degree of disability, or the health and well-being of the caregiver, require the use of a mechanical lift. A variety of mechanical lifting devices can be used to transfer clients of any weight (Fig. 11.14). A properly trained caregiver, even one who is considerably smaller than the client, can learn to use the mechanical lift safely and independently.[211] The client's physical size, the environment in which the lift will be used, and the uses to which the lift will be put must be considered to order the appropriate mechanical lift. The client and caregiver should demonstrate safe use of the lift for the therapist before the therapist prescribes it.

FIG 11.14 A, Traditional boom-style mechanical lift. B, Sling attachments should be exposed with the outside seams of the sling directed away from the patient. C, Position the lift perpendicularly to the patient, close to the bed, and with the spreader bar over the chest; attach the chains or web straps to the spreader bar. D and E, Fold the patient's arms over the abdomen and elevate the body. Elevate the patient until the buttocks clear the surface of the bed. F to H, The patient's knees can be allowed to flex or can be kept extended. Carefully move the lift away from the side of the bed and then turn the patient to face the support column. Transport the patient to the wheelchair and lower into the chair. (From Fairchild S: *Pierson and Fairchild's principles and techniques of patient care,* ed 5, St Louis, 2013, Saunders.)

Transfers to Household Surfaces

Sofa or Chair (Fig. 11.15)

Wheelchair to sofa and wheelchair to chair transfers are similar to wheelchair to bed transfers; however, a few unique concerns should be assessed. Transfers to surfaces that are variable are described as complex transfers. The therapist and the client need to be aware that the chair may be light and not as stable as a bed or wheelchair. When transferring to the chair, the client must be instructed to reach for the seat of the chair. The client should not reach for the armrest or the back of the chair because this action may cause the chair to tip over. When moving from a chair to the wheelchair, the client should use a hand to push off from the seat of the chair as he or she begins to stand. Standing from a chair is often more difficult if the chair is low or the seat cushions are soft. Dense cushions may be added to increase height and provide a firm surface to which to transfer.

FIG 11.15 Client who sustained a stroke in midtransfer reaches for seat of chair, pivots, and lowers body to sitting. (Courtesy Luis Gonzales.)

Toilet and Bedside Commode

In general, wheelchair to toilet and wheelchair to bedside commode transfers are difficult because of the confined space in most bathrooms, the height of the toilet, and the instability and lack of support of a toilet seat. The therapist and client should attempt to position the wheelchair next to or at an appropriate angle to the toilet or commode. The therapist should analyze the space around the toilet and wheelchair to ensure that no obstacles are present. Adaptive devices such as grab bars and raised toilet seats can be added to a regular toilet to enhance the client's independence during this transfer. (Raised toilet seats are poorly secured to toilets and may be unsafe for some clients.) The client can use these devices for support during transfers and to maintain a level surface to which to transfer.

Bathtub

The OT should be cautious when assessing or teaching bathtub transfers because the bathtub is considered one of the most hazardous areas of the home. Transfers from the wheelchair to the bottom of the bathtub are extremely difficult and are used with clients who have good bilateral strength and motor control of the upper extremities (eg, clients with paraplegia and lower extremity amputation). A commercially produced bath bench or bath chair or a well-secured straight-back chair is commonly used by therapists for seated bathing. Therefore, whether a standing pivot, bent pivot, or sliding board transfer is performed, the technique is similar to a wheelchair to chair transfer. However, the transfer may be complicated by the confined space, the slick bathtub surfaces, and the bathtub wall between the wheelchair and the bathtub seat.

If a standing pivot transfer is used, it is recommended that the locked wheelchair be placed at a 45-degree angle to the bathtub if possible. The client should stand, pivot, sit on the bathtub chair, and then place the lower extremities into the bathtub.

If a bent pivot or sliding board transfer is used, the wheelchair is placed next to the bathtub with the armrest removed. The transfer tub bench may be used and removes the need for a sliding board. This approach allows the wheelchair to be placed right next to the bench, which permits safe and easy transfer of the buttocks to the seat. Then the lower extremities can be assisted into the bathtub.

In general, the client may exit by first placing one foot securely outside the bathtub on a nonskid floor surface and then performing a standing or seated transfer back to the wheelchair. Often the client's buttocks may be bare; therefore, a pillowcase may be placed over the sliding board, or a Safetysure Transfer Sling (The Wright Stuff [*http://www.thewright-stuff.com/*]; AAA.) (Fig. 11.16) may be used for safe transfers for bathing.

FIG 11.16 Safetysure Transfer Sling fastened around the client's waist and lower back for support. (Courtesy Scan Medical, North Billerica, MA.)

Car Transfers

A car transfer is often the most challenging for therapists because it involves trial-and-error methods to develop a technique that is safe and easy for the client and caregiver to carry out. The therapist often uses the client's existing transfer technique. The client's size and degree of disability, in addition to the vehicle style (two door or four door), must be considered. These factors will affect the client's level of independence and may necessitate a change in the usual technique to allow a safe and easy transfer.

In general, it is difficult to get a wheelchair close enough to the car seat, especially with four-door vehicles. The following are some additional considerations when making wheelchair to car transfers:

1. Car seats are often much lower than the standard wheelchair seat height, which makes the uneven transfer much more difficult, especially from the car seat to the wheelchair. Sport utility vehicles (SUVs) and trucks are especially challenging due to the increased height.

2. Occasionally clients have orthopedic injuries that necessitate the use of a brace, such as a halo body jacket or a lower extremity cast or splint. The therapist often must alter the technique (eg, recline the car seat) to accommodate these devices.

3. The therapist may suggest the use of an extra-long sliding board for this transfer to compensate for the large gap between transfer surfaces.

4. Because uphill transfers are difficult and the level of assistance may increase for this transfer, the therapist may choose a two person–assist instead of a one person–assist transfer to ensure a safe and smooth technique.

5. The therapist may have to practice transfers in both the front and back seats to determine which car position would be safest for the client.

Section 2 Summary

A wheelchair that fits well and can be managed safely and easily by its user and caregiver is one of the most important factors in the client's ability to perform ADLs with maximal independence.[209] All wheelchair users must learn the capabilities and limitations of the wheelchair and safe methods of performing all self-care and mobility skills. If a caregiver is available, he or she needs to be thoroughly familiar with safe and correct techniques of handling the wheelchair, the positioning equipment, and the client.

Transfer skills are among the most important activities that must be mastered by the wheelchair user. The ability to transfer increases the possibility of mobility and travel. However, transfers can be hazardous. Safe methods must be learned and followed.[211] Several basic transfer techniques are outlined in this chapter. Additional methods and more detailed training and instructions are available, as discussed previously.

Many wheelchair users with exceptional abilities have developed unique methods of wheelchair management. Although such innovative approaches may work well for the person who has devised and mastered them, they cannot be considered basic procedures that everyone can learn.

Section 3 Transportation, Community Mobility, and Driving Assessment

Ana Verran, Sandra Okada, Gayle San Marco

Section 3: Threaded Case Study

Jacqueline, Part 1

Jacqueline is a 67-year-old retired teacher who has been referred to outpatient occupational therapy by her physician. She has had increased difficulty in her ADLs because of painful arthritis in her neck, hands, back, hips, knees, and ankles. While establishing an occupational profile for Jacqueline, her therapist, an OT in general practice, asks her if she drives. She learns that Jacqueline's husband, a retired accountant who has diabetes and peripheral neuropathies in his legs, has had to cease driving. This has brought about a major change in Jacqueline's role. Whereas she had previously been a passenger and navigator, she has now assumed the primary role for transportation and driving, including assisting her husband with his wheelchair and car transfers. Jacqueline is 5 feet, 6 inches tall and weighs 138 pounds. Her husband is 6 feet tall and weighs 220 pounds. The family vehicle is a 20-year-old sedan, which is meticulously maintained.

The OT reviews Jacqueline's chart and ascertains that she seems to be in good health other than the limitations imposed by the arthritis. During the IADL evaluation, the OT carefully observes Jacqueline's occupational performance in the kitchen and notes that she is able to plan and problem-solve easily. Her primary deficits are in motor performance areas. Larger grip kitchen utensils are recommended to facilitate meal preparation. Because Jacqueline has emphasized the importance of being the caregiver and driver for her husband, the therapist makes a plan to observe how her deficits affect her ability to transfer her husband into the car. In doing this she notes difficulties in several other driving-related areas. There is trouble loading the husband's manual wheelchair, managing the key in the car door, and opening the door. Jacqueline tells the therapist that she doesn't mind driving, but on days when she is experiencing a lot of pain or fatigue, she does not drive at all.

During therapy sessions Jacqueline reports that she feels fatigued from so much driving. She mentions that she drives herself and her husband to all doctor appointments, to the pharmacy for medicines, and to church. When the therapist asks about her preferred occupations, she states that she rarely participates in her hobby of scrapbooking anymore because of fatigue and lack of time. She is worried about what the future will bring in terms of transportation because their two adult children live out of state, 500 miles away.

Critical Thinking Questions

1. What areas of Jacqueline's community mobility are appropriate for OT intervention?
2. Upon analysis of the task of driving relative to her diagnosis, what client factors can be predicted as needing assessment and intervention?
3. What adaptations or recommendations can Jacqueline and her therapist consider to improve mobility for her and her husband?

Competence in community mobility is an important component of quality of life throughout the lifespan.[16,45] Community mobility can be accomplished in many ways, including walking, using a bicycle or a powered mobility device, riding as a passenger, driving oneself, or using public transportation.[13,215] It is an area of occupation that affects all areas of practice and is considered an IADL in the current version (2014) of the "Occupational Therapy Practice Framework: Domain and Process," third edition[23] (OTPF-3). Community mobility can be a means to an occupation (walking or driving to work) or an occupation in and of itself (a leisurely stroll or scenic drive).

The potential for engagement in areas of occupation and community mobility are closely linked.[59] OTs understand that community mobility is critical for accomplishing necessary activities and enabling individuals to maintain social connectedness.[215] In the United States, community mobility, and the subset of driving in particular, is often viewed as synonymous with independence.[87] Conversely, limitations in community mobility and loss of a driver's license can negatively impact autonomy and feelings of well-being. Lack of transportation to engage in occupations such as grocery shopping, going to medical appointments, and attending religious and/or recreational events can result in diminished social participation.[14,98] Transportation problems are often cited as a primary barrier among individuals with disabilities.[193,213] Also, older adults faced with driving cessation risk depression[156] and entry into long-term care[95] and have increased self-perceptions of disability.[108]

Role of Occupational Therapy

The OT is ideally suited to identify when community mobility occupations require assessment and intervention.[14] OTs understand the interplay between engagement in occupation, the existence or lack of mobility options, and physical and mental health. Knowledge in this area makes the profession relevant to clients, the community, and public and private entities.[13] Therapists develop treatment plans by analyzing the interplay of client factors, performance skills and patterns, and the contexts and environments involved in community mobility (Fig. 11.17).[23] Within this framework OTs are concerned with the community mobility needs of clients with varying disabilities at all stages of life. Service recipients could be as diverse as a toddler with cerebral palsy, an adolescent with Asperger's syndrome, a young adult with a spinal cord injury, and a senior citizen with dementia.[13]

FIG 11.17 OTs must take a comprehensive view of community mobility throughout the lifespan. Community mobility in this context includes pedestrian, bicycling, public transportation, and driver issues.

OT services are directly related to a client's mobility concerns and are as varied as clients and the occupations in which they engage. They can address various aspects of passenger safety, walking, biking, and use of mass transit. Interventions may also involve training in preparation to acquire a first driver's license, evaluation of experienced drivers with age-related changes that interfere with driving, and exploration of alternative transportation options for those people who must temporarily discontinue driving.[13] Although clients are often individual persons, organizations or populations may also benefit from OT services.[13,45] Examples of services that might be provided to organizations include modification of the **paratransit** eligibility evaluation for a transit company seeking to increase ridership of disabled persons and training of drivers and bus aides for a school system seeking to improve the safety of student passengers with special needs. Services to populations may include collaboration with municipal planning organizations to promote roadway design, bike lanes, and pedestrian paths to support **older drivers** and persons using other modes of transportation.[13]

Historical Context

Current driver rehabilitation practices were developed during the last half of the 20th century. A growing interest in providing professional education and support to practitioners in the various disciplines involved in driver rehabilitation led to formation of the Association for Driver Rehabilitation Specialists (ADED) in 1977.[33] The organization, which is multidisciplinary and includes OT practitioners, has developed a code of ethics and standards of practice,[30] in addition to best practice guidelines[31] for delivery of driver rehabilitation services by individuals providing services to persons with disabilities or age-related impairments. The ADED has offered a certification in driver rehabilitation to allied health professionals and individuals from other multidisciplinary backgrounds since 1995.[35]

Expansion of the driver rehabilitation field prompted trade and government agencies to address safety issues. In 1997 the National Mobility Equipment Dealers Association (NMEDA), a national organization to promote and support individual members engaged in the modification of transportation for people with disabilities, established an accreditation program to promote quality, safety, and reliability within the mobility industry.[142] The National Highway Traffic Safety Administration (NHTSA), a federal agency charged with saving lives, preventing injuries, and reducing the economic costs related to traffic accidents, also became involved in overseeing vehicle safety related to vehicle modifications for people with disabilities.[140]

As the issues of driving, driving cessation, and the need for transportation alternatives brought about by an aging American population became recognized, NHTSA developed a plan to address the needs of older drivers.[126] The agency has funded research and developed educational materials to increase awareness of older driver issues. One example is the American Medical Association's (AMA) *Physician's Guide to Assessing and Counseling Older Drivers*,[51] which was created in collaboration with the NHTSA to help physicians address the public health issue of older adult driver safety. To increase the quality and availability of service providers dealing with senior driving, the NHTSA has promoted partnerships with professional organizations serving the older population. The agency has recognized the role of OTs in driving and community mobility of older adults and acknowledges that OTs in general practice, who frequently encounter seniors with medical conditions, would be in a position to screen for problems and refer at-risk individuals for additional services. The NHTSA also realizes that OTs with a driver rehabilitation specialty have the skill set to offer driving-related services and interventions that other allied health professionals cannot.[129]

In 2003 the American Occupational Therapy Association (AOTA) received funding from the NHTSA for an Older Driver Initiative (ODI) to provide professional training in the specialty area of older adult driving and to coordinate multiple projects related to raising awareness of senior driving issues.[13] The ODI resulted in various continuing education materials, development of the AOTA's Older Driver Microsite (*http://www.aota.org/olderdriver*), the annual Older Driver Safety Week, and the Specialty Certification in Driving and Community Mobility.[13] The ODI plan has also included partnering with other providers and stakeholders in older driver safety. For example, CarFit, a national educational program to ensure that seniors fit well with their vehicles, resulted from a multiagency partnership between the American Society on Aging (ASA), the American Automobile Association (AAA), the American Association of Retired Persons (AARP), and the AOTA.[9,187] The Gaps and Pathways Project, launched by the AOTA in 2011, was funded through another cooperative agreement with the NHTSA. The intent of the Gaps and Pathways Project is to provide guidance to OTs for effectively addressing the IADLs of driving with all clients, either through direct service or through referral pathways.[174] One of the outcomes of the Gaps and Pathways Project was a special issue of *Occupational Therapy in Health Care*,[27] which presented resources and papers to guide practitioners in promoting client participation in driving and other forms of community mobility.[25]

The Centennial Vision endorsed by the AOTA board of directors in 2003 has served as a road map for the profession,[12,29] prompting practitioners to identify opportunities to expand OT practice. An initial focus on opportunities for meeting the needs of senior drivers led to recognition of community mobility and older drivers as an emerging practice niche.[26,46] The current emphasis is that OT within various practice settings must evolve to address community mobility throughout the life span in a comprehensive way that considers needs beyond driving rehabilitation.[13,14] The Centennial Vision's strategy of linking education, research, and practice has been implemented by increased scholarly research in the driving and community mobility area. Several evidence-based literature reviews related to driving and community mobility for older adults have been published in the *American Journal of Occupational Therapy*.[63,100,184] Additionally, four critical appraisals of articles focused on driving and community mobility topics have been conducted.[18-21]

Generalist and Specialist Roles

Both OT generalists and specialists have the skills and training necessary to ask basic questions about community mobility issues.[13,45] The two levels of practitioners have in common the goals of supporting participation in the community, optimizing independence in community mobility, and reducing crashes, injuries, and fatalities. In order to optimally meet driving and community mobility needs, OT services are provided along a continuum.[15] The depth at which the individual therapist addresses community mobility issues with clients depends on his or her level of experience and the specialized training that he or she has received.[153,173] A generalist OT practitioner addresses driving and community mobility as part of a larger agenda to optimize occupational engagement. OT practitioners with specialty training and advanced certification may offer a focused approach in which driving is the primary goal.[13]

All OTs should explore how impairments impact driving and set goals related to their clients' driving and community mobility needs. Generalists should incorporate questions about driving and community mobility when performing an initial IADL evaluation.[8] The observation of performance skills during the IADL assessment enables a determination of the client's strengths and whether his or her impairments have the potential to impact driving.[15] If impairments are noted, the generalist has the opportunity to initiate treatments that may improve driving capabilities.[107] Generalists may recommend temporary driving cessation for clients with acute medical conditions based on this evidence.[102] Additionally, if it is determined that a client must eliminate complex IADLs (eg, cooking or financial management) because of moderate to severe dementia, the generalist may appropriately recommend driving retirement and focus intervention efforts on exploration of transportation alternatives.[14] Generalist practitioners can assist clients in choosing simple aids that do not directly affect vehicle control (eg, a key holder or a handle that attaches to the door latch to assist with entering and exiting a vehicle), but they should consider the potential effect of any recommended piece of equipment.[14]

An OT driver rehabilitation specialist should be contacted if there are any questions about driving safety and driver competence. Driving presents a greater possibility of personal and public harm than does any other ADL or IADL; therefore, OTs offering driver evaluation services should have advance training to effectively intervene in this complex occupation. OT driving specialists administer assessments specific to the requirements involved in driving, including those for vision, cognition, motor performance, reaction time, knowledge of traffic rules, and a behind-the-wheel (BTW) assessment of skill.[13] They recommend whether to continue, modify, or cease driving, suggest vehicle modifications and adaptive devices, provide driver retraining or specialized driver education, and document all findings. In some states OT practitioners specializing in driving must also be certified driver instructors in order to perform on-road assessments and provide **driver training**.[13,14] OT specialists who are not driving instructors should consider working in collaboration with driving instructors with advanced training with medically at-risk drivers.

Specialty Training and Certification

Professional specialty designation expedites services, assures appropriate matches between the practitioner's skills and the client's need, and validates the depth and breadth of OT practice.[182]

There are two ways by which OT practitioners can designate themselves as specialists in the area of driver rehabilitation (Box 11.2). The first is the Specialty Certification in Driving and Community Mobility (SCDCM), which is available to OTs and Certified Occupational Therapy Assistants (OTAs) through the AOTA. The SCDCM is awarded after a peer review of a reflective portfolio demonstrating the practitioner's relevant experience and ongoing professional development.[17] Board and specialty certifications are recognized as quality markers by accrediting and regulatory agencies and sources of reimbursement.[97] They communicate OT expertise to consumers and professionals outside the profession.

Box 11.2

Certification Programs

Association for Driver Rehabilitation Specialists (ADED)

Certification objectives, eligibility, candidate handbook, and testing location and dates

- http://www.aded.net/?page=215

American Occupational Therapy Association (AOTA)

Specialty Certification in Driving and Community Mobility

- http://www.aota.org/Education-Careers/Advance-Career/Board-Specialty-Certifications/Driving-Community-Mobility.aspx

The second alternative is the Certified Driver Rehabilitation Specialist (CDRS) certification in driver rehabilitation, available through the ADED. The CDRS credential allows individuals from an allied health or a driver training background who meet the criteria for educational background and experience to sit for an examination covering driver education, disabilities, and vehicle modifications.[34] In some states, agencies such as the Department of Rehabilitation require the CDRS credential to provide services.

Occupational Therapy Assistants

OTAs are a valuable asset to driver rehabilitation. Completion of standardized testing, vehicle entry/exit and lift safety training, transfer training, and functioning in the role of driver instructor are just some of the ways the OTA can contribute to a driving program. The OTA must work under the supervision of and in partnership with the OT.[22] Appropriate utilization of OTA skills can be an asset to driving programs by assisting with cost containment. Expanded roles are possible when intervention protocols are developed, documented, and followed, again under the OT's supervision. For example, OTAs can be used to determine the need for progression in driver training, as long as the driving skills being observed have been defined and training has been provided to the OTA in recognizing them. Clear treatment protocols facilitate supervision by enhancing communication between colleagues.

Public Transportation

Impact of the Americans With Disabilities Act

Public transportation refers to services operated by public agencies or supported by public funds that are available to anyone for any trip purpose.[206] Public transportation involves the use of buses, trolleys and light rail, subways, commuter trains, streetcars, cable cars, van pool services, paratransit services, ferries and water taxis, and monorails and tramways.[28] Title II of the **Americans with Disabilities Act (ADA)** of 1990[3] prohibits discrimination on the basis of disability by all public entities that provide transportation at the local and state levels. Title III extends coverage to private entities that provide public transportation services.[3] The ADA has jurisdiction over most modes of transportation, including buses, trains, and ships but transportation that is specifically covered through other laws is excluded. For example, discrimination on the basis of disability in air travel is prohibited by the Air Carrier Access Act of 1986 (ACAA).[5]

The ADA's public transportation requirements for vehicles, facilities, and service were meant to create integration so that people with disabilities could travel to desired activities and do so in a nonsegregated way.[83] The law established accessibility guidelines for buses, trains, and light rail systems and specified the need for wheelchair lifts and ramps.[196] ADA guidelines also provide for priority seating, handrails to facilitate interior circulation, public address systems to announce stops, stop request controls, clearly marked destination and route signs, and various other features intended to ease navigation by persons with disabilities. Major improvements in transit systems across the United States have resulted from this legislation. As of 2006 the Federal Transit Administration (FTA) estimated that 98% of bus service was ADA accessible.[93]

Fixed-Route and Demand-Response Systems

Public transportation includes both fixed-route and demand-response systems of service delivery. **Fixed-route systems** use defined routes with predetermined stops and run on a published schedule.[206] Trains, city buses, and shuttles are types of fixed-route transportation. Demand-response transit refers to transportation service delivery in which rides are generated by calling a transit operator who then dispatches a vehicle to pick up passengers and transport them to their destination. The vehicles do not operate over a fixed route or on a fixed schedule. They may be dispatched to pick up several passengers at different points before taking them to their respective destinations.[198]

Fixed-route transportation creates links to home, work, schools, recreation areas, and other important destinations. The fixed-route system does not have a process for qualification and is open to anyone. It is an important transportation alternative for many segments of the population because it costs less and offers greater autonomy and flexibility than demand-response systems. In some locations the use of fixed-route transit by people with disabilities is two to six times higher than ADA paratransit ridership.[186] Older nondrivers also rely on public transit significantly, using it for 9% of their trips.[2] Public transit appears to be important to the Millennial generation. Some studies have also shown that young people born between 1983 and 2000 appear to be less focused on using cars for transportation than older generations and seem to use alternate transportation methods, including public transportation, more extensively.[80]

The ADA requires public transit agencies that provide fixed-route service to offer a type of demand-response service called "complementary paratransit" to people unable to use the fixed-route service because of a disability. The individuals who are entitled to the complementary service as a civil right and the service characteristics that must be provided for it to be considered complementary are defined by the law.[82] Some communities offer demand-response transit referred to as "call-a-ride services" in addition to ADA complementary paratransit. These services may be offered in place of ADA complementary paratransit in locations where there is no fixed-route service.[83] Call-a-ride systems may be open to the general public or may be limited to people who participate in specific social service programs. The services such systems offer can vary from community to community.[82]

The people entitled to use complementary ADA paratransit include those with physical or mental impairments who cannot board and ride accessible fixed-route transit systems, those in areas where the fixed-route system lacks accessible vehicles, and those who have specific impairments that prevent them from getting to and from a stop. Eligibility may be conditional if the person can use fixed-route transit for some trips and not others. Examples of situations that might prevent an individual from using a fixed-route service for some trips include weather conditions for a person with temperature sensitivity, presence of a variable medical condition, and environmental barriers at certain locations.[82,208]

Complementary paratransit service considered equivalent to the fixed route must be provided within ¾ of a mile of a bus route or rail station, at the same hours and days, for no more than twice the regular fixed-route fare. The ADA further requires that paratransit rides be provided if requested at any time during the previous day. Trip times can be negotiated but must not be more than 1 hour before or after the requested departure. Personal care attendants can ride for free.[113]

Transit authorities are required to have a process for determining paratransit eligibility.[73,114] An application is usually needed to qualify. Some transit authorities also ask for supporting documentation, an in-person interview, and/or an in-person assessment of the applicant's ability to use fixed-route service.[208] The in-person assessment is conducted either in a real setting or using a transit simulator. The focus of the in-person assessment is to determine whether the person can perform the tasks involved in using public transportation, not on the presence of a disability.[73]

Intervention Implications for Fixed-Route Transit

Trepidation about traveling alone can make an older adult or a person with a disability reluctant to use the fixed-route system, even when it is a viable transportation alternative.[45,149,206] To achieve increased ridership, OTs must match the task demands of the local fixed-transit environment with client factors and performance skills.[208] If possible, the client's proficiency and destination points, skill in boarding and exiting the bus, and the time at which he or she would travel as a fixed-transit user should be evaluated in the actual setting in which the bus or rail services will be used. Factors such as the ability to efficiently get to a bus stop, the safety of bus stops at origin and destination points, skills in boarding and exiting the bus, and whether the time at which travel will occur is optimal for the client should be addressed.

If barriers to successful use of fixed transit are identified,[149] a focused intervention plan may be necessary to remediate or compensate for limited subskills. Strengthening, balance, and endurance programs to increase ambulation or efficiency in using a mobility device[207] can be carried out in the clinic. OTs recommending a scooter or wheelchair should determine whether the device's weight and dimensions will allow it to fit and be safely transported on a bus's lift. Guidelines require buses to have lifts with a minimum design load of 600 lb and the lift platform to accommodate a wheelchair measuring 30 inches by 48 inches.[199] Lower footrests tend to make a wheelchair functionally longer. The length may make the wheelchair incompatible with some transit lifts and complicate maneuverability within the bus or light rail system. The ADA allows transit operators to adopt a policy specifying whether wheelchairs must be secured or can ride unsecured on a bus.[199] Clients should know where securement devices should be placed on their wheelchair. Bus drivers receive training to become proficient in using securement devices but in practice may not know how to work them properly.[72] Practice in verbally communicating how to secure the wheelchair is thus warranted.

Skills such as managing money and reading a schedule can also be practiced in the clinic. Trip planning tools found on transit authority websites and those available through smart phone apps from third-party developers are useful resources. Clients who do not use computers or smart phones can be shown how to obtain travel information by dialing 511 on their telephone land line or mobile phone. The Federal Communications Commission (FCC) has designated this number as the single travel information telephone number available to states and local jurisdictions across the country.[197]

The natural environment poses limitations that cannot always be anticipated or duplicated in a clinic setting. Many clients benefit from participation in real-life sessions to develop the competence and confidence to use fixed-route transit independently. Community outings provide opportunities for skill practice and discussion of problems. Some transit systems offer individualized training programs, known as travel training, to assist persons who cannot negotiate the fixed-route system to travel safely and independently to a regularly visited destination such as work or school. OTs who are part of an Individualized Educational Plan (IEP) team should consider the need for travel training when they plan for a child's postsecondary transition needs.[195] OTs have the basic academic competencies to provide travel training.[14] Additional education in this area is available through Easter Seals Project Action, a national technical assistance program for community transportation.[81] Some transit authorities offer travel instruction geared specifically to older adults. In some cases a senior is paired with an experienced bus user who will accompany them on a test ride to a destination of their choosing.[116]

Intervention Implications for Paratransit

OTs can play a critical role in helping clients determine whether paratransit service best meets their community transportation needs. To do this practitioners must become familiar with the policies of the local transit company and clearly understand their clients' passenger assistance level. The ADA allows transit companies to determine whether door-to-door or curb-to-curb service will be provided. In door-to-door service, the driver offers help from the door at the origin point of the trip and comparable assistance to the door at the destination point. In curb-to-curb service, help is not provided until the person actually reaches the curb. Guidance provided by the federal Department of Transportation (DOT) to transit agencies has clarified that transit agencies with curb-to-curb service must still provide assistance to riders who need it due to a disability; however, door-to-door service may be provided only as needed, not necessarily for all rides.[74] The activity demands of curb-to-curb service are greater than those of door-to-door service. The OT should prepare the client to advocate for door-to-door service if the person's functional limitations require it.

Because Jacqueline had reported that she was sometimes unable to drive because of arthritic flare-ups, her therapist used the opportunity to talk to her in greater depth about her transportation needs. Jacqueline had never heard of paratransit, but after the therapist explained how it operated and what the qualification process to use it would involve, Jacqueline decided it would be an option worth trying. However, because she was still concerned about her husband's blood sugar level if the ride caused them to be way from home for an extended time, the therapist recommended that she pack appropriate diabetic snacks to avoid low blood sugar problems during the trip. After Jacqueline had established paratransit eligibility for herself and her husband, she expressed relief that she had found an effective transportation safety net.

The costs of providing a paratransit trip are significantly higher than for a fixed-transit trip—often 10 times higher.[52] The high expense of providing paratransit service has caused some transit providers to implement a stringent eligibility certification process as a way to contain costs.[52] OTs have a potential role in all aspects of eligibility certification.[208] To ensure appropriate categorization of disability, assistance can be provided during the application process. Clients can be encouraged to accurately report all significant disabling conditions that interfere with using fixed-route service. Assistance during the interview process could involve educating the person to provide necessary documentation of these problems and helping him or her articulate the difficulties encountered when using fixed-route service, for example, by describing an inability to wait at a bus stop. OT services are also needed by transit authorities to determine whether a person's wheelchair conforms to the common wheelchair ADA requirements, to prescreen an applicant for balance and motor capabilities, and to conduct an assessment of the person's skills during an actual transit trip.

OT interventions may include orientation to the local system, training in making a reservation, and education related to service limitations. Paratransit ridership combines the trips of several individuals to meet the capacity of the vehicles; consequently, travel often takes longer than private transportation. In some cases it can exceed fixed-route timelines. Long trips can pose a hardship for those whose medical conditions or symptoms include urinary urgency and frequency, pain with prolonged immobility, insensate skin, or decreased endurance. OT intervention in such cases may call for cushioning and positioning devices to decrease discomfort and fatigue during the trip. Clients who are reluctant to travel alone can gain confidence in their abilities when accompanied by an OT on a trip to a destination and back.

Private Transportation

Private transportation refers to vehicles that are privately owned, either individually or by a group, and are used for the benefit of those individuals.[15,145] The primary advantages of private transportation are the on-demand, 24-hour availability of origin-to-destination travel, the flexibility to modify travel plans, and the strong sense of control over one's life. Individuals in rural areas that are not served by fixed-transit routes may have no alternative but to use private transportation. The costs of fuel and insurance, the expenses related to maintaining and replacing a vehicle, and the need for adaptive driving controls and vehicle modifications prohibit many people from using private transportation options. Nondrivers who own vehicles also face the expense of hiring drivers.

Supplemental Transportation Programs for Seniors

The aging of America has resulted in a focused effort to develop supplemental transportation programs for seniors, sometimes referred to as STPs.[41] The primary purpose of these programs is to support the gap in transportation service for older adults, particularly those over age 85, who most likely do not drive. There are thousands of STPs throughout the country, sponsored by a wide variety of private organizations, places of worship, government agencies, and even public transportation authorities. Some STPs have their own vehicles, purchased through public funding. Others, such as volunteer driver programs, rely on the vehicles of their volunteer drivers. Eligibility criteria are established by the sponsor organization, and the services provided can vary significantly. Depending on the program, door-to-door, door-through-door, escort, and assistance at the destination services might be offered. Service destinations may be affected by who sponsors a program. In some cases an organization may only offer transportation for a specific purpose, such as to attend religious services or to participate in a hot lunch program. Some STPs do not restrict the types of trips that can be taken and provide very flexible service, allowing for multiple stops during a single outing and crossing jurisdictional boundaries.

Intervention Implications for Supplemental Transportation Programs for Seniors

OTs should be aware of the factors (availability, accessibility, acceptability, affordability, and adaptability) that have been identified as facilitating senior-friendly transportation services.[42] Knowledge of the resources available for locating programs in a particular community is helpful in matching services to a client's particular needs (Box 11.3). The Eldercare locator is a public service of the federal Administration on Aging that connects users to information and assistance resources, including transportation services, for older adults at the state and community level. This resource can be accessed by telephone or through its website. The interactive maps on the AAA's Senior Driving website and the website for the Beverly Foundation are additional resources for finding

STPs. The nonprofit Independent Transportation Network of America (ITNAmerica), offers a searchable national database and toll-free telephone number where callers can obtain information about the transportation alternatives available in their particular areas.[105]

Box 11.3

Resources for Driving Safety Programs

AAA Foundation for Traffic Safety

- http://lpp.seniordrivers.org/lpp/

Contains a database of state driver licensing policies and practices affecting older and medically at-risk drivers.

American Association of Retired Persons (AARP)

- http://www.aarp.org (search under Driver Safety Resources)

Contains We Need to Talk online seminar about driving retirement, information about driver safety education classes, brain games, and various tools, including interactive driving simulations and a link to the University of Florida's Fitness to Drive Screening Tool.

American Automobile Association (AAA)

- http://dev.seniordriving.aaa.com/

Contains the Roadwise Review, Roadwise Rx, videos of the 12 steps involved in CarFit, a tool for selecting vehicles with features adapted to individual considerations, and additional information about topics related to senior driving.

American Occupational Therapy Association (AOTA)

- http://www.aota.org/Practice/Productive-Aging/Driving.aspx
- http://otconnections.aota.org/

Contains a driver rehabilitation specialist database, various tip and fact sheets, continuing education offerings, evidence-based research articles, and the organization's official documents related to driving and community mobility. Provides a discussion forum for driving and driver rehabilitation issues that is available to any AOTA member via the Physical Disabilities Special Interest Section in OT Connections.

Association for Driver Rehabilitation Specialists (ADED)

- http://www.aded.net

Contains documents related to best practices, ethics and standards of practice, disability fact sheets, and a database of driver rehabilitation specialists.

Beverly Foundation

- http://www.beverlyfoundation.org/map/stps

Provides an interactive map with a city and state listing of volunteer transportation providers. The Beverly Foundation dissolved in 2014 but made arrangements for the map to be maintained by the National Volunteer Transportation Center.

ITN Rides in Sight Hotline 1-800-60-RIDES

A free service uses ITN America's database of senior transportation options to identify local availability for callers.

National Mobility Equipment Dealers Association

- http://www.nmeda.org

Trade association for manufacturers of equipment and vehicle modifiers. Has a quality assurance program (QAP).

National Highway Traffic Safety Administration (NHTSA)

- http://www.nhtsa.gov (Search under Driving Safety)

The Older Driver subsection contains a video toolkit on medical conditions, a link to the Physician's Guide to Assessing and Counseling Older Drivers, and driver fitness medical guidelines. Parents Central has information about child safety, including selecting the right car seat, a database of installation locations, and information to promote seat belt use. Information about Safe Routes to Schools programs and pedestrian safety workshops for youth and older adults is provided under the Pedestrian subsection. The Bicycles subsection has materials and videos related to bicycling safety for youth and adults.

Rehabilitation Engineering Research Center on Wheelchair Transportation Safety

- http://www.rercwts.pitt.edu/RERC_WTS2_Intro/RERC_WTS2_Intro.

Contains information and educational materials about safe transportation of people who use wheelchairs as a seat in a motor vehicle.

Safe Kids Worldwide National Child Passenger Safety Certification

- http://cert.safekids.org/

Contains information for becoming a child passenger safety technician, certified to provide one-on-one personalized instruction on how to properly install a child's safety seat.

U.S. Administration on Aging Eldercare Locator

- http://www.eldercare.gov/Eldercare.NET/Public/Index.aspx and 1-800-677-1116

The site connects users to information and assistance resources, including transportation services, for older adults at the state and community levels.

Taxis and Ride-Sharing Services

Taxi service is a significant source of transportation for people with disabilities affecting mobility, vision, and thinking and other mental processes. Easter Seals Project Action (mentioned earlier), a government-funded program to assist the disability community and transportation industry to achieve the goal of accessible community transportation, reports that as many as 10% of taxi service customers are people with disabilities.[84] Taxi services are mandated to comply with ADA requirements as private companies that provide demand-response–type services. Companies do not have to purchase accessible sedan-type automobiles; however, if a new vehicle type other than a sedan is purchased, it must meet ADA accessibility requirements for transportation vehicles. Service cannot be denied to a person who uses a service animal or to a person who is able to transfer from a wheelchair to a vehicle seat, if the wheelchair can be stowed in the cab or the trunk. Additionally, personnel have to be trained to proficiency. Dispatchers must know how to operate communications equipment, such as a Telecommunications Display Device (TDD), and have enough knowledge about various disabilities to dispatch an appropriate vehicle. Training in the correct operation of lifts and securement devices is required for drivers.

Ride-sharing services, primarily Uber, Sidecar, and Lyft, are new additions to the transportation industry.[117,179,201] These businesses use smart phone apps and the smart phone's GPS function to identify a user's location and connect the person to a ride in the personal vehicle of the nearest available driver. Payment transactions are cashless and are completed using the smart phone app. Proponents of ride-sharing services proclaim their convenience, environmental benefits, and potential savings in fuel and parking costs. However, ride-sharing services are so new that they have been largely unregulated. They face opposition from the taxi industry, which claims they are unfair competition and also pose a risk to public safety because ride-sharing companies are not subject to the same licensing rules and other regulations imposed on traditional taxis. Ride-sharing services have also faced criticism from disability rights advocates because they lack accessible vehicles to provide service to people who use wheelchairs. and they sometimes discriminate against people who use service animals.[123,162,194] In 2013 California became the first state to regulate ride-sharing services. The California Public Utilities Commission mandated that ride-sharing companies (called transportation network companies in that state) provide incentives to attract accessible vehicles to their fleets, report annually on the demand for them, and ensure accessibility accommodations for their apps and websites.[50]

Interventions for Taxi and Ride-Sharing Services

For some clients, practice in the clinic using the telephone, computer, and smart phone apps to arrange for taxi and ride-sharing services may be helpful. If the client uses a wheelchair, he or she should be trained in the procedure for correctly securing it in a vehicle and should be able to communicate the steps for doing so to another person. Clients who believe they have been denied transportation services or have been treated unfairly should know where to seek information about legal requirements. OTs can be helpful in providing general information but should know about resources that can assist with accurately answering questions. The ADA National Network, funded by the National Institute on Disability and Rehabilitation Research, provides informal guidance on the ADA to meet the needs of business, government, and individuals at local, regional, and national levels. Inquiries can be submitted to the 10 regional centers comprising the network, either online, via email, or by calling a toll-free number (1-800-949-4232). Specialists can answer most questions immediately, and, if necessary, will research complex questions. Referrals to local resources for disability issues not addressed by the ADA are also provided.[4]

Traveling as A Passenger

General Considerations

In the United States, motor vehicle crashes are a source of significant medical and work costs. They are a leading cause of death among people ages 1 to 54 years and the leading cause of death among teens. Seat belts reduce serious crash-related injuries and deaths by half, but not everyone wears them.

Seat belts are designed to be used in conjunction with air bags to provide optimal protection. Without the seat belt, occupants can be thrown into the rapidly inflating front air bag, which could result in significant injury or death. Passengers need to wear both a lap and shoulder belt to best distribute crash forces.[131] The chances of living through a collision are three to four times higher when both belts are worn. The shoulder belt should be placed across the middle of the chest and away from the neck, and the lap belt should be adjusted to fit low on the pelvis, across the hips and below the stomach. The shoulder belt should never be worn behind the back or under an arm.

Intervention for Passengers

Because of the significant role seat belts play in reducing injuries and fatalities in a car crash, seat belt use should be encouraged in all clients. OTs should be aware of the populations with lower seat belt use (ie, teens, adults aged 18 to 34, people living in rural areas, and men[57]), and they should be ready to provide factual information about seat belts' effectiveness and how to wear them properly.

Safety in entering a vehicle should be carefully assessed. Training family and personal care attendants to assist a client in transferring to the passenger seat may be warranted. OTs not primarily responsible for teaching transfers should work in conjunction with physical therapists to maximize safety during the process. Generalists can make recommendations for low-tech equipment to facilitate entering and exiting the vehicle and twisting in a seat. Motorized turning seats designed for use by elderly or disabled passengers may be a good solution for some clients but should be prescribed by driving rehabilitation specialists because their fit in a particular vehicle will vary, depending on the model. Cushions, either commercially available or custom made, can aid in positioning and maximizing comfort and should be considered when pain and joint limitations are present. Jacqueline, the client described in the case study, may need to consider specialized passenger seats designed for the elderly to help her husband transfer more easily. These motorized seats move outside the car and rotate, easing the activity demand of car transfers (Fig. 11.18).

FIG 11.18 Bruno's Valet Plus aids vehicle entry by modifying activity demands for caregiver and client. (Courtesy Bruno Independent Living Aids, Oconomowoc, WI.)

Traveling While Riding in a Wheelchair

In most cases sitting in a motor vehicle seat offers the highest level of protection for a person riding in a vehicle. Cars, vans, and SUVs are designed with seats and belt restraint systems that work in conjunction with air bags to prevent occupant ejection and minimize the potential for contact with the vehicle interior. For various reasons people who use wheelchairs may find that they have to ride in their wheelchair when seated in a motor vehicle. However, wheelchairs are not typically designed for this purpose. Protecting vehicle occupants that use a wheelchair as a seat requires attention to the position of the wheelchair in the vehicle, the structure of the wheelchair itself, and to the systems for securing the wheelchair to the vehicle and restraining the occupant in the wheelchair.

Occupied wheelchairs should face forward during transport.[159] A sideways orientation is the least safe for enduring a frontal crash, which produces the most serious injuries. Wheelchairs that meet standard WC 19 of the American National Standards Institute/Rehabilitation Engineering Society of North America (ANSI/RESNA) are recommended by safety experts. However, not every wheelchair will meet this standard. A WC 19–compliant wheelchair (also known as a wheelchair with the transit option) has a frame and transit components that have been sled-impact tested to determine how they will respond in a crash. The chair also has four securement points, specific securement point geometry, a clear path of travel for proper placement of vehicle-mounted occupant safety belts, and anchor points for an optional wheelchair-anchored pelvic safety belt.[160] Wheelchairs that meet this standard are labeled to show that they comply.

Wheelchair tiedown and occupant restraint systems (WTORS) should meet standard J2249 of the Society of Automotive Engineers (SAE), which ensures that these systems have undergone dynamic strength testing conducted on an impact sled.[161,203] The wheelchair tiedown portion of WTORS is the system for securing the wheelchair to the vehicle. It consists of two front straps and two rear straps, all four of which are needed for safe transport. If an individual is traveling in a personal vehicle, an SAE J2249 docking system can be recommended in place of the straps.[160] Adaptor hardware is attached to the wheelchair frame so it can engage with a docking device installed on the vehicle's floor. The occupant restraint part of WTORS is the system for keeping the wheelchair occupant safely in his or her seat. OTs should be aware that the postural support belts of a wheelchair cannot do this effectively. Occupant restraint can be provided either by the vehicle manufacturer's three-point restraint or by an upper and lower torso occupant restraint provided by the WTORS manufacturer.[180] All parts of the WTORS must be used to safely transport a person in a wheelchair.

Interventions for Passengers Traveling in Wheelchairs

Passenger evaluations, which can significantly improve the safety of a rider, are too often overlooked as a focus of OT intervention. Determining whether a client can safely and efficiently transfer to a vehicle seat or should ride in his or her wheelchair is an important first step in addressing passenger transportation safety. If the client cannot transfer, the OT should advocate for a WC 19 wheelchair by providing justification and documentation of need to third-party payers. Collaboration with physical therapy may be needed if the OT is not directly responsible for ordering the wheelchair. OT driver rehabilitation specialists should recommend that SAE J2249–compliant WTORS be installed by vehicle manufacturers or accredited members of NMEDA.[96] The website of the Rehabilitation and Engineering Research Center on Wheelchair Transportation Safety (*http://www.rercwts.pitt.edu*) provides valuable resource information about WC 19–compliant wheelchairs and other issues of transportation safety for occupants of motor vehicles who remain seated in their wheelchair.

OTs working in a school setting must consider that their responsibility for students who use wheelchairs extends to their safe transportation to and from school.[162] Educating transporters in the safe loading of a wheelchair onto a lift (passenger facing away from the vehicle and wheel locks applied) and in deciding whether an individual with a power wheelchair can safely drive onto a lift is warranted. Additional opportunities exist for school-based therapists to work with transporters in developing a bus evacuation plan for disabled students.[178]

Child Passengers

Children are at significant risk when traveling in a motor vehicle. The leading cause of death among those ages 3 to 14 years is car crashes.[163] Fortunately, there are several steps that can be taken to mitigate risk. Safety seats have been shown to reduce fatal injuries by 71% for infants and 54% for toddlers.[134] The safety seat should be selected according to the child's age, height, and weight and should be positioned in the back seat of a vehicle. The NHTSA recommends a four-step progression from rear-facing car seats, to forward-facing car seats, to booster seats, to seat belts.[132] Children are ready to use seat belts in the back seat when they are tall enough to sit without slouching and are able to keep their back against the vehicle seat, naturally bend their knees over the edge of the seat, and keep their feet flat on the floor. The NHTSA advises that children remain in the back seat at least until age 12.[132]

Incorrect installation of car seats can jeopardize the safe transport of a child in a motor vehicle. Most parents believe that they are putting their children in car seats correctly and installing the car seats in the right way; however, NHTSA research has shown that 7 of 10 children are actually improperly restrained.[176] Typical mistakes include using the wrong harness slot, improper harness retainer/chest clip position, loose car seat installation, loose harness strap, and improper seat belt placement.[133] The confusion is understandable because there are different installation instructions for every vehicle and car seat.

Intervention for Child Passengers

Parents may need help in selecting and installing a car seat that is appropriate for their child's needs. The NHTSA's Parent Central website (*http://www.safercar.gov/parents/index.htm*) offers information about various car seat types, in addition to tools for finding an appropriate seat based on the child's age and size. The site allows parents to register the car seat so that they can be notified if there is a safety recall.[139] OTs can also refer families to a SeatCheck program for assistance in installing the car seat. SeatCheck is a national campaign to promote proper securement of children in motor vehicles. The program's website (*http://www.seatcheck.org*) and toll-free number (1-866-SEAT-CHECK) list inspection stations where trained and certified child safety technicians provide a free installation check. The website also contains tips and tools for keeping children safe in a motor vehicle, a listing of safety seat manufacturers, and a seat recall list.

OTs may want to take a more active role in child safety seat inspection by providing this service themselves. Safe Kids Worldwide, a global organization dedicated to preventing injuries in children, offers a Child Passenger Safety Technician certification course that provides specialized training in this area.[166] The certification course combines classroom instruction, hands-on activities, and skills assessments with car seats and vehicles. It concludes with a checkup event in which new technicians teach caregivers how to properly install and use car seats and booster seats.

Safe transport of infants and children with medical needs or disabilities is another area of practice that should not be overlooked. Car seats should not be modified unless the person performing the modification is certified to do so. Inappropriate car seat adaptations recommended or made with good intentions can have life-threatening implications.[40]

Assessment for children and teenagers must take into account future physical growth. For example, a 6-year-old riding in a van seated in a wheelchair may no longer fit in the vehicle by age 15 because of increased height. Also, activity demands associated with caregiving will be greater for a 15-year-old than for a 6-year-old. Alternate mechanical or power lifts or adaptations may become necessary for children or adults when their body size becomes unmanageable (and therefore unsafe) for their caregiver. Growth and development and aging affect the choice of equipment that will meet the individual's needs at a given age.

Pedestrians and Cyclists

General Considerations for Pedestrians

Regardless of transportation preferences, the vast majority of Americans will be pedestrians at some point, either by walking or using a wheelchair or other mobility device. Although walking is an important means for getting around and has health, environmental, and economic benefits, it also involves risk. In 2012 alone, traffic crashes in the United States resulted in 4743 pedestrian deaths and 76,000 injuries.[135]Awareness of the factors that cause risk for various age groups is necessary in order to plan effective OT interventions that allow clients to fully realize the benefits of walking.

Older adults are one of the population groups most at risk for pedestrian injury. Decreased visual acuity, reduced reaction time, and slower walking speed contribute to the risk.[214] Nonfatal injuries from walking due to falls, especially while attempting to navigate curbs, are common.[56] Due to their greater physical frailty, older adult pedestrians are less likely to survive a collision with a motorized vehicle than are younger pedestrians.

Children are also at significant risk for injury when walking. In 2012, 1 of 5 children killed in a car crash was a pedestrian.[56] Young children may not have fully developed judgment of speed and distance or use of peripheral vision, which can make crossing the street by themselves unsafe. Safety experts suggest that children age 10 or younger should not cross the street without an accompanying adult.[167] A child's experiential basis for judging traffic situations is small. Emotions such as excitement may overwhelm their regard for safety. Older children have a more mature sensory processing system, but the brain areas that deal with the ability to control impulses and weigh the long-term consequences of actions may not be fully mature.[172]

Adolescents and young adults become increasingly mobile as they strive to gain independence. Teens have both the highest death rate and the highest nonfatal pedestrian injury rate of any group of children.[164] The problem appears to be connected to distractions brought about by listening to music, texting, and talking on cell phones.[164] Walking while intoxicated is connected to very significant risk because of impaired judgment and diminished appreciation of hazards. More than one-third of the pedestrians killed in crashes were intoxicated.[136]

Intervention for Pedestrian Safety

Mitigation of walking risk begins with pedestrian education. Some basic rules apply to all pedestrians and are fundamental to walking safety. These include walking on the sidewalk or facing traffic when there is no crosswalk, and crossing at intersections whenever possible, looking left, right, and left when doing so. Additional recommendations are to increase visibility by wearing light-colored or reflective clothing, avoiding alcohol and distractions such as cell phones and headsets, and carrying identification.

The NHTSA and the Federal Highway Administration (FHWA) have developed a one-stop shop website (*http://www.nhtsa.gov/pedestrians*) with tips and resources for pedestrian safety that can be incorporated into OT interventions for people at various ages and developmental levels. The site includes links to the NHTSA's *Child Pedestrian Safety Curriculum* for students in kindergarten through the 5th grade and to the *Pedestrian Safety Workshop: A Focus on Older Adults*. There are additional links to the FHWA's *Pedestrian Safer Journey* series of videos about walking safety for children ages 5 to 18, checklists for conducting environmental audits, educational materials to teach parents about walking safety, and guides for community pedestrian safety advocates.

Individual assessment of skills to determine a person's potential to move about safely and independently as a pedestrian should be conducted. Impairments in vision, cognition, and motor skills caused by medical conditions and aging can potentially affect walking speed and endurance, management of uneven terrain, stepping up and down curbs, way finding, accurately estimating the time for street crossing, and recognizing and reacting appropriately to hazards. If assessments show that walking independently would be unsafe, OTs have an obligation to advise the client and his or her family of the risks involved.

When pedestrian skill acquisition or remediation appears feasible, skills should be practiced within a natural context as much as possible.[14] Real-life settings are valuable for reviewing the basic rules of safe walking, showing clients how to effectively use vision to scan for traffic hazards, and for practice in managing mobility devices outdoors. However, in the majority of clinical settings there are many opportunities to improve pedestrian skills. For instance, OTs can take part in selecting a mobility device that matches a client's functional abilities while keeping in mind the areas where the person will be walking. Tasks such as reading a map and selecting an ideal route to a destination do not have to occur on the streets to be practiced. The clinic can also be an ideal setting for educating families with children about pedestrian risks and helping parents develop strategies for modeling safe pedestrian behaviors.

According to the Centers for Disease Control and Prevention (CDC), many Americans view walking and biking in their communities as unsafe due to the presence of environmental barriers and absence of sidewalks, crosswalks, and bicycle paths.[54] Crashes between pedestrians and motor vehicles commonly involve people attempting to navigate environments designed primarily for use by cars.[216] In contrast, "walkable" communities are those in which it is easy and safe to walk to goods and services. They encourage pedestrian activities, expand options for transportation, and have safe streets that serve people with different ranges of mobility.[169] OTs can be involved in bringing about change to improve the walkability of a neighborhood; however, intervention in this area requires a change in focus from serving individuals to serving communities. The FHWA's *A Resident's Guide for Creating Safe and Walkable Communities*[169] is a useful resource for practitioners interested in influencing neighborhood walkability. In addition to providing a section on assessing environmental problem areas, the guide discusses ways to take action, the various government agencies responsible for maintaining roads and the engineering improvements and law enforcement strategies needed to lower pedestrian risk.[169]

Safe Routes to School (SRTS) is a national and international movement to create safe, convenient, and fun opportunities for children to bicycle and walk to and from schools through its "Walking School Bus" and "Bike Train" programs.[124,168] The website for this organization offers free tools and resources for establishing SRTS programs and ideas for integrating SRTS considerations into community planning.[128] SRTS allows OTs to address issues of childhood obesity with individual pediatric clients, and it also offers a platform for OTs to serve the community by providing input for the design of roadways, bike lanes, and pedestrian paths that foster mobility for people of various ages and abilities using multiple forms of transportation.

General Considerations for Cyclists

Bicycling can be a means of exercise, recreation, conducting personal errands, or commuting to work or school. According to the National Survey of Pedestrian and Bicyclist Attitudes and Behaviors, 18% of the population age 16 or older rode a bicycle at least once during the summer of 2012.[150] Like walking, bicycling has many health benefits. Yet bicycling is not without risk. In the United States, bicyclists are at greater risk for injury and fatality from crashes than occupants of motor vehicles, even though bicycle trips represent only a small portion of all trips taken.[55] Most bicycling deaths occur at night and in urban areas.[137] In 2010 roughly half of the cyclists killed or injured in the United States were children and adolescents under the age of 20. Annually 26,000 of the bicycle-related injuries to this age group have been traumatic brain injuries.[59] Alcohol use also appears to be a significant risk factor to safe bicycle riding. One in four bicycle riders killed in a crash had an illegal blood alcohol level.[137]

Bicycles are considered vehicles, and bicyclists are considered operators of vehicles in all 50 states.[137] Bicycle riders consequently have the same rights and are subject to the same rules as other motorists when they operate in traffic. There is no federal law requiring bicycle helmets; however, close to half of the states have state laws mandating that children wear helmets. Additionally, some areas have local ordinances related to helmet use.[43] The League of American Bicyclists, an organization dedicated to creating a more bicycle-friendly America, is an excellent resource for information about the rules of the road and bike riding laws in the various states.[189,190]

Intervention for Cycling Safety

Bicycling requires clients to simultaneously pedal, balance, look around, and make decisions about whether it is safe to proceed. OTs should determine whether a client has these skills prior to recommending bicycling. Interventions to improve subskills such as strength, ROM, coordination, and balance may be needed before bicycling can become a realistic goal.

Pedestrian activities in progressively complex traffic situations may be necessary to understand traffic patterns and practice safe decision prior to introducing biking. Knowledge of a client's physical and cognitive functioning allows OTs to provide guidance in selecting the contexts in which bicycling can safely occur. Not every person will be able to bike ride in all environments. Heavy city traffic conditions may be too fast moving for some people who can ride effectively in their familiar residential neighborhood. Off-road conditions may prove too physically challenging for some clients who can ride easily on paved roads.

Most clients will benefit from classes to ensure they can ride confidently, safely, and legally. The bicycle safety education classes shown to be the most effective in preventing crashes are those that involve lectures to teach rules and include several hours of supervised riding to practice their application in dynamic situations.[90] The League of American Cyclists offers online lessons with interactive components and videos, in addition to local education classes for all experience levels taught by certified instructors.[191] The FHWA's *Bicycle Safer Journey*, a series of three free educational videos for those ages 5 to 18, can be used to introduce safe bicycling skills or augment a comprehensive biking curriculum.[91] The NHTSA's *Bike Safe–Bike Smart*[125] and *Ride Smart–It's Time to Start* [138] videos use a peer-to-peer approach to teach bicycle safety to children from elementary to high school. A safety video targeting adult bicycle riders is also available on the NHTSA website.

Use of appropriate bicycling equipment should be encouraged. Knowledge of the client's functional abilities is valuable for selecting an appropriate bicycle. OTs should familiarize themselves with the many design options available for various abilities. These range from hand-pedaled bikes to recumbent bikes to adult tricycles. Bicycle helmet use during every ride should be encouraged for clients of all ages. These helmets are the single most effective safety device to reduce head injury and death from bicycle crashes.[165] An instructional video for correctly fitting a bicycle helmet is available from the NHTSA at the following website: *http://www.nhtsa.gov/bicycles*.

OTs can make a significant impact on reducing the number and extent of bicycling injuries by advocating to increase bicycle safety on a community level. Advocacy efforts in the community could focus on bringing about engineering changes to alter the infrastructure affecting the operation and movement of traffic and pedestrians or involve education to motivate behavioral change among various groups. Advocacy might also entail efforts to enforce laws and regulations or encouragement to promote bicycling in a community.[169]

Driving

Driving is cited again and again as the basis for personal independence, employment, and aging in place (Fig. 11.19).[14,51,129] A driver's license has deep social and cultural contexts; it serves as a rite of passage for the teenager and provides the adult with an ability to pursue employment and recreational opportunities. The social impact of an aging population (20% of the U.S. population will be 65 or older in 2030)[92] has brought the issues of maintaining independence and quality of life, especially as they pertain to driving, to the forefront of public attention.

FIG 11.19 This client was experiencing difficulties driving and at work because progression of her multiple sclerosis exceeded the activity demands of pushing a manual wheelchair. Driving from a power wheelchair and using an electronic gas-brake hand control decreased the activity demands on her upper extremities, enabling her to drive safely and work full time as a teacher.

Clinical Reasoning for Driving and Community Mobility Services

An OT's ethical responsibility to investigate a client's vulnerability in driving is no less than with any other IADL that is within the profession's scope of practice. Where a client desires to go and if he or she wants or needs to drive to get there should be determined when the client's occupational profile is established. Although it is understood that driving may not be a goal for some people, for others it will be an important way to get around, in which fitness to drive can be negatively impacted by disabilities or medical conditions.

An understanding of the implications of medical conditions and disease processes, the ability to analyze ADLs and IADLs, and knowledge of adaptive devices and occupation-based interventions make OTs uniquely qualified to provide driver rehabilitation. OTs already make up the overwhelming majority of professionals providing these services for the physically disabled population.[109] The ODI has poised the profession to respond proactively to meet the needs of the growing numbers of senior drivers. However, there is a shortage of OTs that specialize in driver rehabilitation, and the need to train additional practitioners in this practice area is tremendous.[2,14] To contain costs and expedite service delivery, OT generalists must be prepared to address driving-related needs within their level of expertise. This includes accurately identifying clients requiring comprehensive assessment by a specialist, appropriately timing referrals, and understanding the spectrum of services provided by driving programs.[71]

Observation of performance during ADLs and IADLs is a fundamental part of the OT generalist's evaluation process and provides valuable data about a client's skills. OTs routinely correlate observations such as paralysis, impulsivity, and visual neglect with the client's ability to function safely and independently in the home, but they may not realize that the IADL assessment can also provide information about abilities associated with driving (eg, scanning the environment, simultaneously timing and sequencing tasks, anticipating outcomes, and modifying actions in a changing environment). Research conducted by Dickerson et al.[71] demonstrated that experienced generalist OTs can use skilled observation of complex IADLs to identify older adults who are not at risk for driving unsafely, who must stop driving until their functional performance has improved, or who would benefit from comprehensive evaluation by a driver rehabilitation specialist. These researchers developed an algorithm based on the OTPF (Fig. 11.20) to illustrate the decision-making process necessary to determine how providers and services can be effectively involved in assessment, referral, and training.[71] The referral pathway demonstrated in the algorithm can be appropriately modified for specific practice settings and used with any population.[14]

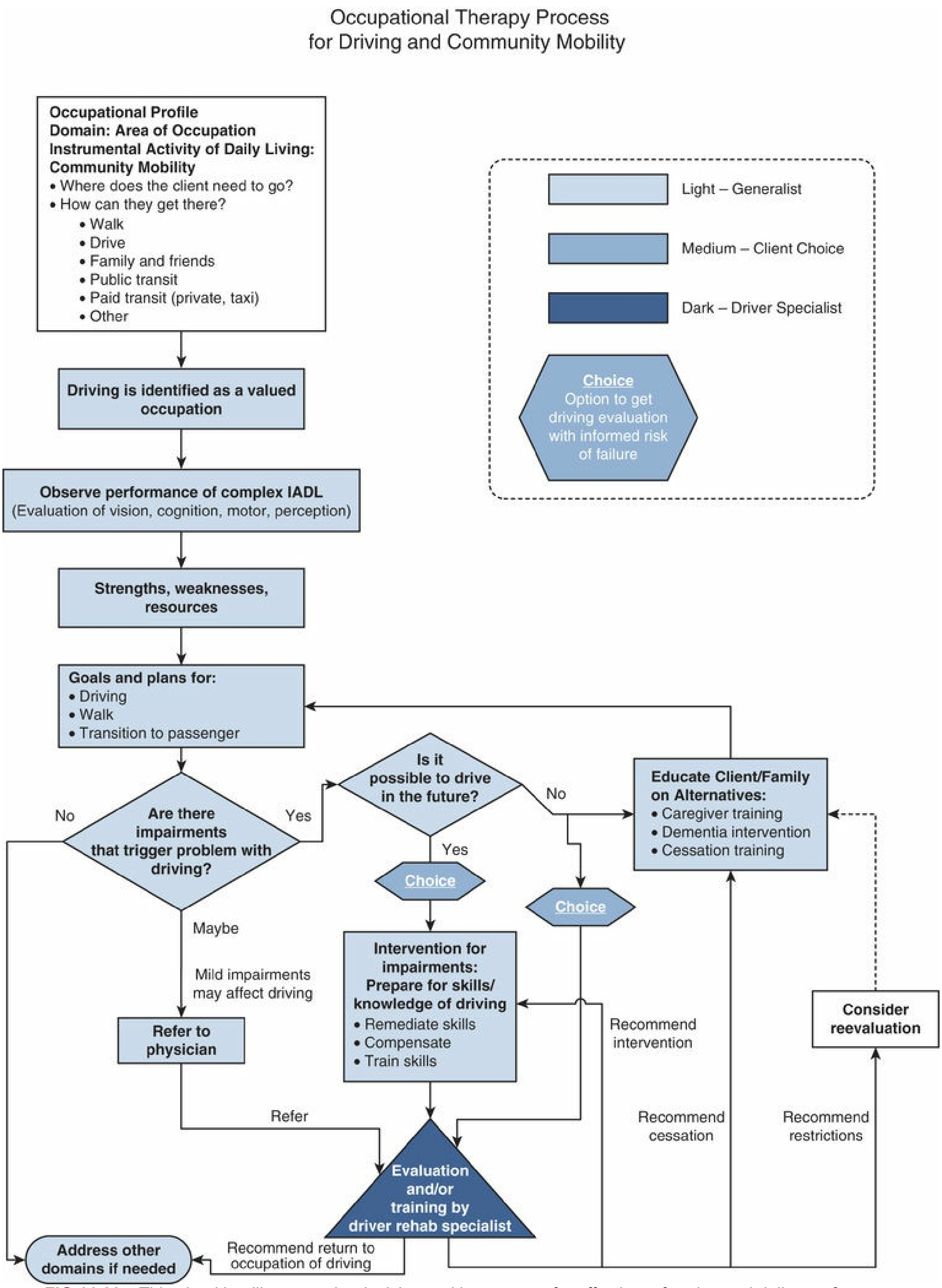

FIG 11.20 This algorithm illustrates the decision-making process for effective referral to and delivery of driving-related services. (From Dickerson AE, Reistetter T, Schold Davis E, Monahan M: Evaluating driving as a valued instrumental activity of daily living, *Am J Occup Ther* 65:64–75, 2011.)

Driving Evaluation Program Spectrum

Driver rehabilitation programs provide a wide range of services related to driving and community mobility for individuals with disabilities, medical conditions, or age-related changes. These programs offer driving skills assessment, education and training, and instruction in the use of driving adaptations and compensatory techniques. Identifying the program that is best for a particular person can be challenging for consumers and referral sources because of the variation in services. The ADED, in association with the AOTA/NHTSA Pathways Project, has developed a document to define the various program models. The *Spectrum of Driver Services/Spectrum of Driver Rehabilitation Program Services*, approved in 2013, describes three categories of driving program services: community-based education programs; medically based assessment, education, and referral programs; and specialized evaluation and training programs.[36]

Community-based education programs include driver safety programs having specific credentials (eg, AARP and AAA driver improvement programs) and driving schools. Driver safety programs offer classroom or computer-based refresher courses for licensed drivers. Driving schools employ licensed driving instructors to teach, train, and refresh driving skills for novice or relocated drivers. These schools focus on well individuals rather than people who have medical or age-related conditions that might interfere with driving. Driving schools typically provide services to enhance driving skills and to assist in acquisition of a driver's license or permit.[36]

Medically based assessment, education, and referral programs offer driver screens and clinical IADL evaluations. Programs offering driver screening are typically staffed by healthcare professionals (eg, physicians, social workers, or neuropsychologists) with knowledge of medical conditions, assessment tools, and intervention processes. They understand the limits and value of the assessment tools used as a measure of fitness to drive and are able to counsel consumers regarding the risks associated with medical conditions and make referrals when indicated.[36]

Programs offering clinical IADL evaluations employ OT practitioners (either a generalist or a driver rehabilitation specialist) or another healthcare professional with expertise in IADLs who has knowledge of medical conditions and their implications for community mobility, including driving. Clinical IADL evaluators interpret risks associated with changes in vision, cognition, or sensory motor functions caused by acute or chronic conditions; they also facilitate remediation of deficits, develop individualized transportation plans, and discuss resources for vehicle adaptations. They refer to driver rehabilitation specialists when appropriate, discuss driving cessation, and follow professional ethics on referrals to other resources or to the driver licensing authority.[36]

Specialized evaluation and training programs administer comprehensive driving evaluations that include clinical and on-road components to establish fitness to drive. These programs provide rehabilitative services specific to driving. There are three levels of this type of program, distinguished by the complexity of evaluations, types of equipment used, and expertise of the provider. Basic programs offer comprehensive driving evaluations and training for individuals who can independently transfer and drive using standard primary driving controls (eg, a standard steering wheel and standard gas and brake pedals). Low-tech programs offer comprehensive evaluation and training services with or without the use of adaptive equipment. At this level of service, the adaptations for primary control are typically mechanical (eg, a mechanical gas/brake hand control, pedal extensions, and left foot accelerator). Wireless or remote access to secondary controls (eg, turn signal, horn) may be used.[36]

High-tech driver rehabilitation programs offer all the services available through basic and low-tech programs; however, they also have high-tech equipment for primary control (eg, powered hand controls, remote steering, and joystick driving controls) and devices such as powered transmission shifters, remote panels, and switch arrays for secondary control. They have the ability to address the needs of drivers able to transfer to an unmodified vehicle seat; those who require a transfer seat base to facilitate a transfer; and those who cannot transfer and must drive while seated in a wheelchair. Service providers in this category are able to recommend vehicle structural modifications (eg, ramps or lifts) that allow people in wheelchairs access to the vehicle's interior and to the driving position.[111]

Jacqueline's OT generalist noticed that she demonstrated some difficulties with motor skills when performing kitchen tasks. Because Jacqueline planned to continue to drive as her primary way of getting around, the therapist was concerned that she might have problems gripping the steering wheel, turning her head to check traffic, and applying the brakes quickly. The OT designed a home exercise program to address these areas of limitation and recommended that Jacqueline undergo a comprehensive driving evaluation by a driving rehabilitation specialist.

Ethical Considerations

Therapists in this practice area must be able to withstand significant pressure in their decision making. A novice driver with significant cognitive and perceptual impairments, for example, may press to curtail the assessment process prematurely because of time and financial considerations. Pressure to sway the therapist's opinion before completion of an assessment may come from biased third-party payers; even family members may strongly attempt to influence the outcomes of the assessment in a direction that is not supported by performance observations.

Best Practice Standards for Driving Programs

Practice guidelines for driving and community mobility for older adults, which use an evidence-based perspective and concepts from the *Occupational Therapy Practice Framework: Domain and Process (2nd ed.),* have been developed by AOTA. The guidelines emphasize the expertise of OTs in understanding the occupations of driving and community. They are helpful for OT practitioners, program developers, administrators, legislators, third-party payers, educators, and others to understand the contribution of OT in serving the needs of the older adult population.[183] Although developed for older adults, the process they describe can be appropriately used in various practice settings with people across the lifespan.

Best Practices for the Delivery of Driver Rehabilitation Specialists was initially published by the ADED in 2004 and was updated in 2009. The document is intended for any individual providing rehabilitation services to persons with various disabilities or age-related impairments that impact driving. It is not specific to OTs. Guidelines for assessment, BTW training, and intervention are discussed, as are the recommended procedures for documentation, completion of a prescription for equipment, and conducting a final fitting.[31]

Clinical Assessments in Driving

The level of assessment related to driving will depend on the OT practitioner's expertise, the availability of assessments in his or her practice setting, and time constraints. An initial assessment of the skills that impair driving can be accomplished as part of an observation of the quality of complex IADL performance.[71] Generalists may also administer screenings of visual, motor, and cognitive function to determine the need for additional evaluation and intervention.[69] In-depth clinical evaluation of the client's driving skills and a BTW assessment are conducted by the specialist.[13] A systematic review of the research on screening and assessment tools used to determine fitness to drive revealed that while some measures were better able to discriminate the skills and abilities necessary for driving, no measure by itself was sufficient to predict fitness to drive. Currently specialists tend to use the same assessment tools with all clients instead of selecting measures for specific diagnoses.[68] The systematic review supported using specifically selected tools in combination for specific diagnoses.[70]

Ethical Considerations

Principle C-46 of the ADED's Code of Ethics states that, “Driver rehabilitation specialists use only assessment techniques that they are qualified and competent to use. They do not misuse assessment results or interpretations.”

Occupational Profile and Client-Centered Goals

A review of the available medical records and a client interview are necessary to establish an occupational profile that identifies the importance of driving and the contexts and environments in which it is performed.

The medical record will contain valuable information related to driving abilities, including whether a client's medical condition is acute, chronic, or progressive; the amount of medication taken; the presence of symptoms (eg, pain and fatigue); and the client's communication status. Clients should be asked about driving frequency; whether they drive with passengers; whether they have experienced driving problems, such as seeing clearly, turning the steering wheel, confusing the pedals, getting lost, getting tickets, or having near misses; and whether family members or friends have expressed concern about their driving ability.[102] License status and the availability of a suitable vehicle should also be established. Without this information it is very difficult to project the client's future needs for driver rehabilitation, adaptive driving equipment, or a modified vehicle.

The information-gathering process should focus on establishing what the client's goals for driving are. Is the goal to be able to conduct errands and get to medical appointments? Does the client want to be able to commute to work? Does he or she want to drive on surface streets or freeways or both? A client-centered focus is necessary to understand the client's perspective, guide assessment, and help therapists plan interventions that are contextually appropriate. The *Canadian Occupational Performance Measure* can be used to help clients identify and prioritize goals important to them and to make decisions about their care.[103] If driving is not an option at the time, addressing alternate transportation needs would be more appropriate.

Jacqueline was concerned that she was the primary driver for her husband and lacked a backup transportation plan. Based on her identified priority, the immediate intervention was for the therapist to provide information about alternative transportation options using public transportation.

Analysis of Occupational Performance

An analysis of occupational performance is conducted after the occupational profile has been established. The purpose is to more specifically identify the client's assets or problems related to driving through observation, measurement, and enquiry about supporting and limiting factors. OT generalists are not able to directly observe a client's performance behind the wheel, but they can make inferences about driving performance based on how well the client does on other complex IADLs. Emerging evidence suggests that the *Assessment of Motor and Process Skills,*[94] a standardized assessment to observe IADL performance, can be used to successfully predict whether a client will be able to pass or fail a BTW assessment or would require restrictions for driving.[71]

There are many assessments available for evaluating the contexts, environments, and client factors that influence performance skills and patterns in driving. Some of these are screenings that can be appropriately used by a generalist; others are more complex tests that are more appropriate for use by the specialist. The reader is referred to *Driving and Community Mobility: Occupational Therapy Strategies Across the Lifespan*[14] for an extensive list of various tests. This section describes a few assessments that are commonly used or are recognized for their usefulness in predicting fitness to drive.

Professionally Administered Driver Safety Screens

Driver safety screens allow OTs to obtain data about a client and identify areas of concern for additional evaluation and intervention. Generalists can use results from driver safety screenings to supplement observations of risk obtained during IADL performance and as evidence to justify the need for a BTW assessment by a specialist. The Assessment of Driving Related Skills (ADReS)[51] is a screening test battery, developed by the AMA with support from the NHTSA, to assist physicians in preventing motor vehicle crashes in older adults. It screens aspects of vision, cognition, and motor function, three areas that have been identified as necessary for safe driving. The ADReS does not predict crash risk, although some of its components have documented associations with crash risk.[102] A limitation of this test is its poor sensitivity because it tends to recommend intervention even for people who do not demonstrate a lack of fitness to drive.[122] The test is available in the Physician's Guide to Assessing and Counseling Older Drivers, which can be accessed at no cost on the NHTSA website.

The DrivingHealth Inventory is a software screening program based on research sponsored by the NHTSA and the National Institute on Aging.[192] It contains eight measures (high- and low-contrast visual acuity, leg strength and stamina, head/neck flexibility, route planning, short-term and working memory, visualization of missing information, visual search with divided attention, and visual information processing speed) that have been validated against at-fault crashes. The test procedures are standardized and provide a rating of no deficit, mild deficit, or serious deficit in the tested abilities. The software can be ordered at a cost at *www.drivinghealth.com*.

Self or Family/Caregiver–Administered Driver Screens

Some screening measures are intended for client self-administration outside of a clinical setting to increase self-awareness about fitness to drive. These measures may be less threatening for some clients than other types of assessments, but they may not be suitable for cognitively impaired persons who lack insight.[85] These types of tests may also have value when completed in conjunction with an OT for the purpose of gathering data to plan an intervention program or identify individuals who would benefit from comprehensive assessment. The AAA's Roadwise Review is based on the DrivingHealth Inventory.[61] Feedback about the level of impairment on each of the eight test items is given, and advice is provided for improving performance in each area. The test is available for free online at *www.SeniorDriving.AAA.com* and *www.aaafoundation.org* or as a CD ROM from regional AAA offices.

SAFER Driving: The Enhanced Driving Decisions Workbook is an online workbook to help clients consider health concerns that could affect safe driving. The instrument content has been validated and provides individualized feedback on potential driving problems and strategies to continue safe driving. Three health concern areas (seeing, thinking, and getting around) based on symptoms experienced from medical conditions, medications, and the general aging process that affect fitness to drive are addressed.[85] This self-assessment is free and can be completed online at *www.um-saferdriving.org/firstPage.php*.

The Fitness-to-Drive Screening Measure is a Web-based tool designed for caregivers and/or family members of older drivers and OTs to identify at-risk older drivers. Caregivers and family members who have driven with the driver in the past 3 months rate the driver's difficulties with 54 driving skills. A rating profile classifying the driver into at-risk, routine, or accomplished driver categories is generated, and recommendations based on the category are provided.[202] The recommendations can be used to begin a conversation about fitness to drive and to identify the need for referrals to other professionals for further intervention.

Tests Related to Specific Client Factors

OT driver rehabilitation specialists routinely administer tests, either individually or as part of a battery, to examine specific body functions (vision, visual perception, cognition, and motor and sensory functions)[68] with the potential to affect driving performance. Generalists may administer these tests during an overall evaluation of a client's occupational performance. The tests would supplement observations of driving risk gleaned from observations of IADL performance. Screening results would inform decisions for improving function in a specific area, to establish a basis for advising clients of the need for driving cessation, and to provide evidence of the need to refer to a specialist for a comprehensive driving evaluation.

Vision (Acuity, Eye-Motor Skills, Visual Fields, and Contrast Sensitivity)

Vision provides most of the sensory input related to driving.[177] Not surprisingly, uncorrectable vision deficits are a leading cause of driving cessation.[106] Visual conditions that are red flags for driving problems include cataracts, glaucoma, macular degeneration, diabetic retinopathy, diplopia, and strabismus. Specialists may have access to an instrument such as the Optec Functional Vision Analyzer[185] to test skills such as visual acuity, depth perception, color perception and recognition, phorias, and eye teaming. However, there are many tests that can be performed by either generalists or specialists with minimal equipment or by using mobile phone or tablet apps. Clients should be referred to a vision care practitioner to maximize visual skills before a referral to a driver rehabilitation specialist is initiated.[45] Vision care specialist interventions, such as a corrective lens prescription, prisms, and eye occlusion or surgery, can have a significant impact on safe driving potential. Because standards for licensing vary among the various states, OTs should be aware of the requirements in their particular area to appropriately educate clients. The AAA Foundation for Traffic Safety maintains a database of driver licensing policies and practices, which includes a state-by-state listing of vision requirements for driver licensing. The information can be accessed at *http://lpp.seniordrivers.org/lpp/index.cfm?selection=visionreqs*.[1]

Visual acuity, typically tested using a Snellen wall chart, is the most widely tested skill among driver licensing agencies. Acuity can impact the ability to read signage if it is worse than 20/30,[146] but it does not appear to be related to crash risk unless it is worse than 20/70.[51] Most state driver licensing agencies have established a far acuity standard of 20/40 with both eyes for initial licensing and for some renewals. Clients with acuity worse than 20/40 should be referred to a vision care specialist for further assessment.

Screening of ocular ROM and ocular alignment (pursuits, saccades, phorias, and tropias) is also valuable because these functions can impact the ability to efficiently scan the road for hazards. Visual field testing provides information about the range of the traffic environment a person is able to see. Peripheral vision is particularly important for detecting cues such as a signal light blinking on a car in the next lane. Visual field deficits have been linked to crash risk, but there is currently no conclusive evidence about the field range that is adequate for driving.[51] Eye movements can serve as a compensatory strategy to increase the amount of the visual environment that can be seen.[146]

However, the difficulty of accomplishing this successfully is increased in a fast-paced driving environment. There is evidence that educational programs improve awareness of visual deficits in people with low vision; however, they do not appear to result in lowered crash risk.[106] Training of visual skill deficits in a protected environment using a driving simulator may be appropriate prior to initiating an actual driving assessment.[106]

Contrast sensitivity, the perception of contrast between visual stimuli,[51] is an important visual function that is not currently used as a measure for driver licensing. It has been found to be a valid predictor of crash risk among older drivers.[75] Testing is accomplished using a Pelli Robson Contrast Sensitivity Chart,[154] which presents lines of letters with progressively less contrast relative to the chart's background color. Deficits in this function are common in cataracts and glaucoma. The specialist should be careful to identify the lighting conditions under which a client will drive because low-light conditions such as fog, dawn, and dusk exacerbate deficits in contrast sensitivity.

Visual Perception

Although visual skills, visual perceptual processing skills, and cognition are typically evaluated individually, in the dynamic and complex driving context, they work synergistically and must be used quickly. The Motor-Free Visual Perception Test is a widely used standardized test that measures various aspects of perception without requiring a motor response. The most recent version includes norms for ages 4 to 80 years.[49] Research results linking it (or its subcomponent of visual closure) to fitness to drive have been inconsistent, with some showing a link and others no relationship.[18] In relation to driving, visual closure, which is the ability to complete a figure when only fragments are presented, might be needed for tasks such as anticipating where lane markers would continue when they are divided by an intersection or for recognizing a stop sign that is partially occluded by a branch.

The Clock Drawing Test is widely used with geriatric populations to discriminate healthy individuals from those who have dementia.[51] There are several versions and various procedures for scoring it.[121] In the Freund Clock Drawing form that is used in the ADReS, the person is asked to draw a clock on a blank sheet of paper with the numbers and hands arranged to read 10 minutes after eleven. Scoring is based on correct completion of seven different elements, not time for completion.[51] This seemingly simple measure involves visual spatial skills, language, selective attention, long- and short-term memory, abstract thinking, and executive functioning. Its visual spatial demands appear to be significant in identifying fitness to drive, given that visual spatial skills have the highest level of prediction in the driving performance of older adults.[158]

Cognition (Attention, Processing Speed, Memory, and Executive Function)

A significant part of what is required to drive safely occurs "between the ears." Cognitive factors in driving include the ability to focus and sustain attention on single and multiple stimuli, the speed with which traffic information is perceived, and all aspects of memory. There is clear evidence that higher order cognition involving executive functioning is critical to safe BTW performance.[18] There are many tests of executive function with varying levels of ability to predict safe driving. The strongest predictive evidence for fitness to drive derives from the UFOV (useful field of view) test and the Trail Making Tests (TMTs), which are discussed in this section.

The useful field of view can be conceptualized as the spatial area from which a person can quickly extract visual information without head or eye movement.[204] It requires identification and localization of targets, and it is not the same as the visual sensory field.[65] Age-related speed of processing deficits can cause the area to decline and its size can be reduced by poor vision and difficulty in dividing attention and ignoring distraction (Fig. 11.21).[86] Driving places particular demands on processing speed and selective and divided attention. For instance, quick processing speed is necessary for a driver to recognize when a child's ball has rolled into the street. Selective attention is needed to attend to urgent stimuli (the person in the crosswalk) without being distracted by unimportant ones (eg, the puppy running on the sidewalk). Divided attention is required to focus on the multiple relevant stimuli that are encountered in a complex driving environment (eg, viewing traffic to the front and sides of the vehicle when changing lanes).[51] The UFOV test is a computerized measure of visual processing speed, divided attention, and selective attention. Test takers are assigned to five crash risk categories based on results from the assessment. The test has been widely used in research related to crash risk in older drivers. There is moderate evidence that it correlates with crash outcomes and fitness to drive.[18] Although the UFOV test is becoming more widely used, it is still not widely used by driver rehabilitation specialists[68] and may not be a test that is widely available to a generalist.

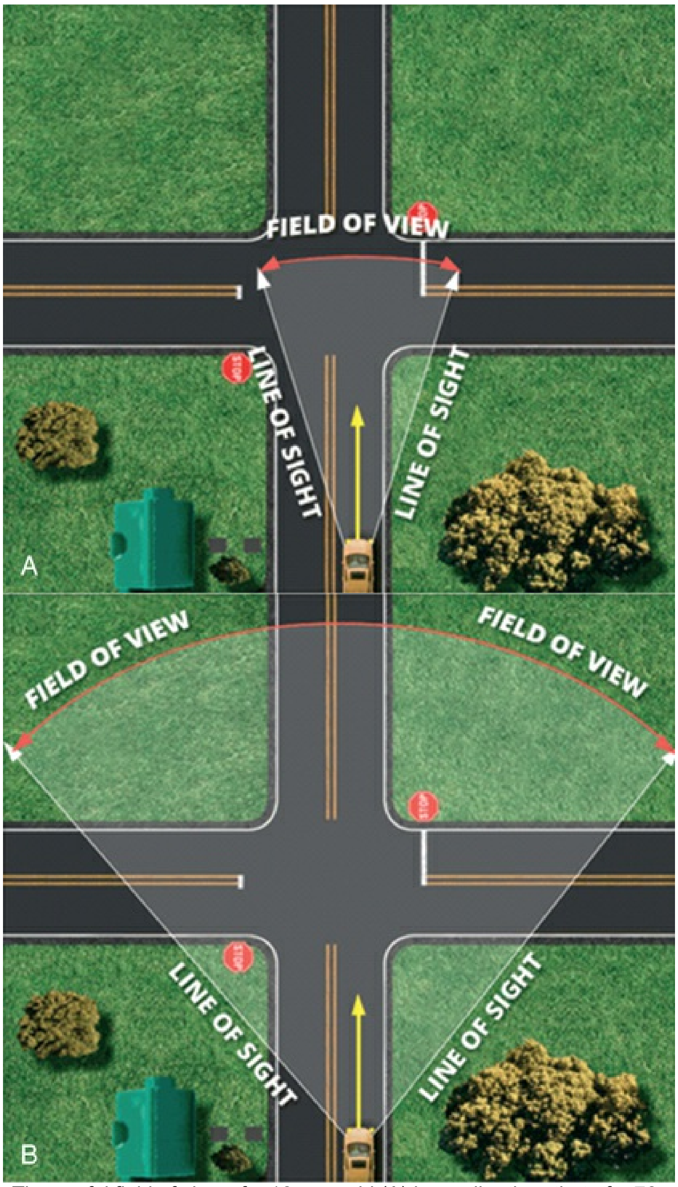

FIG 11.21 The useful field of view of a 16-year-old (A) is smaller than that of a 76-year-old (B). Reduction of the useful field of view can prevent the individual from seeing things that are a safety risk to driving. (Courtesy American Automobile Association, Heathrow, FL.)

The TMTs Parts A and B are paper-and-pencil assessments of overall cognitive function measuring selective and divided attention, mental flexibility, visual scanning, sequencing, and visual memory.[61] Part A involves connecting scattered numbers in order, and Part B requires alternately connecting numbers and letters. Poor performance on Part B has been significantly correlated with poor driving performance.[61] Part B is one of the components of the ADReS and is scored by the time needed to correctly connect the letters and numbers. A time for completion of greater than 3 minutes signals a need for intervention.[51]

There are a number of assessments borrowed from the field of neuropsychology that test memory, orientation, attention, calculation, recall, language, and visual-spatial perception. These include the various versions of the Mini-Mental State Examination, the Short Blessed Test, and the Montreal Cognitive Assessment. Lower scores on these assessments are associated with poor driving performance and warrant referral to a specialist.[14,61]

Motor Skills (Strength, Range of Motion, Sensation, and Balance)

Strength, ROM, sensation, and balance are important to many driving-related tasks. Paralysis, incoordination, tremors, amputations, limitations in static and dynamic balance, fatigue, and slowing of reaction time can impact performance of driving tasks such as loading and unloading a mobility device, entering and exiting a vehicle, turning a key in an ignition, and operating the primary and secondary controls. Both generalist and specialist OTs are trained in evaluation of client factors such as strength, ROM, and sensation using well-established testing protocols. The OT generalist can use clinical reasoning and task analysis to anticipate the impact of identified limitations on driving. For example, when a client demonstrates restriction in cervical ROM, it can be anticipated that there may be difficulty turning the head to see blind spots or check cross traffic. When deficits are identified, the generalist should determine whether it is possible to remediate skills, either through OT intervention or through treatment by professionals such as physical therapists.

The specialist will have an in-depth understanding of how motor skills relate to driving. The assessment information will be used by the specialist to determine when it is appropriate to use adaptations and vehicle modifications to compensate for deficits. Technological advances have made it possible to compensate for motor deficits in many instances. Matching client abilities with vehicle characteristics and equipment features, particularly when high-tech equipment is required, is critical to driving safety and is the purview of the specialist.

In terms of usefulness for predicting driving safety, some research has demonstrated a link between the Rapid Pace Walk (RPW) test and fitness to drive.[18,51] In this test clients are asked to walk 10 feet, turn around, and return to the starting point as fast as possible, using a mobility device if necessary. The RPW test, which is another component of the ADReS, measures lower extremity mobility, trunk stability, and balance. The Toe Tap Test simulates the lower extremity mobility for alternately pressing gas and brake pedals with a foot. To observe for deficits in proprioception, the test can be performed with the eyes closed. Scores have not been shown to be predictive of at-fault crashes in older drivers, but the test has face validity as a measure of one's ability to move the leg/foot quickly from the accelerator to the brake.[181] Diminished cervical ROM is another motor ability that some studies have linked to increased risk of a motor vehicle crash.[61] Brake reaction time is typically measured as the time of the stimulus to the time the brake pedal is depressed. It decreases with age[14] and is affected by surprise, urgency, and critical situations.[101] Although shown not to be predictive of crashes,[18] brake reaction time does have face validity and may be an effective tool for observing psychomotor performance.[14]

Driving Simulators

Interactive driving simulators use computer-based technology that provides virtual scenarios of driving situations. Ranging in cost and size, they enable assessment in a safe environment coupled with the ability to change the scenarios to reflect various traffic situations, daytime or nighttime driving, and weather (eg, sunshine, rain, fog). Driving simulators can provide an effective way to initiate a stationary assessment and to train a client in driving skills in controlled situations. Additionally, the conditions for testing can be replicated for data comparison. For these reasons, simulators' popularity is increasing among OTs working in hospital settings. Yet the question of whether they can predict driving behavior in real-life situations remains. These devices may not represent the reality of driving accurately because they do not drive like an actual car, and the depictions of driving situations may not be perceived as realistic. Currently there is a limited amount of evidence that driving simulators can be used to determine driving fitness.[18] One of their biggest limitations is simulator sickness. The problem is similar to motion sickness and is sometimes experienced when the ocular, motor, and kinesthetic systems receive sensory messages of movement in the absence of true motion.[14] Client factors such as being female and being over age 70 appear to contribute to simulator sickness.[14]

In-Vehicle Assessments

Stationary Assessment

Before the on-road assessment is initiated, the specialist typically performs a number of evaluation steps with the vehicle parked. At the most basic level, the evaluation involves a check of the driver-vehicle fit. Decisions about whether the client is sitting at an appropriate height to optimally look out the front window; his or her position relative to the steering, gas, and brake pedals; and the person's ability to reach these controls easily must be made. Additional skills that require assessment are opening and closing the door, getting into and out of the vehicle, adjusting the seat, securing the seat belt, adjusting the mirrors, turning the key in the ignition, and reaching and operating all the secondary driving controls (eg, horn, headlight switches, turn signals, windshield wipers). Generalist OTs can be involved in evaluating the driver-vehicle fit of older adults through participation in a CarFit event (Fig. 11.22).[9] All OT practitioners should be familiar with the guidelines for driver-vehicle fit established by this program.[14] Videos demonstrating the 12-point assessment used to determine the vehicle-driver fit are available on the program's website (*http://www.car-fit.org/*).

FIG 11.22 Participation in CarFit events provides the OT generalist with experience in evaluating the fit between an older adult and his or her vehicle.

After familiarizing the client with the evaluation vehicle, the next step is to start the engine and assess performance skills for turning the steering wheel and applying appropriate pressure to the gas and brake pedals. When the specialist encounters a client who requires either low-tech or high-tech driving equipment, the stationary assessment includes additional steps. The adaptive equipment is chosen based on the client's needs, but in order to minimize cost, it is important to start with the lowest-tech option that is appropriate. When low- or high-tech equipment is involved, the stationary assessment serves to verify whether the proposed equipment is the correct option or whether another option needs to be tried. At various points in this phase the client will move into the driver's seat and the engine will be turned on to assess the driver-vehicle fit and the performance skills in steering, acceleration, and braking. This process continues until the correct equipment configuration is identified. If the on-road component of the evaluation reveals that the demands of the driving activity exceed the client's performance skills, the stationary process is repeated using the next level of equipment. This trial-and-error approach is an expected and necessary step when assistive driving technology is being considered.[39]

Seating and Positioning

Primary controls are used to operate the vehicle while it is moving. The term refers to the steering, gas, and brakes. Seating and positioning issues can impact effective use of the primary controls and must be carefully assessed to ensure safety. A driver must be seated in a favorable position in front of the steering wheel so that optimal mechanical advantage is realized. When poor trunk control is present, an upper torso support or chest strap may be needed to prevent falling or leaning to the side during braking and turning. The proximal stability provided by the torso support will enhance control of the extremities, which will in turn facilitate operation of the primary controls. Seating and positioning as they relate to maintaining a functional field of view for the driver must also be considered. The sitting position goal is for the line of sight to be 3 inches above the steering wheel, whether the person is seated in the vehicle seat or a wheelchair.[14]

Steering

Either the upper or lower extremities can be appropriately used for steering. When the feet are used, a specialized wheel is mounted on the floor of the vehicle (Fig. 11.23). With either the upper or lower extremities, steering competence is demonstrated by having the client slowly turn the steering wheel to the lock position in both directions without exhibiting undue effort or pain. Rapid turning can cover substitution patterns or decreased strength and does not address performance skills adequately or allow motor performance to be analyzed.

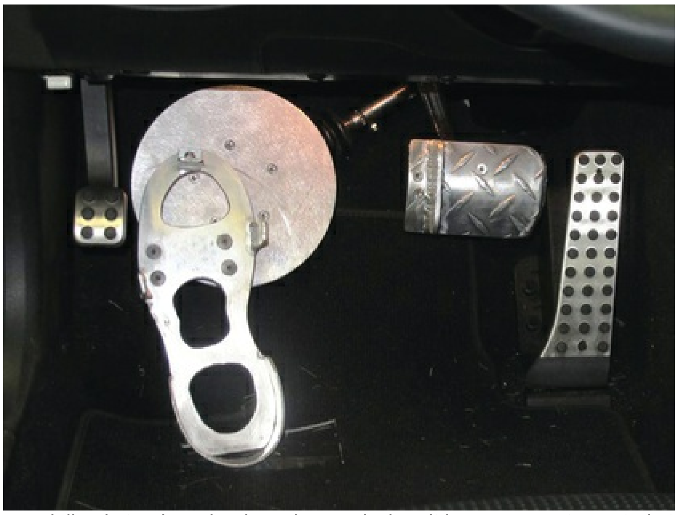

FIG 11.23 A specialized steering wheel can be used when it is necessary to control steering using a foot. (Courtesy Drive-Master, Fairfield, NJ.)

The stronger arm is typically used for steering when a driver cannot use both arms for the task. A steering device attached to the steering wheel is often recommended to improve one-handed control, especially during sharp, fast turns and evasive maneuvers. Adaptive steering devices, such as a spinner knob, **V**-grip, tri-pin, palmar cuff, or amputee ring, can accommodate a variety of hand function abilities and improve the driver's control and speed when turning the wheel.[14] After the setup has been completed, the client's competence in steering must be verified through a dynamic on-road evaluation.

All steering systems include an element of resistance. Automotive manufacturers do not have universal standards for grading resistance. As a result, one car manufacturer's power steering can be as difficult or as easy to turn as another vehicle's manual steering. Knowledge about the trends and patterns in steering system resistance among popular vehicle models is helpful in order to make appropriate recommendations and achieve desired outcomes. It is very difficult to remain current on this type of technology because it changes quickly. Rehabilitation engineers and vehicle modifiers can be a valuable information resource to OTs in this area.

Both low-tech and high-tech modifications are available for clients who lack the strength or ROM to effectively turn an original equipment manufacturer (OEM) power steering wheel. Steering column extensions can bring the steering wheel up to 6 inches closer to the wheelchair driver when there are reach limitations or when extra leg room is needed for positioning. Smaller diameter steering wheels can be used for people who have upper extremity ROM restrictions, but they require more strength and repetitions to turn than a standard wheel. When strength limitations are present, they are often coupled with steering effort reduction adjustments.[44] Effort reduction of approximately 40% is achieved with low-effort steering, whereas zero effort reduces effort by approximately 70%.[143] A mechanical horizontal steering wheel enables a gravity-eliminated horizontal placement when the arms cannot be raised to turn the wheel in a vertical position (Fig. 11.24).[76] Small electronic steering wheels that enable horizontal positioning for clients with very severe weakness are also available. In general, high-tech solutions such as electronic remote steering are only considered after all the lower tech options have been tried.

FIG 11.24 A steering wheel that can be placed in a horizontal position can enable steering for clients who lack upward range to reach a traditional wheel. (Courtesy Drive-Master, Fairfield, NJ.)

A critical final step in steering assessment developed as a result of air bags. The driver air bag is located in the steering wheel hub. Newer vehicles have advanced air bag technologies that tailor air bag deployment to the severity of the crash and thus reduce injury. Close or direct contact with an air bag module during deployment can still cause serious or fatal injury, however. The NHTSA continues to recommend that drivers sit with at least 10 inches between the center of the breastbone and the center of the steering wheel.[127] In some instances wheelchair-seated drivers are positioned very close to the steering wheel so that they can reach adaptive equipment. The NHTSA will grant permission for installation of an on/off switch to disconnect a driver air bag under certain circumstances. These include a medical condition that places the driver at specific risk or inability to adjust the driver's position to stay the recommended distance from the steering wheel.[127] The specialist should document the client's distance from the steering wheel.

Accelerator and Brake Controls

Modified accelerator and brake controls can be installed in most vehicles. Simple modifications, such as pedal extensions, which extend the OEM pedals over 12 inches, can compensate for limited lower extremity reach in short persons. Maintaining an appropriate seated distance from an air bag can often prevent the driver from fully reaching the accelerator and brake pedals and has resulted in an increased need for this type of modification.

When right hemiplegia or right lower extremity amputation is present, the right foot is unable to operate the standard pedals. Intuitively some clients cross over with the left foot to operate the brake and accelerator pedals. This can be an unsafe practice because the person is off-center for proper steering, and the awkward posture involved can cause strain on body structures over time. A left-sided accelerator pedal can be placed to the left of the standard brake pedal so that the accelerator and brake can be operated with the left foot. It is imperative to determine that the device can be operated reliably. Cognitive and visual perceptual deficits may prevent safe use of this seemingly simple device.[14] If the device is recommended, the driver must be educated about the necessity of instructing anyone who will be operating the vehicle (mechanics, parking attendants) in how to use it.

Hand controls can be used when the lower extremities are not functional for operating foot pedals. Mechanical hand controls consist of rods connected to the OEM accelerator and brake pedals. In a push/right angle type of hand control, the motion of pulling down presses the rod attached to the right foot pedal and causes acceleration. Pushing forward depresses the rod attached to the left foot pedal and activates the brake. Depending on the style, hand controls use various upper extremity movements (rotary, push-pull, push-pull down, or push-rock motions) to activate the brake and accelerator pedals. Hand controls that use a motor to move the pedals are known as powered controls. High-tech accelerator and brake controls have servomotors that are activated by vacuum, hydraulic, or electronic means.[44] Some high-tech driving systems allow a client to steer, brake, and accelerate using a single vertical column control or a joystick and can enable driving with a single limb (eg, the EMC AEVIT 2.0 gas/brake/steering system, Scott Driving

System, Joysteer Driving System, and Paravan Space Drive II).[77-79,88] A careful match between the functionality provided by these devices and the client's strength and motor control must be made. The devices are very sensitive, and postural control is absolutely critical when they are used. Inadvertent movements may result in loss of vehicle control. Longer, more complex evaluations and lengthier driver training are needed when high-tech systems such as these are recommended (Fig. 11.25).

FIG 11.25 This client with muscular dystrophy required a joystick system to operate the primary controls for driving. Evaluations and training requirements for clients using high-tech systems are more complicated and time intensive.

Secondary Controls

Secondary controls include those for interacting with the elements and other roadway users. They are operated while the vehicle is in motion but do not affect the vehicle's speed or direction. A driver must be able to activate at least four secondary controls at will when the vehicle is in motion: turn signal indicators, horn, dimmer, windshield wipers, and cruise control.[14] The switches to control these functions can either be placed on the hand control itself or in a spot where they can be controlled through elbow and sometimes lower extremity motions.

Some people lack the motor function to access multiple switches. In such cases secondary functions can be controlled by a single sequencing switch. Activation of the switch initiates a tone or word assigned to a particular function. A second touch of the switch selects the desired function. The transmission, parking brake, heater, air conditioner, hazard light, and headlights can be operated when the vehicle is parked. As the configuration and positioning of these controls vary, they may be operable by some clients without modification. If a client cannot access them, extension levers and other mechanical alternatives for operation can be investigated. Remote switches and electronic modifications can be considered if these options are not appropriate for a client's function.[14]

Section 3: Threaded Case Study

Jacqueline, Part 2

Jacqueline was initially concerned that the driving evaluation would result in her losing her license and was hesitant about participating. Her OT generalist took the time to communicate the intent of the evaluation. After Jacqueline realized that the purpose was to help her drive safely for as long as possible, she readily agreed to a referral to the low-tech driving program at the hospital.

The specialist in this program took a closer look at how Jacqueline's hand limitations affected opening the car door and gripping the steering wheel. Jacqueline received an adaptive key holder to open the car door and a recommendation to purchase a steering wheel wrap to build up the steering wheel diameter. A cartop carrier for her husband's wheelchair was recommended, but

Jacqueline decided to wait to purchase it because of financial considerations. Jacqueline told the specialist that she had had some near misses while changing lanes, nearly colliding with cars she didn't see. Many older drivers never received formal driver training and are unaware that a blind spot check is required. In Jacqueline's case the problem was caused by neck ROM limitations that prevented her from turning her head sufficiently to look over her shoulder.

A wide-angle interior rearview mirror and blind spot mirrors on the car's exterior mirrors greatly improved Jacqueline's safety and confidence in viewing traffic and conducting blind spot checks. The specialist also found that she sat too low in the driver's seat, which resulted in poor field of view out the windshield and poor mechanical advantage for turning the steering wheel. Jacqueline's seat was adjusted, and a cushion was used to raise her eye level 3 inches above the top of the steering wheel.

On-Road Assessment

Behind-the-Wheel Assessment

Once the stationary assessment has accomplished the task of setting the driver up with primary controls, the specialist applies the OT skill of IADL observation to the actual process of driving. This part of the evaluation is commonly referred to as the BTW assessment, or **on-road assessment**. It is considered the definitive measure of driving competence because it is completed in the context of the environment and has ecological validity.[18] The OT generalist should not undertake the on-road evaluation because it requires the advanced training and skills of the specialist. The specialist will conduct the on-road evaluation to determine whether the client is able to meet competency criteria (eg, passing a driver licensing test) and to identify driving deficiencies in order to develop a remediation program.[67]

The individual in the role of the driving instructor orients a driver in the use of adaptive driving equipment, maintains vehicle control by intervening for safety when necessary, and directs the route. In some settings the specialist will work alone in the role of the driving instructor to directly administer the on-road evaluation. In others he or she will collaborate with a commercial driving school instructor. OT practitioners specializing in driving should be well versed about the rules and regulations related to driving instruction in their state. Some locations will require that OT practitioners specializing in driving also be certified driver instructors in order to perform on-road assessments and provide driver training.[13,14]

Ethical Considerations

No therapist should proceed with the on-road driver evaluation without first meeting the industry standard or equivalent for driver instructors within his or her own state. Proceeding without this basic driver instructor training is not recommended; it has the potential to be unsafe and to result in the therapist teaching techniques incorrectly that must later be unlearned.[14]

Driving Routes

The on-road assessment should be no longer than 2 hours but should be a minimum of 45 minutes long. A time less than 45 minutes is inadequate to make the necessary observations, particularly those required to determine whether the client is able to sustain mental and physical effort during the drive. Driving routes used for the assessment should incorporate a sampling of road conditions, traffic patterns, and unusual settings common to the local region. The driving route should allow the driver time to become familiar with the vehicle and adaptive equipment in a low-stimulation environment. This period of learning and accommodation will be longer for the novice or apprehensive driver.

Initially the assessment will involve straight-line driving to determine the driver's ability to maintain lane position or to make accommodations to position. The route should progress through faster and more congested traffic and various dynamic traffic conditions so that information about the driver's performance in a wide variety of conditions can be gathered. A method of keeping track of driving performance, such as recording observations of driving errors, is recommended. The criteria for assessing driving performance should reflect physical management of the vehicle, ability to use the adaptive equipment, interaction with other traffic, adherence to rules of the road, and safety judgment.

Competence implies that a client can repeat a performance skill consistently; that his or her success was not based on a lack of environmental or traffic challenges. Repeated success in executing maneuvers in situations requiring the use of judgment must be demonstrated before competence can be ascertained. Specialists should always work within a window of comfort and only take clients in situations in which it is possible to provide override control.

After the on-road assessment has been completed, the driving team reviews the results with the driver. Asking the client for feedback before doing this provides a valuable perspective on his or her insight. Results cannot be shared with family without permission from the client; a verbal agreement from the client to share results should be documented.

Jacqueline was very nervous during the BTW portion of the driving evaluation and made some noncritical errors in freeway situations. She felt that the better positioning in her car decreased her shoulder pain and believed that she had performed well overall. The specialist agreed with her appraisal but recommended 4 hours of driver training focusing on defensive driving skills, use of expanded mirrors, and freeway maneuvers. The ADED best practices resources were used by the specialist to assist her in formulating the criteria used in making recommendations for the additional training.

Recommendations Resulting From Assessment

The driver evaluation culminates in a decision about driver competency, identification of the necessary adaptive equipment and vehicle, and when appropriate, a recommendation for the number of driver training hours required to raise performance skill to a safe and independent level. New driver evaluators need to be cautious not to misconstrue new driver or older driver patterns as uncorrectable errors incompatible with driving. Conversely, errors must be carefully weighed, especially with neurologically involved clients who may have inconsistent driving performance. Recommendations may include (but are not restricted to) (1) drive unrestricted; (2) drive with restrictions; (3) cessation of driving pending rehabilitation or training; (4) planned reevaluation for progressive disorders; (5) driving cessation; and (6) referral to another program.[36]

Written Report

The comprehensive driving report should contain a summary of the clinical assessment and driving performance observations and should provide a statement of the client's potential to be a safe and independent driver. It should specify the type of vehicle needed, the specific vehicle modifications required, the necessary primary and secondary controls and recommendations for their location, all equipment necessary to position and restrain the client and secure his or her mobility device, and all necessary auxiliary equipment. When high-tech or custom equipment has been recommended, the report should specify the need for follow-up fitting sessions to confirm that the equipment has been installed correctly and is functioning as intended.[31] The report should also estimate the amount (duration, frequency, and total length) of driver training needed, indicate specific areas of emphasis for training, and provide resources for where the training is available.

Driver Training

Training needs for clients vary, depending on the person's amount of driving experience and the need to use adaptive vehicle controls. A young person with a disability who has never driven may have training needs related both to being a novice driver and to the limitations imposed by the disability. Individuals with driving experience who have cognitive and perceptual impairments and older adults with age-related declines often need to relearn driving behaviors or implement compensatory skills to obtain consistent driving performance, even though they may not require adaptive equipment. Extensive training with a focus on vehicle control and recovery, especially in unexpected situations and at high speeds, is essential when high-tech equipment is recommended. Some clients will require training in their own vehicle because the unique modifications that they need for driving may not be available on any of the evaluation program vehicles. Depending on each state's requirements and on the individual client's needs, driver training may occur before or after the vehicle has been modified.

Vehicle and Equipment Prescription

A basic level of service provided by the majority of driving programs is the car evaluation. A car is generally appropriate if a person is able to enter and exit a vehicle and load mobility devices into it independently. The standard car recommendation is a midsize vehicle with power steering, power brakes, and an automatic transmission. A two-door car can be advantageous for wheelchair loading by the driver, although some find the larger and heavier vehicle door difficult to manage. Fewer two-door models are being manufactured, resulting in the more frequent use of four-door vehicles.

When loading a manual wheelchair into a car is not feasible, a mechanical device such as a cartop carrier or rear bumper loader may provide the driver with some independence. Clients with limited ambulation who use a scooter or wheelchair for long distances may be able to continue using their standard sedan, SUV, truck, or minivan with the assistance of a power hoist to lift the mobility device (Fig. 11.26).

FIG 11.26 Bruno's Curb-Sider lifts and stows a scooter or power wheelchair inside a minivan by the push of a button on a handheld pendant. (Courtesy Bruno Independent Living Aids, Oconomowoc, WI.)

Numerous variables affect equipment selection and driving performance when a person drives from a wheelchair; consequently, a more skilled evaluation is needed. Individuals who must drive from a wheelchair most often choose between minivans and full-size vans in which the floor has been lowered to provide more headroom to pass through the door while seated in a wheelchair. Another reason for the floor lowering is that the wheelchair seat is higher than the OEM seat. If the floor were not lowered, the wheelchair user would sit too high to have optimal visibility through the front window.[44] A ramp and kneeling system are used to lower the minivan height and decrease the ramp angle sufficiently for a wheelchair user to roll in. Lifts are required for entry into a full-size van because they are higher than minivans. Full-size vans have more headroom, a greater load capacity, and more ground clearance than minivans. Because of this, they are more suitable for certain environments (the rough terrain of unpaved roads, for instance). Minivans are popular because they drive like a car, fit more easily in home and public garages, and get better gas mileage than full-size vans. Their entry ramp can be positioned at the rear or the side, depending on the driver's needs and preferences.

Manufacturing changes in the automotive industry have affected the choices available to people that need to drive from their wheelchairs. The Ford E series full-size van, which was most often modified, is no longer in production. Its replacement, the Ford Transit van, is not suitable for a lowered floor conversion, although it can be used as a wheelchair passenger van. The specialist will need to keep abreast of changes in the automotive industry through attendance at NMEDA and ADED conferences to know which full-size alternatives will be available to clients in the future. SUVs and trucks, both midsize and full size, may present additional options for individuals (Fig. 11.27). However, when clients decide on vehicle options other than vans or cars, it becomes more difficult to ensure that the modifications they require to drive safely and independently will be compatible with the chosen vehicle type.

FIG 11.27 The BraunAbility MXV is a wheelchair-accessible SUV that might be an appropriate alternative to a minivan for some clients. (Courtesy Braun, Winamac, IN.)

Client factors, adaptive equipment features, and vehicle modifications must match appropriately before an expectation of safe and independent driving can be met. The OT generalist can play an important role by advising clients and their families that vehicle choices will have implications and by recommending that they consult with a specialist before making a vehicle purchase. Vehicle modifiers and funders may have requirements for the age, mileage, make, and model of a vehicle. It may not be feasible to install costly modifications in an old vehicle that will not last and might not be safe.[14]

Follow-Up Fittings

Follow-up services are another important aspect of comprehensive assistive technology service delivery. When adaptive equipment is recommended, a follow-up evaluation ensures that the equipment is positioned and adjusted to meet the client's functional needs (Fig. 11.28).[31] Follow-up services include mid-fit and final fitting sessions for quality assurance and verification of safety. When an adapted vehicle is delivered, it is the first time that the client, adaptations, and selected vehicle have interfaced. Some adjustment is almost always needed to meet functional goals and to have the adaptations perform as envisioned.[14] An on-road session is recommended to make sure adjustments are adequate for function when dynamic forces involved in driving come into play.

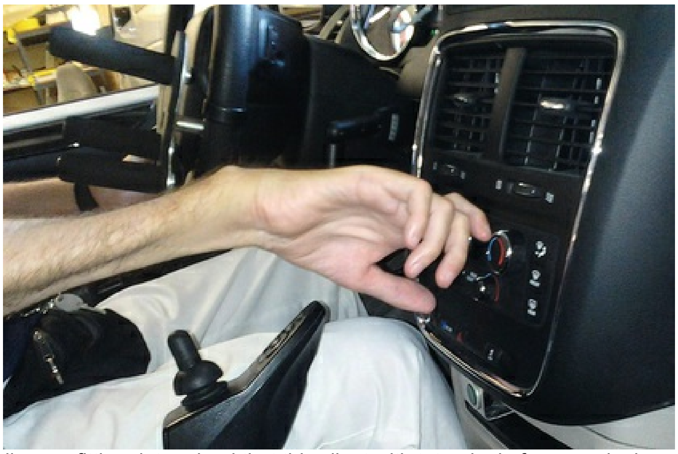

FIG 11.28 A follow-up fitting determined that this client with tetraplegia from a spinal cord injury required extension modifications to operate the dials on the dashboard.

Licensing Assistance

Dealing with the licensing situation related to a disability or medical condition can be both daunting and intimidating to a client. Some individuals may feel unjustly treated if their license has a medical suspension. OTs must be knowledgeable about the licensing procedures, requirements, and reporting laws in their state and understand how they may impact the client's ability to begin or return to driving and participation in their valued occupations.[175] To determine qualification for on-road testing, specialists should ascertain license status, eligibility for acquisition/renewal of the license or permit, the expiration date of the license/permit, and any restrictions that have been imposed. State licensing forms and related information should be made available to the client and other health professionals to hasten resolution of licensing issues.[31] Compilation of a resource file that includes links to licensing information websites, handbooks of licensing laws in culturally appropriate languages, and the medical evaluation forms required by licensing agencies is beneficial. The process of obtaining the permit or license can be expedited by early vision screening. Testing of visual acuity, visual fields, and color vision may be appropriate, depending on a particular state's requirements. Clients with deficits should be referred to an eye care specialist for treatment and correction of problems that could otherwise delay the process.

State licensing agencies are the primary entities providing the criteria for safe road users. License practices and reporting laws vary among the states.[1] Licenses must be renewed every 4 to 5 years in most states, but in some the time is longer. Arizona, for instance, has a license validation time of 12 years. Mandatory physician reporting is the policy in some states; others encourage but do not require reporting, and some have no reporting requirements at all. Immunity from liability depends on a particular state's policy. Frequent review of the state licensing laws is warranted to stay abreast of changes. An online database of state-by-state driver licensing policies and practices affecting older and medically at-risk drivers has been compiled by the AAA Foundation for Traffic Safety. The database is accessible at *http://lpp.seniordrivers.org/lpp/*. Individual agencies, facilities, and hospitals should establish policies and procedures for reporting clients who are unsafe drivers based on their state's laws. As stakeholders in public safety involved in the screening of medically at-risk drivers, OTs should provide input relevant to formulation of the policy.

Driving Retirement

Driving is the most complex IADL we perform on a day-to-day basis, requiring that visual, cognitive, and sensory-motor skills be in peak condition. As the Baby Boomer generation begins to experience functional declines brought about by medical conditions common in aging, safe driving may no longer be realistic. **Driving retirement** is the term used by the AMA to refer to the transition from driver to nondriver.[51] OTs should approach this very emotional topic with compassion. The Hartford Center for Mature Market Excellence has created several free publications related to older adult driving.[188] *We Need to Talk: Family Conversations with Older Drivers* is their guidebook of practical information to help with initiating productive and caring conversations about driving safely. It is available at *http://www.thehartford.com/mature-market-excellence/publications-on-aging*. AARP has produced a free, three-module, online seminar with videos, printable worksheets, practice activities, and an interactive review based on the Hartford materials. The seminar is available at *http://www.aarp.org/home-garden/transportation/we_need_to_talk/*.

The discussion of driving retirement should be initiated well before the need arises for driving cessation so that the client can begin exploring available resources for alternative transportation within the structure of his or her home and community. Making a "plan" for driving retirement helps to normalize the process so that it feels similar to planning for financial retirement or retirement from gainful employment. Discussions of this subject should include transportation alternatives and barriers to participation, such as finances, limited service destinations, and reluctance to rely on family and friends.[51]

Technology-based resources that can ease the transition from driver to passenger are becoming increasingly obtainable and should be discussed with the client facing driving retirement. Many goods and services can be procured via the worldwide Web. Home delivery of groceries and medications has become more common. As they gradually become more accepted by society, app-based transit services (eg, Uber, Sidecar, and Lyft) have the potential to foster independence in the community and facilitate engagement in occupations. Finally, self-driving vehicles, such as the Google car, which have been in development for over a decade, will be introduced to American roads in the near future and have the potential to have a transformative effect on community mobility.

Although the subject is sensitive, when deficits that preclude driving safely are demonstrated, it is imperative that the OT make the recommendation for the client to refrain from driving. If the client's medical condition is one with potential for functional improvement, the recommendation should be that the client refrain from driving until the area or areas of deficit have been remediated. However, if additional functional decline is anticipated, retirement from driving should be clearly recommended. If possible the client's family or another individual within his or her support system should be included in the discussion. Recommendations should be provided to the client both verbally and in writing. All aspects of the assessment and recommendations should be clearly documented in the medical report. Additionally, the client's physician should be informed in writing of the assessment results and recommendations made by the OT.

After her competency was verified and she received interventions for freeway situations, Jacqueline decided that she was not ready to retire from driving. She told the specialist that she shared the good news about her driving skills with her family. Although they were relieved she had had the evaluation, they were still concerned about her transportation needs long term. The specialist used the opportunity to discuss services available through STPs that would enable Jacqueline to augment the transportation available to her through paratransit. She encouraged Jacqueline to talk about transitioning to driving retirement with her family now, so that there would be a well-thought-out plan in place when the time actually came.

Intervention Implications for Various Disabilities

Many different types of disabilities affect driving ability. OTs can apply their knowledge of the various conditions to understand the client factors that might be affected and to anticipate how disease progression could influence the need for driving equipment over the course of time. The ADED website provides factsheets discussing driving issues and assessments for several different types of disabilities.[32] A discussion of the driving issues related to some commonly seen disabilities is presented below.

Wheelchairs and Driving

People with many different types of disabilities use wheelchairs to move about in the community. It is important to keep clients informed about how their wheelchair choices will impact their ability to drive safely and independently. Consultation with a specialist is strongly recommended when a wheelchair-using client plans to become an independent driver; otherwise, factors critical to driving may be inadvertently overlooked by professionals involved in prescribing the wheelchair. For example, independent driving for a client pushing a manual wheelchair may not be feasible if management of the ramp of a minivan cannot be accomplished.

The implication of the wheelchair's width in optimal positioning for steering may not be understood. Also, there may not be an appreciation of whether the wheelchair frame's design will be compatible with certain types of loading devices. Finally, some wheelchair evaluators may not be aware that generally desirable features (eg, independent suspension) can cause inadvertent movements that affect a driver's ability to safely use high-tech driving systems, or they may not know that wheelchairs in which the seat rests on a single post may be unsafe to use as a driving platform.

Client education about the safety risk involved in driving from a wheelchair is necessary. It is generally accepted that the hierarchy of safe seating for a driver begins with the OEM driver's seat, which is designed to withstand crash forces. The OEM seat is followed by an aftermarket powered seat base. Driving from a wheelchair is next, with a power wheelchair considered safer than a manual wheelchair, even when both are WC 19 compliant. The heavier weight of the power wheelchair allows it to withstand forces at the higher speeds typical in many driving situations. Proper securement of the wheelchair in the vehicle is critical to safety in either case. Guidelines for using a WTORS for this purpose were discussed earlier in this chapter. For safety reasons, it is not possible to drive from a scooter.

Spinal Cord Injury

Many people with a spinal cord injury (SCI) will have a goal of resuming driving or becoming independent drivers. Driving-related intervention for these clients requires critical thinking early on in a rehabilitation program. Mild or undiagnosed traumatic brain injury (TBI) is common among people with an SCI.[119] It is important to remain alert to possible signs of TBI so that intervention services addressing the future demands of driving can be planned. Because there is evidence that transfers can increase the risk for upper limb injury in people with an SCI,[147] the client's efficiency and technique during transfers into and out of a vehicle should be carefully assessed. If limiting transfers is necessary in order to preserve upper limb function, the client may need to consider driving from a wheelchair.

The functional outcomes and equipment needed for driving with an SCI depend on a number of factors. Particularly critical are which key muscle groups are functioning and whether the injury is complete or incomplete. A significant percentage of SCIs are incomplete,[144] which allows varying levels of motor and/or sensory function below the level of the lesion that can facilitate task performance. Steering devices may be needed to accommodate hand and upper extremity impairments. Upper torso supports or chest straps may be required in addition to a diagonal seat belt to maintain an upright position during a sharp or fast turn. Lower extremity spasms in some people may necessitate the use of pedal blockers to prevent accidental activation of the brake and gas pedals.

In practice, even some people with a C5 SCI can drive safely from a wheelchair in a lowered floor minivan with a ramp. A high-tech, one-arm driving system in which the steering, gas, and brakes are operated with a lever modified with a tri-pin is needed (Fig. 11.29). Individuals with C6 tetraplegia typically require a modified van and sensitized steering and hand controls for driving. Some are able to transfer into the driver's seat if it is modified with a powered seat base, which moves up/down, forward/back, and rotates to facilitate transfers. People with C7-8 injuries and paraplegia typically have sufficient upper limb function to use mechanical hand controls and can usually transfer into the driver's seat of a car. However, full hand function is not present in low tetraplegia, and there may be balance limitations due to varying degrees of trunk musculature paralysis in paraplegia. These two factors can make dismantling and loading/unloading a manual wheelchair from a car difficult and time-consuming and should be considered when evaluating the feasibility of driving from a car.

FIG 11.29 Some people with severe disabilities are able to drive if matched with the right technology. This variation of the Scott Driving system allows the steering, gas, and brake to be operated with a single arm. (Courtesy Driving Systems, Van Nuys, CA.)

Traumatic Brain Injury

Diffuse and local damage from TBI can cause physical and visual deficits; impairments in aspects of cognition such as attention, processing speed, language function, and memory; and visuospatial and visuomotor limitations. Moderate and severe TBI can result in paresis, plegia, and posttraumatic seizures that affect fitness to drive.[99] However, even mild TBI, which accounts for most TBIs,[58] can lead to concentration and attention difficulties, irritability, and executive functioning challenges that interfere with driving performance.[66] Although research studies have not consistently identified the risk for crashes after a TBI, there is evidence that even mild cognitive difficulties can lead to increased risk while driving.[47] Despite this, between 40% and 80% of people with moderate to severe injuries return to driving after injury, many without evaluations for driving competency.[66]

These findings suggest that clinicians should be concerned about fitness to drive in any client with a history of TBI, regardless of its severity. People with mild TBIs may experience a short hospitalization and may be discharged before their symptoms have fully resolved. OTs in an acute care setting may be called upon to provide advice about whether it is safe to return to driving. Based on the time for resolution of symptoms from mild TBI, some facilities have developed clinical protocols identifying the timing for safe return to driving.[38] Clinicians in a facility without such established protocols should administer a driving screen to identify whether referral to a specialist for more in-depth evaluation and BTW assessments is warranted. Generalists should be aware of their state's laws for reporting loss of consciousness or seizure disorders to the state's Department of Motor Vehicles.

Given that cognitive and perceptual impairments are common problems that can interfere with driving safety, generalists in inpatient and outpatient rehabilitation settings should be familiar with the evidence pertaining to the effect of interventions to address cognition and perception in people with TBI. Evidence-based guidelines for practice with TBI clients using key concepts from the OTPF are available.[99] Additionally, the AOTA's "Critically Appraised Topics and Papers" series reviews current evidence for interventions related to cognitive impairments and skills, vision and visual processing, and psychosocial, behavioral, and/or emotional impairments and skills.[24]

It is important to establish whether driving or a returning to driving is a goal for a client with a TBI. Family members and other caregivers often have valuable insight into a client's ability to return to driving[157] and should be included in the conversation about driving potential, provided the client agrees. The timing of consultations, predriving assessments, and referrals to on-road driving programs should be carefully considered. Clients whose functional return has stabilized require less adaptive equipment than those who are newly injured. A referral made too early can use up limited therapy visits from an insurance provider or tax the financial resources of the individual or family. Exploration of driving potential becomes appropriate when there is evidence that the client has insight about his or her physical and cognitive limitations and when improvement in factors such as the ability to demonstrate new learning, divide attention, and incorporate good judgment into decision making has been demonstrated. Consultation with the driving specialist can identify performance skill needs that can be integrated into inpatient, outpatient, day treatment, or community intervention programs prior to the actual referral. OTs can render a valuable service, even if driving is not a realistic goal, by providing information about transportation alternatives.

Cerebrovascular Accident

A cerebrovascular accident (CVA) can have varying effects on function, depending on the anatomical brain structures damaged. Deficits that can interfere with driving include hemiparesis or hemiplegia, visual limitations, problems with memory and concentration, slowed reactions, spasms, speech and reading difficulties, and other consequences.[130] Scores on the Functional Independence Measures and extremity Motoricity Index on admission to inpatient rehabilitation may be helpful in focusing treatment goals for patients who want to resume driving. Low scores on these measures have been linked to a lower likelihood of return to driving at 6 months.[37] Driving screens are a valuable service that a generalist can provide to identify people who are at risk for unsafe driving from a stroke. There is evidence that many stroke survivors do not receive professional advice or a formal evaluation on which to base a decision to resume driving.[102] The NHTSA has produced a series of short videos to show how different medical conditions can affect driving abilities.[141] The educational video about stroke, available as part of the NHTSA video tool kit on the agency's website, can be an important tool for educating stroke clients about the driving risks resulting from their functional deficits.[141]

Hemianopia is a common occurrence after a CVA.[151] Visual field loss is of concern because it has the potential to affect driving safety.[51] Visual neglect often occurs in conjunction with visual field loss and can result in lack of attention to the neglected side. In these cases driving is usually counterindicated.[14] However, there is evidence that people with hemianopia or quadrantanopia with no lateral spatial neglect can demonstrate safe driving.[89] To best advise clients, OTs will need to familiarize themselves with the DMV visual field requirements in their states because they vary substantially.[51]

Equipment used for driving after a CVA will depend on the individual's functional impairments. If the person cannot steer with both hands, a steering aid may be needed to assist with turning.

When there is paralysis of the right leg, modification of the vehicle with a left foot accelerator might be appropriate, if the person is able to operate it reliably. Extra mirrors may be necessary in order to compensate for visual deficits.

Arthritis

Arthritis is the most prevalent disease of people over 65 years of age. The pain, fatigue, ROM deficits, and diminished strength and reaction time caused by arthritic conditions can negatively impact driving performance.[205] Depending on the location of joint involvement, arthritis can limit specific driving skills. For example, involvement of the cervical spine can impair head turning and the ability to check traffic to the side and rear of a vehicle. Clients report difficulties in turning a key, operating the switches for the secondary controls, entering and exiting a vehicle, managing seat belts, and operating gas and brake pedals. Loading and unloading mobility devices can also prove to be problematic. OTs should be aware that side effects from medications used to treat pain associated with arthritis also have the potential to affect reaction time and alertness for driving.

The NHTSA video tool kit previously referenced is a helpful tool to assist generalists in educating clients and their families about the driving problems associated with arthritis. Exercise programs to improve strength and ROM and instruction in proper body mechanics and energy conservation may also be warranted. Some clients will benefit from adaptations such as key turners and simple devices to facilitate getting into and out of a car. A knowledge of resources for identifying vehicle design features that facilitate comfort and safety for drivers with arthritis may also be helpful. The website *SeniorDriving.AAA.com* includes the Smart Features for Older Drivers tool to assist with selection of vehicle features tailored to individual considerations, including those related to arthritis.[10] However, generalists need to appreciate that all levels of equipment affect how a driver interfaces with a vehicle and must be ready to refer clients to a specialist for a comprehensive evaluation when a client's needs exceed simple aids.

Medically At-Risk Older Drivers

By the year 2020 there will be 53 million seniors. Licensed drivers will account for approximately 75% of this group.[51] Driving in this age group is often viewed negatively by the public, but age by itself is not a good determinant of one's fitness to drive. The facts are that older drivers do not engage in risky behaviors such as speeding, not wearing a seat belt, and drinking and driving, and they often self-regulate their driving by using strategies such as not driving at night or forgoing left turns.[51] The real issue is that age increases the likelihood that they will experience the type of medical conditions that can impair driving abilities and increase crash risk.[14] Even with self-regulation, the rate of crashes per mile driven starts to increase after age 65.[51] Another factor is that seniors are more susceptible to injury because of fragility and do not survive crashes as well as younger people. Their risk of being involved in a fatal car crash begins to increase at ages 70 to 84 and is highest for drivers 85 or older.[104] Functional declines brought on by polypharmacy have also been shown to be associated with an increased risk of motor vehicle crashes. This is significant because more than 40% of persons age 65 or older use five or more medications per week.[115] Considered all together, these issues are the reason that older adult driving is a pressing public health concern.

Driving is the preferred transportation for older adults[41] and is the means by which many of them remain connected to goods, services, and leisure activities. Loss of driving privileges can cause social isolation and can have a very harmful effect on engagement outside of the home. Because most older adults will outlive their ability to drive (men by 6 years and women by 10 years),[51] OTs must be diligent in helping them remain drivers as long as it is safe. When driving is no longer feasible, practitioners have an important role in helping to identify transportation alternatives.

The importance of the role of the generalist practitioner in addressing older driver needs cannot be sufficiently stressed, as is evidenced by the algorithm for making driving and community mobility decisions introduced earlier. Driving status should be explored routinely when the OT is establishing these clients' occupational profiles. Medical records should be carefully reviewed to identify "red flag" health issues and medications known to have the potential to impair driving. OTs can use the AAA's RoadwiseRx tool,[11] accessible at no cost at *SeniorDriving.AAA.com*, to provide clients with individualized feedback about how medication side effects and interactions can impair their ability to drive safely. Observation of a client's performance on complex IADL tasks, a routine part of the OT generalist's intervention, provides valuable information about whether the client is likely to encounter problems in driving; it is a key factor in helping generalists identify when a client requires referral to a specialist.[14]

Generalists should keep the performance skills needed for driving in mind throughout the evaluation process so that appropriate interventions can be designed to remediate any deficits. When clients demonstrate a lack of insight into how their health issues and driving interact, many of the tools discussed earlier in this chapter (ie, RoadwiseReview, Enhanced Driving Decisions Workbook, and the Fitness to Drive Screening Measure) are useful for assisting them to gain self-awareness. CarFit events will provide an opportunity for clients to learn about how well they fit with their vehicle. They also serve to increase the public's awareness of the role of OT in older driver safety and provide a means to identify clients who would benefit from referral to a specialist. Practitioners need to introduce local transportation options to senior clients well in advance of the need to cease driving, in preparation for eventual driving retirement. To facilitate referrals for the right level of service for clients requiring comprehensive driver evaluation services, generalists should be aware of the various driver rehabilitation programs available in their particular area.

Section 3 Summary

Community mobility, whether it occurs while accessing a school bus, driving one's own vehicle, or riding in the local senior transport van, is a pivotal IADL. All forms of community mobility have the ability to enable engagement in necessary and meaningful occupations and are thus the concern of OT practitioners, regardless of whether they are generalists or specialists in the practice area. Individual evaluation, with consideration of valued occupational roles and the transportation systems available to a person, provides a foundation for determining the necessary level of intervention. Evidence-based research should be used to support practice, but without losing sight of the importance of driving and community mobility for facilitating social participation and involvement in other occupations throughout the life span. OTs are challenged to provide driving and community mobility services that will be widely recognized and valued by consumers, communities, and organizations.

Section 3: Threaded Case Study

Jacqueline, Part 3

Jacqueline's generalist OT and her OT driver rehabilitation specialist both played important roles in meeting her needs in driving and community mobility. Her generalist OT first identified problem areas in community mobility as she formulated Jacqueline's occupational profile. She assisted her in successfully applying for paratransit services, to be used as backup transportation when pain from her arthritis prevented her from driving. After evaluating Jacqueline's performance capabilities, she also designed a home exercise program to improve her limited neck ROM and grip strength. Because these deficit areas could negatively impact Jacqueline's performance behind the wheel, she discussed the benefits of a comprehensive driving evaluation with her. The generalist OT used her knowledge of local driver rehabilitation programs to determine that Jacqueline's needs could be met through the low-tech program at her hospital. The specialist at this program prescribed equipment to help Jacqueline compensate for the physical limitations to driving imposed by the arthritis. She provided Jacqueline with training in adaptive techniques for vehicle entry/exit, car transfers, wheelchair loading, and driving performance. She also helped her to begin thinking about a transportation plan for the future, when she had to retire from driving. Jacqueline's quality of life was greatly improved through therapeutic intervention in several aspects of community mobility. She is quite pleased with the outcomes achieved with the help of both therapists.

Review Questions

1. Define functional ambulation. List three ADLs or IADLs in which functional ambulation may occur.
2. Who provides gait training?
3. What is the role of the OT practitioner in functional ambulation?
4. How do OT and PT practitioners collaborate in functional ambulation?
5. List and describe safety issues for functional ambulation.
6. Name five basic ambulation aids in order of most supportive to least supportive.
7. Discuss why great care should be taken during functional ambulation within the bathroom.
8. List at least three diagnoses for which functional ambulation may be appropriate as part of OT services.
9. What purpose does a task analysis serve in preparation for functional ambulation?
10. What suggestions could be made regarding carrying items during functional ambulation when an ambulation aid is used?
11. What is the objective in measuring seat width?
12. What is the danger of having a wheelchair seat that is too deep?
13. What is the minimal distance for safety from the floor to the bottom of the wheelchair step plate?
14. List three types of wheelchair frames and the general uses of each.
15. Describe three types of wheelchair propulsion systems and tell when each would be used.
16. What are the advantages of detachable desk arms and swing-away footrests?
17. Discuss the factors for consideration before wheelchair selection.
18. Name and discuss the rationale for at least three general wheelchair safety principles.
19. Describe or demonstrate how to descend a curb in a wheelchair with the help of an assistant.
20. Describe or demonstrate how to descend a ramp in a wheelchair with the help of an assistant.
21. List four safety principles for correct moving and lifting technique during wheelchair transfers.
22. Describe or demonstrate the basic standing pivot transfer from a bed to a wheelchair.
23. Describe or demonstrate the wheelchair-to-bed transfer using a sliding board.
24. Describe the correct placement of a sliding board before a transfer.
25. In what circumstances would you use a sliding board transfer technique?
26. List the requirements for client and therapist to perform the dependent transfer safely and correctly.
27. List two potential problems and solutions that can occur with the wheelchair-to-car transfer.
28. When is the mechanical lift transfer most appropriate?
29. How is community mobility defined?
30. What unique qualifications do therapists have that enable them to address community mobility issues?
31. What are the primary advantages and disadvantages of public and private transportation?
32. What are the basic components for protecting passengers seated in a wheelchair within motor vehicles?
33. What are three resources for educating clients about safe pedestrian behavior?
34. Describe the role of the OT generalist and specialist in driving rehabilitation.

35. Name four ways the OTA may be used in a driver evaluation program.
36. Describe the decision-making process for assessment, referral, and training of clients with driving related needs.
37. What are the three categories of driving program services?
38. Explain the useful field of view and its impact on driving.
39. What is the best method to determine driver competency?
40. How long should the on-road evaluation session be?
41. Why are older driver issues of particular interest?
42. What additional credentials can therapists obtain in the field of driver rehabilitation?
43. What is the function of driver training?
44. Why is a follow-up evaluation necessary when adaptive equipment is prescribed?
45. What legal issues must be considered by a driver rehabilitation therapist?
46. Where can the interested therapist go for additional information on this area of practice?

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Sexuality and Physical Dysfunction

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CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Justify sexuality as a concern of the occupational therapist.
2. List at least five possible reactions of the person with physical disability to her or his sexuality.
3. List some attitudes and assumptions that the able-bodied population may make about the sexuality of people with physical disability.
4. Discuss how sexuality and sensuality are related to self-esteem and a sense of attractiveness.
5. Define sexual harassment and describe how to handle a situation in which clients harass staff members.
6. Describe the effects that such items as mobility aids and splints can have on sexuality.
7. List signs of potential sexual abuse of adults.
8. List at least two intervention goals designed to improve sexual functioning.
9. Discuss ways in which the occupational therapist can provide a safe environment for discussing sexual issues.
10. Describe how sexual values can be communicated.
11. List at least five effects that physical dysfunction can have on sexual functioning, in addition to possible solutions for each.
12. Discuss the potential hazards of birth control.
13. List the potential complications of pregnancy and childbirth for a woman with disability.
14. Discuss methods of sex education.
15. Define PLISSIT.

KEY TERMS

Autonomic dysreflexia
Emasculation
Erogenous
New body
PLISSIT
Reflexogenic erection
Self-perception
Sensuality
Sexual abuse
Sexual harassment
Sexual history

Sexual values
Sexuality
Sexually transmitted diseases (STDs)
Vaginal atrophy

Threaded Case Study

Shivani, Part 1

Shivani has cerebral palsy. She is 29 years old and has been married for 2 years. She would like to have a child but has some barriers to overcome with the occupation of reproduction. To start with, as she was growing up, she was never taught by her therapists or anyone else to enjoy her body. Also, she has never had a role model who has cerebral palsy give birth to and raise a child. For 2 years she has been trying to relax and enjoy sexual activities with her spouse. This has been complicated by the fact that several people sexually molested her as she grew up, including her physician and a caretaker. Shivani has also found that sex is uncomfortable for her in the missionary position (ie, lying on her back with her husband on top of her), but this is the only position she is aware of for sexual intercourse. She feels like a failure as a partner and a woman, and in her culture, she feels that she should not discuss this topic with anyone.

Critical Thinking Questions

1. Can Shivani enjoy having sex, get pregnant, and raise a child?
2. Do issues such as sexual positioning, enjoyment of the body, and abuse have anything to do with occupational therapy?
3. How would you approach this situation with Shivani and her partner?

Sensuality and sexuality are important aspects of everyone's activities of daily living (ADLs) and directly relate to the quality of each person's life.[2] As an ADL, sexual activity is in the domain of occupational therapy (OT).[66] Occupational therapists work with clients in all areas related to sensuality and sexuality (Box 12.1). Sexuality is an integral part of the human experience and is important for self-esteem and self-concept. It includes emotions, feelings, and hopes for the future. Individuals express sexuality in different ways. Sexual expression is not only the sexual act of intercourse; it may include talking, touching, hugging, kissing, or fantasizing. Engagement in sexual activities does not always take priority when individuals are coping with so many other problems and deficits related to their disabling condition (Fig. 12.1).

Box 12.1

Factors Related to Sexuality and Sensuality

- Quality of life
- Role delineation
- Cultural aspects
- Impulse control
- Energy conservation
- Muscle weakness
- Hypertonicity and hypotonicity
- Appreciation of body

- Psychosocial issues
- Range of motion
- Joint protection
- Motor control
- Cognition
- Increased or decreased sensation

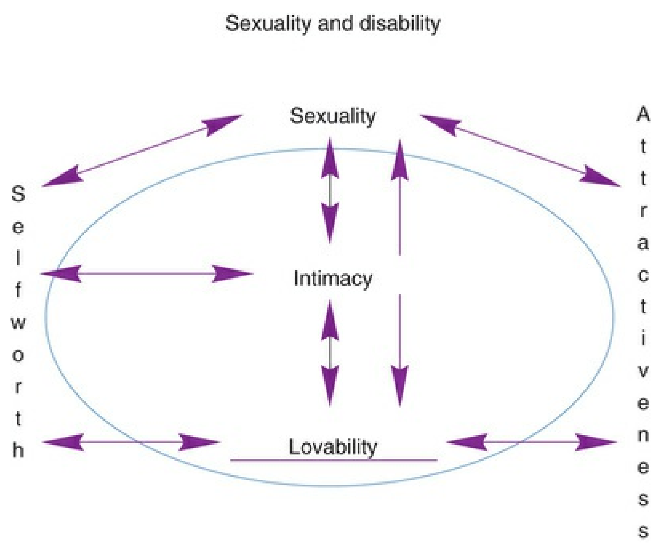


FIG 12.1 Sexuality and disability.

Physical limitations may cause the client to question his or her physical attractiveness, sexual desire, arousal, and/or general ability to experience sexual pleasure. With the onset of physical disability, the client undergoes a significant change in how he or she perceives the world and how others perceive him or her. This transformation significantly affects the client's perception of the commonly held roles and practices of the able-bodied population.[12,60,71]

Individuals with disabilities have a broad range of sexual expression and orientation, just as is the case in the population of individuals without disabilities. Healthcare providers and individuals without disabilities often incorrectly assume that individuals with disability are sexually inactive, or the healthcare provider neglects to consider the issue of sexuality. In a recent study, 94% of the subjects with physical disabilities were found to be sexually active, a rate matching that of nondisabled individuals.[13]

There is a significant paucity of information in the medical and scientific literature about sexuality in individuals with disabilities. The available literature contains biases and myths that individuals with disabilities are asexual, lack sexual desire or attractiveness, are incapable of healthy sexual function, and lack the social and/or problem-solving skills necessary for sexual functioning. In particular, women with disabilities are even more poorly understood.[24] For example, in general women are portrayed as less affected sexually than men with disabilities. These incorrect assumptions are not supported by scientific data and unfortunately often negatively influence how healthcare providers perceive and treat sexuality in individuals with disabilities.[1,53]

The result of this general lack of awareness or bias is that individuals with disabilities may not receive adequate and/or appropriate healthcare, including screening, education, and/or treatment for sexual problems or reproductive health.[1] Even more troubling is that women with physical disabilities encounter serious barriers to receiving appropriate reproductive healthcare. This includes identifying physicians and other healthcare professionals who are knowledgeable about the disability.[13]

For individuals with disabilities, the associated features of the disabling condition may significantly influence the assessment of the client's sexuality. For example, incontinence, pain, spasticity, medications, cognition, and many other associated features may have a significant impact on sexual functioning. Many healthcare professionals may not recognize the ways in which the disabling condition may affect sexuality and intimacy. Therefore, OTs must not only receive training in sexuality, they also must be educated about how disabling conditions influence sexual functioning.

The individual with a disability may be regarded by people without disabilities as asexual, or hyposexual, an object of pity, and unattractive.[5,41,45] Being perceived as unattractive and possibly unlovable can cause the client to believe that he or she can never be intimate with anyone. Holding this belief can lead the client and related others to a sense of despair. McCabe and Taleporos[48] found that “people with more severe physical impairments experienced significantly lower levels of sexual esteem and sexual satisfaction and significantly higher levels of sexual depression than people who had mild impairments or who did not report having a physical impairment.”

Low and Zubir[45] and Kettl et al.[39] found that females with acquired spinal cord injuries reported feeling less than half as attractive after they had acquired the disability, even though spinal cord injury is a disability with little observable physical change in body appearance. These studies showed a major decrease in the **self-perception** of attractiveness.[45] Another study found that with the advent of a disability, males felt a loss of their sense of masculinity and sensed a threat to the male role.[58]

These are just a few examples of the feelings and perceptions that affect the **sensuality** and **sexuality** of the person who has a physical disability. To provide comprehensive rehabilitation with the client, the OT and other health professionals must address self-perception, beliefs, and needs related to sexuality. This chapter examines issues related to sexuality and sensuality in individuals with physical disability.

Reactions to Sexuality and Disability

The many obstacles encountered by people with disability should not interfere with the expression of sensuous and sexual needs. As an informed professional, each therapist can help the adult client eliminate unnecessary obstacles, overcome anxieties, and appreciate personal uniqueness. The expression of sexuality or sensuality is a sign of self-confidence, self-validation, and a sense of being lovable. When a person acquires a disability or is born with a disability, he or she can feel less positive about him or herself and less lovable or unattractive to others.[23,57,58]

Sexuality can symbolize how a person is dealing with the world. If a person feels inadequate as a sexual, sensual, and lovable human being, the motivation to pursue other avenues of life can be affected. When people have a negative self-image, their approach to other challenges in their lives may also be negatively affected. Coping with life's problems thus becomes much more difficult. Because sexuality can be seen as a barometer of how one feels about oneself, it is productive for the therapist to help the client feel as positive as possible about her or his physical and personal qualities. A healthy attitude toward one's sexuality enhances motivation for all aspects of therapy. The therapist must try to help the client adjust self-perceptions enough to function positively in life.

Sexuality has been found to be a predictor of marital or relationship satisfaction, adjustment to physical disability, social interaction, and success of vocational training. In society, people are often judged by their physical attractiveness.[60] In Western civilization, physical intimacy is closely associated with love. Therefore, if a person perceives himself or herself as incapable of expressing sensuality or sexuality, it is possible that he or she feels incapable of loving and being loved. The majority of people who have had a stroke "reported a marked decline in all measured sexual functions."[28,40] Without the capability to love and be loved, a sense of isolation and of being valueless may ensue.[8,45,52,57] Adaptive devices such as splints, wheelchairs, and communication aids can be a detriment to a person's self-perceived attractiveness and sexuality. For example, it may be hard to perceive of oneself as sexual when an indwelling catheter is present or when splints are worn. By discussing the effects of these devices on social interaction, the client can get some ideas about how to handle difficult situations when they arise.[3,44,52,73]

OT intervention should include goals that facilitate an increase in self-esteem and enable the client to feel lovable. The therapist's role is to foster feelings of self-worth and a positive body image to help the client engage in occupations and to minimize feelings of worthlessness and hopelessness.[8,25,45,57,60] Feeling lovable engenders a sense of self-worth, attractiveness, sensuality, sexuality, and being capable of intimacy. Achieving this goal enhances the development of a healthy and realistic life balance in which the client engages in occupations.

Whether sex is still possible is a concern that arises after the onset of physical disability. This concern is often set aside in the immediacy of coping with the adjustment to hospital life and activities that make up the daily routine. However, the concern is not forgotten. A common complaint from people with disabilities about members of the healthcare team is that the staff members do not readily bring up the subject of sexuality and it's not an integral part of the rehabilitation process, treatment plan, or medical appointment.[24] Individuals with disabilities feel that if their sensuality and sexuality are often negated, a significant facet of their personhood is negated. This lack of acceptance causes the person with a disability to lose the feeling that he or she is being treated as a whole person. Currently no single healthcare profession has been designated to address issues concerning the physiological and psychosocial changes related to sexuality after an injury or illness; rather, interdisciplinary team approaches are often used. However, when a single discipline is not designated, the subject may be left unaddressed.[71]

Often men and women with disabilities have an increased dependence on an able-bodied partner, which can result in a decrease in the couple's sex life.[21] One possible explanation is that the able-bodied partner is less inclined to be aroused when he or she has just bathed the partner or assisted the partner with toileting. It is often difficult to transition from caregiver to intimate partner. The therapist must be sensitive to the possibility of these perceptions and help clients deal appropriately with the feelings they evoke.

The client's sense of masculinity or femininity may be threatened by the disability.[46,58,62] Men who have recently acquired a disability report that they feel emasculated.[58,62] Feelings of **emasculation** can be reinforced by physical limitations. For example, lifting weights may no longer be possible, sports participation may not be possible without adaptations, and the need to use a wheelchair and ask for assistance can engender feelings of dependency.

A man with a disability may react to feelings of dependency and emasculation[58] by flirting or making sexual comments to prove his masculinity. The client may attempt to flirt, making sexually inappropriate gestures or comments to a therapist.

Women experience many of the same feelings but may interpret and react to them in a different way.[5] Although many women with physical disabilities may be just as sexually active as women without disabilities,[13,24] some women with disabilities report feeling unattractive and undesirable. This can lead to despair if a woman feels that she cannot achieve some of her major goals in life. Thus, the female client may flirt to see whether she is still attractive to others.

The therapist must realize that the client may be seeking confirmation of her or his sexuality. The therapist should not be surprised by flirtations or sexual advances from clients. The OT practitioner should deal with these behaviors and set therapeutic boundaries in a positive and professional manner, but therapists should never allow themselves to be harassed. All of the therapist's interactions should be directed toward creating an environment that promotes the client's self-esteem, positive and appropriate sexuality, and adjustment to disability.

Ethical Considerations

When responding to the client, the therapist should be alert to the client's current sexuality issues to avoid doing further damage to the client's sense of self. If the therapist rejects or makes the client feel uncomfortable, the client may hesitate to attempt similar interactions in which these behaviors are more socially appropriate. If the therapist rejects the client, the client may assume that if someone who is familiar with people who have disabilities is rejecting, then a person who is unfamiliar with them would not be likely to be accepting, either.

Inappropriate sexual advances, **sexual harassment**, and exploitation of either the therapist or the client cannot be permitted.[49,65] Behavior is considered harassment when it causes the therapist to feel threatened, intimidated, or treated as a sexual object. If sexual harassment is allowed, it can be damaging to the client and to staff morale.[31] The therapist should provide direct feedback, explaining that he or she feels offended and that the behavior is inappropriate and must stop. All staff members should be informed of the situation, and they should develop and implement a plan to modify the client's behavior if it persists.

Therapeutic Communication

Conversations about sexuality can be opportunities for discussing personal feelings and perceptions. Before initiating a conversation about sexuality, the OT practitioner should ask the client for permission to discuss topics that some may find uncomfortable. Beginning with open-ended, nonthreatening questions can help the client feel more comfortable and assist the therapist in obtaining important information. One way to approach a discussion of intimate matters is to ask the female client how she will perform breast self-examination with her disability. A way to introduce the subject to a male client would be to ask if he has noticed any physical changes in his body or how he will perform self-examination of the testicles. If the treatment facility does not have information about these examinations, the client can obtain them from the American Cancer Society or the local Planned Parenthood Association. Each of these activities falls into the domain of health maintenance, and they may not have been discussed by other health team members either because of lack of knowledge or because of the team member's own discomfort in discussing sexuality with clients. This interaction can set the stage for discussion of other personal matters; it also impresses upon the client the necessity for concern about personal health and reaffirms the client's sexual identity.

Clients may feel safe asking the OT about sexual matters related to their disabilities because the therapist deals with other intimate activities, such as bathing, dressing, and toileting. It is also important to discuss sexual hygiene as an ADL. The trust built up in the relationship encourages this communication. The therapist should be prepared with accurate information and resources. The therapist does not need to know everything or be a sex expert, but he or she should ensure that the client gets the necessary information or appropriate referral.

The OT is the most appropriate professional to solve some problems, such as the motor performance needed for sexual activity.[15] For example, discussing positioning to reduce pain or hypertonicity or to enable the client to more comfortably engage in sexual relations will help the client deal with problems before they occur.[18,42,52]

In the case study, Shivani, who has hypertonicity, particularly in the hip adductors, experiences discomfort in a sexual position in which she abducts her legs during intercourse with her husband. She and her husband have not explored other positions, but instead have reduced the number of times they have intercourse during the month. Shivani's sense of failure and feelings of diminished worth as a wife may have further affected the intimacy of her marriage.

Approaches to intervention can include individual, partner, or group sessions. The format in which the information is presented can also vary and depends on the client's status physically, cognitively, and emotionally. It is important to provide the information in a way that can be best understood and when the individual is ready to assimilate it. Information can be presented in many ways and may include diverse media such as videos, pamphlets, or booklets. Varied media may be used to address the unique learning style and need of the individual.[10]

During all aspects of the rehabilitation process, the therapist, staff members, and the client's sexual partner should work on communication with the client. The therapist can facilitate this process simply by giving the client permission to discuss feelings and potential problems, especially sexual problems, and initiate the discussion through open-ended questions. The client needs to learn how to accurately communicate sexual needs, desires, and position options to a partner, either verbally or nonverbally, to have a mutually satisfactory sexual relationship.[22,39] Each client will have unique problems or issues that are related to the nature of the disability. An example is a client with Parkinson's disease in whom the lack of facial expression impedes the nonverbal communication of intimacy. The client can be taught to communicate feelings verbally that were previously conveyed with facial expressions.

OT Practice Notes

Discussion of sexuality is a way to explore feelings of dependency, identity, attractiveness, and unattractiveness.[39,43] Communication must be established about the client's feelings of sexual role changes. If a client's perceived roles are threatened, this situation should be dealt with as early as possible during intervention. If it is not, the effects could persist throughout the client's life and impinge on occupations important to the client.

Values Clarification

The **sexual values** of the client, the partner, and the therapist must be examined for the therapist to interact with the client in the most effective and positive manner.[5,20,46,52,60] Many professional schools do not train healthcare workers on the subject of sexuality and disability.[5,30,62,67] In-service training can be arranged to help staff members become aware of the sexual needs of people with disability.[27,39] Books, articles, videos, training packets, and online Internet resources are available for professional education.[11,19,20,62] Sensitivity training for staff members is imperative in creating an atmosphere of openness to discussing issues of sexuality. The Sexual Attitude Reassessment Seminar (SARS)[32] uses lectures, media, and small group discussions to help participants explore their knowledge and beliefs about sexuality. This seminar also describes sexual problems, how they develop, and how education and therapy can help with their clients. At the very least, it is helpful for therapists to participate in in-service classes and to role-play situations so as to improve their knowledge and comfort in dealing with questions about sexuality from patients and families.

Unless the staff members are educated about the significance of sexuality and related issues, they may have negative feelings about dealing with these matters.[5,11,67,72] If the therapist is not aware of the thoughts and feelings of all of the individuals involved, the therapist could make incorrect assumptions that have negative results.[18] One of the most direct ways of gaining information is by taking a sexual history.[18,62,63] The purpose of a **sexual history** is to learn how a person thinks and feels about sex and bodily functions and to discover the needs of those concerned.[18,43,62] According to some researchers, individuals with a disabling condition may have had a sexual dysfunction before they acquired the physical disability. Taking the sexual history can help identify such a problem.[44]

Sexual History

When taking a sexual history, the therapist should create an environment that ensures confidentiality and encourages comfort and self-expression. Early in the intervention process, the therapist should ask about the client's concerns regarding contraception, safe sex, sexual orientation, gender, masturbation, sexual health, aging, menopause, and physical changes.

Box 12.2 lists some questions that could be asked. All questions should not be asked at the same time, nor would all questions be asked of every client.

Threaded Case Study

Shivani, Part 2

The following questions may have been able to elicit important responses from Shivani.

1. *How important is sexuality at this time in your life?*
   Shivani's answer would reveal that she does not feel that sexuality is important to her, but that it is to her spouse and also for having a child.

2. *How would you describe your sexual activities at this time?*
   The occupational therapist would find out that sex is uncomfortable for Shivani; the OT would also learn how Shivani views sexual activities—whether sexual activity is a meaningful activity to her, or more of a responsibility.

3. *If you could change aspects of your current sexual situation, what would you change and how would you change it?*
   Shivani may say that she is uncomfortable during sex because she had been molested previously and that sex is physically uncomfortable for her now, which makes her feel like a failure. The therapist may not want to pursue the discussion about the sexual molestation and the psychological counseling aspects, but may ask for a referral to a psychiatric professional. The physical discomfort may be then addressed. Positions could be found to make intercourse more comfortable, helping Shivani to feel less like a failure as a partner.

Box 12.2

Questions to Ask in a Sexual History

- How did you first find out about sexuality?
- When and how did you first learn about heterosexuality and homosexuality?
- Who furnished you with information about sexuality when you were young?
- Were you ready for the information when you first heard about sexuality?
- How important is sexuality at this time in your life?
- How would you describe your sexual activities at this time?
- How do you feel sexuality expresses your feelings and meets your needs and those of others?
- If you could change aspects of your current sexual situation, what would you change and how would you change it?
- What concerns do you have about birth control, disease control, and sexual safety?
- What physical, medical, or drug-related concerns do you have relating to your sexuality?

- Have you ever been pressured, threatened, or forced into a sexual situation?
- Which sexual practices have you engaged in, in the past (eg, oral, anal, and genital)?
- Do you consider certain sexual activities "kinky"? How do you feel about participating in such activities?
- How important do you think sexuality will be in your future?
- What concerns do you have about your sexuality?
- Are there questions or concerns that you have regarding this interview?

After taking the sexual history, the therapist can often ascertain whether guilt or discomfort is connected with the sex act, body parts, or sexual alternatives (eg, masturbation, oral sex, sexual positions, or sexual devices). For example, some clients report feelings of guilt or fear in relation to having sex after a heart attack or a stroke—fear that sex can cause a stroke, or guilt that it may have caused the first episode. Another fear is that the partner will not accept the presence of catheters, adaptive equipment, or scars. Performance is often an issue. Able-bodied individuals and those with disabilities ask questions about the sexual ability of the person with disabilities.

The therapist can provide appropriate and accurate information by (1) directing the client to other professionals, (2) providing magazines and books that discuss the subject, (3) showing movies, or (4) suggesting role models. The therapist must be tactful and remember that the client may be questioning her or his own values and previous notions about sexuality. Personal care issues (eg, toileting, personal hygiene, menstrual hygiene, bathing, and birth control) can evoke reflection on values about sex and body image.

Self-care issues, particularly personal hygiene and sexuality, usually are not emphasized enough during acute illness and rehabilitation. Discussing such issues once or twice is not sufficient. The circumstances and environment in which these issues are discussed should also be considered. The therapist must create an environment that allows personal discussions. A personal conversation cannot take place in a crowded therapy room, during a rushed and impersonal treatment session, or with a therapist with whom a good personal rapport does not exist. Building rapport is a problem in healthcare facilities in which therapists are frequently rotated or work on a per diem basis.

A discussion of feelings will also help the client explore her or his new body, or adapt to ongoing degeneration of the body if there is a progressive disability. These conversations may take place while other therapeutic activities are in progress so that billing insurers for time is not a barrier.

Sexual Abuse

The **sexual abuse** of adults with disabilities is a significant problem.[3,64,67,72] Clients should be made aware of the possibility of exploitation, especially when they use the Internet for social networking and online dating. Others have reported that medical staff members took inappropriate liberties with them and that personal care attendants, on whom they depended, demanded sexual favors. Clients can and should report such abuse to their state's Adult Protective Services agency. The therapist also must report cases of suspected sexual abuse. The client may be reluctant to report abuse because of a concern that it will not be possible to get another aide or that, during the time it takes to hire another aide, essential assistance will not be available. These are major problems for a person who is dependent on others for care. However, therapists must discuss with clients the need for mandatory reporting, to reduce their reluctance to report. In addition, the therapist should provide emotional support throughout this reporting process and/or provide a mental health referral to assist the client once an abuse report has been made.

Therapists may not suspect caregivers, medical staff members, aides, transportation assistants, or volunteers of sexual abuse, but the therapist should be alert to signs of possible abuse even from these sources.[61] Some individuals are sexual predators who prey on adults and children with disabilities. They may be drawn to the health fields with this motive.[3] The therapist must always be alert for signs of potential abuse, such as clients usually being upset after interacting with a specific person, the client being reluctant to be left alone with a particular caregiver, caregivers taking the client off alone for no apparent reason, excessive touching in a sensual manner by caregivers, the client being agitated when around a particular individual, and the client being overly compliant with a specific individual.

Ethical Considerations

Therapists must increase their awareness of what constitutes sexual abuse. Formal training is available through continuing education courses, and therapists should update their knowledge on a regular basis to stay current with changes in laws and regulations in their particular state. Children with disabilities have long been expected to undress and be examined or treated as part of their medical care. This treatment is sometimes necessary, but the preferences and dignity of the client should be respected at all times. A person of any age should not be forced to endure humiliation.

The therapy session should help the client develop a sense of personal ownership of her or his body. However, this goal is sometimes overlooked when the OT is working with adults and children. For example, a child who believes that he or she does not have the right to say “no” to being touched, who cannot physically resist unwanted touching, and who may not be able to communicate that unwanted touching or frank abuse has taken place, is in jeopardy of being victimized.[3]

The therapist should ask permission before touching the client; he or she should touch with respect and maintain the client's sense of dignity. If the therapist does not ask permission to touch a client, the client can lose his or her sense of control over being touched by others. The therapist should guard against communicating this notion to clients and should educate clients about their personal rights regarding others touching them.

Naming body parts and body processes is a good way of helping clients take charge of their bodies. Once the body parts and processes have been named, using correct terminology rather than slang, the possibility exists for the client to communicate and to relate in an appropriate manner.[3,17,51,63] The use of the proper terms has the effect of helping the client view the body in a more positive way, whereas slang tends to communicate negative images.[63]

Effects of Physical Dysfunction

Specific physical problems that may create difficulties in sexual performance for people with disabilities and their partners and suggestions for management of the problems are outlined next and summarized in Table 12.1.

TABLE 12.1

Possible Effects of Selected Conditions on Sexual Functioning

	SYMPTOMS														
	Anxiety/Fear	Contrac-tures	Cultural Barriers	Decreased Libido	Depres-sion	Impo-tence	Incon-tinence	Limited ROM	Loss of Mobility	Low Endur-ance	Medication	Paralysis/Spasticity	Poor Body Image	Tremor	Catheter/Ostomy
Diagnosis															
Amputation	X	X	X		X				X				X		
Arthritis	X	X	X	X	X			X	X	X	X		X		
Burns	X	X	X		X			X	X	X		X	X		
Cardiac disease	X		X	X	X	X	X		X	X	X		X		
Cerebral palsy	X	X	X		X			X	X	X		X	X	X	X
Cerebrovascular accident	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Diabetes	X	X	X	X	X	X			X	X			X	X	
Hand injury	X	X	X		X			X	X			X	X		
Head injury	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Musculoskeletal injury	X	X	X		X		X	X	X	X	X	X	X	X	
Spinal cord injury	X	X	X		X	X	X	X	X	X	X	X	X	X	X

Hypertonia

Hypertonia can increase when muscles are quickly stretched. To prevent quick stretching of muscles involved in a movement pattern, motion should be performed slowly. It is advisable to incorporate rotation into the movement to break up the tone. Slow rocking can be used to inhibit hypertonic musculature. Gentle shaking or slow stroking (massage) can also be inhibitory. Heat or cold can be used to inhibit tone. Clients with hypertonia should review options for different positions in which to have sexual intercourse. Alternative ways of dealing with personal hygiene (eg, toileting, inserting tampons, gynecologic examinations, and birth control) may also need to be explored in relation to hypertonicity.

Shivani's OT discussed strategies that could be used to relax the hypertonicity in her legs, such as gently rocking her legs side to side while she was seated. Although initially presented as a means to reduce the hypertonicity affecting Shivani's sitting balance when toileting and for personal hygiene during menstruation, this technique also was suggested as a means to relax her legs before intercourse.

Hypotonia

Clients with low muscle tone (hypotonia) need physical support during sexual activity. Pillows, wedges, or bolsters may be used to support body parts, allowing for endurance and protecting the body from overstretching and fatigue. Sexual positions that allow support of the joints involved should be explored. The client and her or his partner should also explore their attitudes about the positions.

Low Endurance

Prolonged sexual activity can be intolerable because of low physical endurance. Some techniques for dealing with low endurance apply the principles of work simplification to sexual activity; for example, using timing to engage in sex when the client has the most energy, and assuming positions in which sexual performance uses less energy.

Loss of Mobility and Contractures

Limited mobility and contractures prohibit many movement patterns and limit the number of positions for sex. Activity analysis must be done to find positions that allow sexual activity. This system often requires creative problem solving on the part of the client, the partner, and the responsible professional counselor.

Joint Degeneration

Conditions such as arthritis can cause pain, damage to the joints, and contractures. Avoiding stress and repetitive weight bearing on the joints can reduce joint damage. Activity analysis is needed to reduce joint stress and excessive weight bearing on the joints. It is necessary to find a position that takes weight and stress off the knees or hips, such as the one in Fig. 12.2. This position is sometimes referred to as the missionary position. A position with substantial hip abduction may not be acceptable for the client, in which case a side-lying position may be more comfortable. If hip abduction is limited, the woman should avoid positions such as those shown in Fig. 12.2 (also see Figs. 12.5 and 12.9, presented later in the chapter).

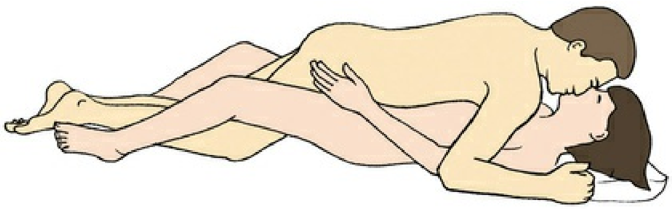


FIG 12.2 This position places pressure on a female's bladder and requires hip abduction but little energy expenditure for her. An excellent discussion of these alternatives can be found in the journal *Sexuality and Disability* 12:1, 1994.

After Shivani's OT introduced the technique of slow rocking, Shivani asked about other positions that would be more comfortable during intercourse. The OT discussed the possibility of using side-lying intercourse.

Pain

Pain limits the enjoyment of sexual activities.[35] Usually, at some time of day, pain is diminished and energy is at its highest. Sexual activities can be scheduled for such times. Many people find that sexual activity is possible after pain medication has taken effect. However, pain medications can also interfere with sexual functioning. These medications can interfere with alertness, sexual desire, and arousal. Communication between partners is especially important when pain is involved. An unaffected partner who does not understand the negative effects of pain and/or the negative effects of pain medications may believe that the affected partner is not interested in sex and/or is not considering her or his personal needs. A referral to a psychotherapist who understands the effects of pain or to a pain specialist can help address emotional and physical aspects of this problem. The OT can help the client think of acceptable ways of meeting the partner's and the client's own sexual needs without causing pain. Masturbation and mutual masturbation with sexual fantasy are possible ways of meeting sexual needs in these circumstances. In this way, the partners are interacting and neither person feels isolated.

Loss of Sensation

The loss of sensation can affect the sexual relationship in several ways. The lack of **erogenous** sensation in the affected area can block proper warning that an area is being abraded (eg, the vagina is not being sufficiently lubricated) or damaged (eg, the bladder or even bones if the partner is on top and being too forceful). A lack of sensation may be a sign of disruption of the reflex loop responsible for sensation and erections in the male and sensation and lubrication in the female.

Cognitive Impairments and Behavioral Changes

Disabilities such as traumatic brain injury (TBI), multiple sclerosis (MS), and cerebrovascular accident (CVA) may affect sexual relationships and sex drive. Clients may have difficulties with impulsivity, poor initiation, attention/concentration, multitasking, memory, social communication, decreased awareness, and executive functions, such as problem solving and reasoning, all of which can affect relationships and successful sexual interactions.[9,59]

Emotional Factors

Depression and anxiety adversely affect sexual desire and arousal, and new onset of a disability has a high incidence of depression. For example, depression is seen in 14% to 61% of those with TBI or a spinal cord injury (SCI).[14,47]

Aging and Sexuality

With aging, changes take place that can affect sexuality. In women, menopause and the resulting hormonal changes cause **vaginal atrophy**, decreased lubrication, pain, an increased need for direct stimulation, and slower reactions to sexual stimulation. In men, greater stimulation may be needed to develop and maintain an erection, and the recovery time between erections may be greater. Partners can be informed of ways to increase direct stimulation and can be helped to understand that it is the quality, not the quantity, of sexual activity that is important in the relationship. In addition, many couples over time develop maladaptive sexual patterns. One common pattern is that any type of sexual or affectionate expression always culminates in sexual intercourse. Unfortunately, any type of sexual dysfunction that arises can lead to a significant decrease in expressions of affection or any sexual touching or communication for these individuals and their partners. Clients and their partners should be educated on the importance of intimacy, sexual and nonsexual touching, and other ways of expressing affection. The client should be made aware of the maturation process and its normal effect on sexuality so that the disability is not blamed for all problems.

Isolation

The environment is composed of objects, persons, and events. All activities involve an interaction between the person and environment. Some of the objects with which people with disabilities interact are wheelchairs, braces, canes, crutches, and splints. These objects are all hard, cold, and angular. They can communicate a hard exterior and a fragile interior and can convey the notion that no softness exists, that it is not safe to hug, and that a person in a wheelchair or in braces or on crutches can get hurt or toppled if touched. As a result of these ideas, individuals with a disability may feel isolated by the appliances or equipment they need to successfully interact with the world around them.

Some people tend to withdraw from the objects around the client. This may reinforce the client's notion of a lack of sensuousness and increase the client's sense of isolation. Clients often feel isolated and different from the "normal" population.[20] This phenomenon is more common among clients who have been out of the healthcare facility for a period of time. In the early phases of the disability, the therapist and the client can role-play about how to deal with a new partner or how to explain the equipment used, such as a catheter. This approach may help ease the client's anxieties and fears and increase his or her comfort with such issues. At the same time, the therapist should be communicating that sex may be a possibility in the future. It should be pointed out to clients that at no time in human history have people with disabilities not existed in society, that they are a part of society, and that it is not "abnormal" to have a disability. All people who live long enough eventually acquire a disability, to a greater or lesser extent.

Medication

Approximately 20% of individuals experience various side effects from prescription medications. Potential side effects of medication are impotence, delayed sexual response, or other problems. Diuretics and antihypertensives can cause erectile dysfunction, decreased desire, and changes in orgasm. Tranquilizers, selective serotonin reuptake inhibitors (SSRIs), and antidepressants can contribute to changes in sexual desire, arousal, and orgasm in some individuals.[62] Side effects of medication should be discussed with the prescriber and the pharmacist to see whether medications can be altered or changed. If they cannot be, acknowledging that the problem is a side effect of a needed medication can be helpful to the client. Clients should be strongly discouraged from stopping their medications on their own, without first discussing the implications with their prescriber.

Street drugs also have sexual side effects and adversely affect sexual functioning at every level of the sexual response cycle. For example, methamphetamines and cocaine may have the sexual side effect of decreased interest in sex and difficulty reaching orgasm. Marijuana and alcohol can cause difficulty in obtaining and sustaining erections. Occupational therapists do not condone the use of street drugs, but it is important for the OT to consider that such drugs may be part of a client's life, and providing education on these side effects is critical.

Performance Anxiety

At times of emotional stress, regardless of his age, a male client may have difficulty obtaining and maintaining an erection. Even one or two instances of difficulty with an erection can lead to increased anxiety and create a cycle of erectile dysfunction and even avoidance of sex. Another problem that can arise is premature ejaculation, which can in turn lead to performance anxiety. It can be helpful for the client and his partner to take the emphasis off erection and genital intercourse and focus on sensuality and making each other feel good. A massage or nondemand touching are techniques that can be helpful with performance anxiety. More specifically, with premature ejaculation there are very useful techniques the patient and his partner can be taught to manage the issue. If these approaches do not work and it has been determined that the problem is not physical in nature or related to medications, a sex therapist or psychotherapist trained in sexuality may be needed to help the couple deal with the problem.

Skin Care

The person with a disability should be informed that positioning modifications might be needed to protect the skin, prevent skin breakdown, and increase pleasure. If a sexual position causes repeated rubbing on the skin, this friction can cause abrasions and result in skin damage. The therapist and client can discuss methods to prevent the friction, such as through an alternative position. Pressure on bony prominences or pressure exerted in a specific area by a partner can also cause problems with skin irritation and must be avoided.

Lubrication

Stimulating natural lubrication in female clients is important. It may be overlooked in a woman with paralysis because she may not be able to feel the stimulation or lack of natural lubrication. Stimulation to cause reflexive lubrication should occur even when the woman does not feel it. Without proper lubrication, damage may occur without the woman being aware of the problem. If needed, artificial water-based lubricants should be used. The individual should be warned that only water-based lubricants are appropriate because petroleum-based lubricants can cause irritation and can attack the integrity of latex condoms, causing condom failure. This is a major concern because the female partner is more likely than the male to become infected with the human immunodeficiency virus (HIV) in any given heterosexual encounter.

Erection

Many men regard the ability to achieve an erection as one of the most significant signs of masculinity.[43] If awareness of sensory stimulation to the penis is blocked by the sensory loss associated with paralysis and if the male client does not try to stimulate a **reflexogenic erection**, he may believe that he is unable to obtain an erection. This is not necessarily true, and the client may go through much needless anguish. The client should be encouraged to explore his body. Rubbing the penis, the thighs, or the anus can be effective ways to evoke a reflexogenic erection. Even rubbing the big toe has been reported by some men with quadriplegia to stimulate an erection. If the normal reflex arc is interrupted, it is usually not possible to achieve an erection, and alternative methods must be explored.

Alternative methods can be forms of sex that do not require an erect penis, such as using a vibrator, or oral or digital sex. If the client feels that penile intercourse is the only acceptable method, other possibilities exist.[16] Injections or penile suppositories that stimulate erections can be used, but this practice may have adverse reactions or lead to problems if the client does not have good judgment or lacks hand dexterity. Penile vacuum devices are available that are very easy to use and result in erections firm enough for penetration. The use of a vibrator or massager against the penis to help produce ejaculate is sometimes effective and is one of the less invasive techniques.[63] Prescription medications are readily available for men with erectile dysfunction (ie, sildenafil, vardenafil, and tadalafil).

Fertility

Some disabilities may directly affect an individual's ability to biologically become a parent. For example, women who sustain an SCI or a TBI may experience a disruption in their menstrual cycle. This pause may last as long as 6 months after an injury. However, a woman's ability to have children is not usually affected once menstruation resumes. It should be noted that depending on the disability, women may be subject to certain pregnancy-related complications, and those should be discussed with a physician prior to considering pregnancy. Men with catastrophic injuries or illnesses (eg, SCI) also experience difficulty with fertility. Typically, the reason for this is the inability to ejaculate during intercourse. Men who wish to father a child do have options, and a fertility specialist should be consulted.

Birth Control

The client should consult her or his healthcare provider when weighing the pros and cons of various methods of birth control. People with disabilities must consider a number of factors when planning birth control.[15,16,33,42,51] Because most disabling conditions do not impair fertility (especially for women), it is important for the client to be aware of birth control and potential complications of the use of birth control.

Adequate hand function is needed to successfully apply a condom. An applicator can be adapted in some cases, but someone with good hand dexterity must assemble the device beforehand. Diaphragms are not very feasible for people who have poor hand function, unless the partner does have hand function and both parties feel comfortable about inserting the diaphragm as part of foreplay. The contraceptive sponge also requires good use of the hands.

Using birth control pills can increase the risk of thrombosis, especially when the client is paralyzed or has impaired mobility. If the client has decreased sensation, the intrauterine device (IUD) can result in complications from bleeding, cramping, puncturing of the uterus, or infection. The use of spermicides requires good control of the hands or the assistance of the partner who has normal hand function. The use of nonoxynol-9 has been suspected to increase the risk of HIV transmission and should be avoided.[50] The injectable type of birth control may allow for easy use but has many of the same side effects as the pill. In using any method of birth control, the client must always be concerned with reducing the chance of infection and practicing safe sex.

Adaptive Aids

Adaptive aids may be necessary, especially if the client lacks hand function. One aid is a vibrator for foreplay or masturbation.[29] Special devices have been adapted for men and women.[18,42,51] Pillows may be used for positioning, and other equipment may be used for clients who have special needs. The therapist must prepare the client for the concept of using sexual aids before suggesting the option to the client. For example, the therapist can suggest that the client privately explore the sensation that the vibrator produces in the lower extremities. The client might discover the possible use of the vibrator for sexual stimulation or at least, when told how it can be used, may be more open to the idea of using a vibrator as a sexual aid.

Safe Sex

The importance of safe sex has increased considerably since the advent of acquired immunodeficiency syndrome (AIDS). However, safe sex is important to protect against all forms of **sexually transmitted diseases (STDs)**.[33] Clients need to be advised that this is a crucial issue. If there is sensory impairment in and around the genital area, the person might not be aware of an abrasion or infection. Any genital irritation or infection allows easy entrance of STD pathogens. The person with disability must be informed of the increased risk of HIV and STDs so that extra care can be taken.

Hygiene

Catheter care is a concern, especially when hand function is impaired. Questions may be raised about how or if a person with an indwelling catheter can have sex. Sex is possible for both men and women, but some precautions should be taken. If the catheter becomes kinked or closed off (which will definitely happen in the case of a catheterized man having vaginal intercourse), pressure should not be placed on the bladder. The bladder should be fully voided before sexual activity. Urine flow should be restricted for as short a time as possible, and no longer than 30 minutes. Damage to the bladder and kidneys could result if these precautions are not followed. The client should not drink fluids for at least 2 hours before sex to prevent the bladder from filling during this time. Sexual positions that avoid placing pressure on the bladder should be used, such as those shown in Figs. 12.3 to 12.10. Many of the same positions can be used if the client uses a stoma appliance.

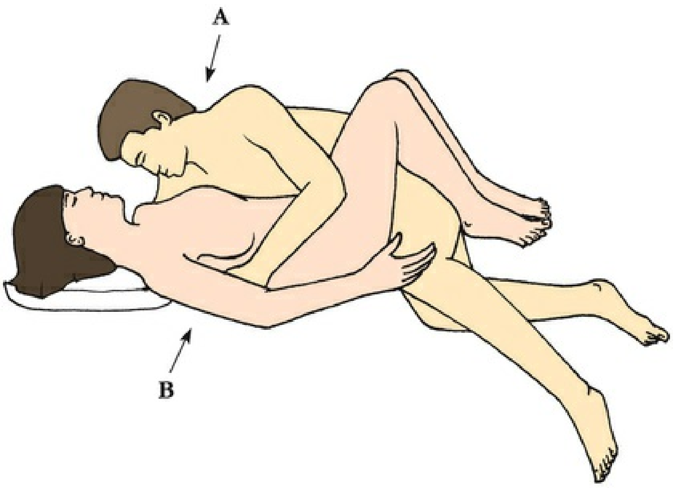


FIG 12.3 Vaginal entry of partner B requires no hip abduction, and hip flexion tightness would not impede performance. Energy requirements for both partners are minimal, and bladder pressure, catheter safety, and stoma appliance safety should not be an issue for partner B. This position may also be recommended if partner B has back pain or is paralyzed, especially if a rolled-up towel is used to support the lumbar spine.

FIG 12.4 Partner A needs little hip abduction but good strength. Partner B may feel less strain on his back. Hip, knee, or ankle joint degeneration would preclude this position for either partner.

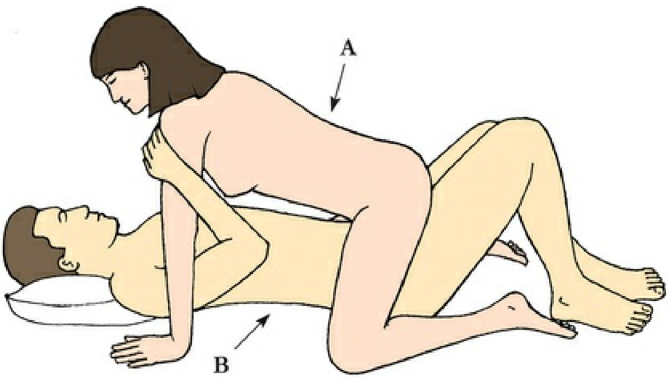


FIG 12.5 Partner A must have hip abduction, balance, and endurance in this position, but pressure is kept off the bladder and stoma. If a catheter is used, it would be unrestricted. Back pain may be avoided by keeping the trunk vertical. Partner B's hip flexors could be contracted. If low back pain is a problem, the legs should be flexed and a rolled-up towel placed under the lower back. If a stoma appliance is used, this position would prevent interference. If low endurance is a problem, this position can be used effectively for partner B.

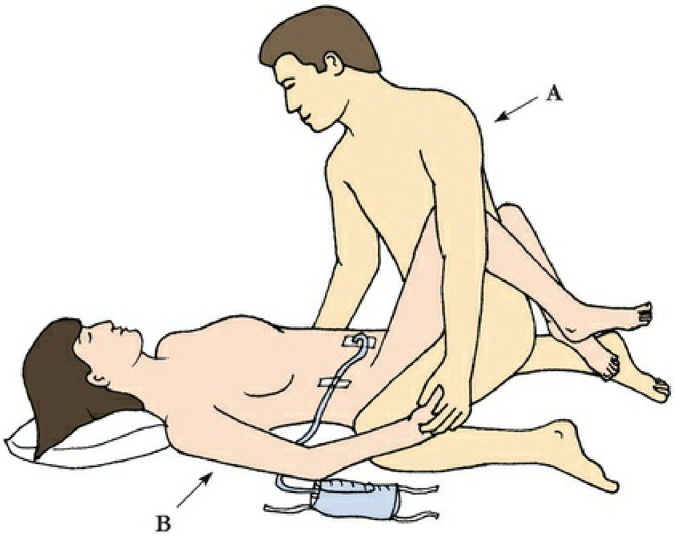


FIG 12.6 This position keeps pressure off the bladder, lessens the chance of tubing becoming bent, reduces pressure on the back (especially if a small rolled-up towel is used under the lower back), and does not require partner B to use much energy. The legs do not need to be as high as shown, but if the hip flexors are contracted, this position may be comfortable.

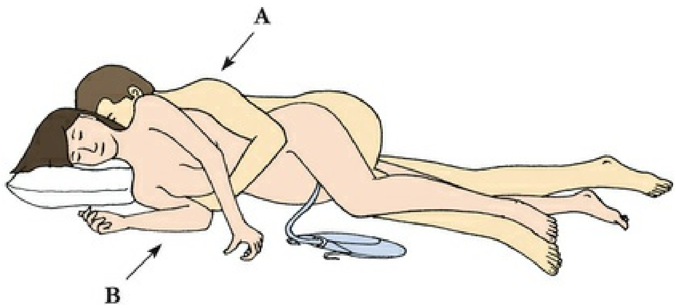


FIG 12.7 Partner B need not expend much energy in this position, and both partners may avoid swayback. Either partner may have hemiparesis. Partner B will not need hip abduction, and pressure on the stoma bag may be avoided.

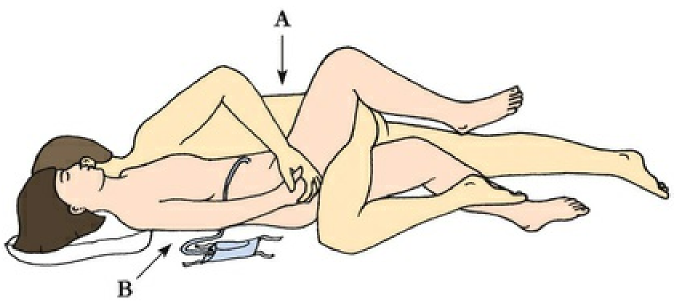


FIG 12.8 This position can be used if either partner has hemiparesis, or if low endurance is a problem. Partner A may avoid swayback in this position.

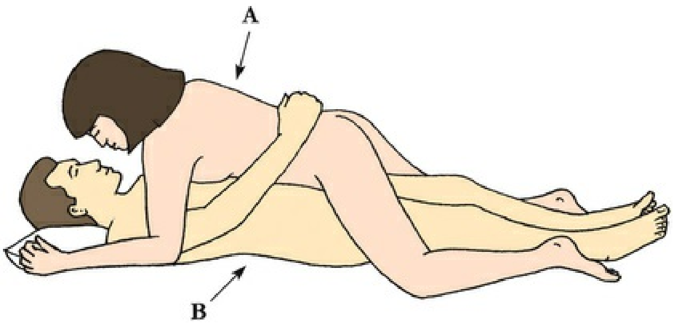


FIG 12.9 Partner B may be paralyzed or have limited range of motion. His back may need a rolled-up towel for support, and he must be concerned with pressure on his bladder.

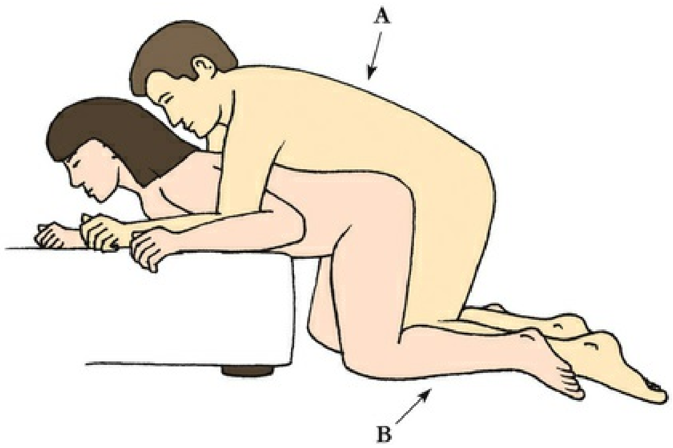


FIG 12.10 Rear vaginal entry of partner B, who does not need much energy because support is provided by a low level bed or cushioned footstool and little or no abduction of the hips is required. Flexion tightness of the hips does not affect performance. Because of the weight on partner B's knees, hips, and back, in addition to the inevitable repetitive movement at the hips, this would not be a good position for individuals with back, hip, or knee joint degeneration.

Women who have various disabling conditions have reported irregular menstrual periods and deterioration of their neurological condition during menstruation.[70] Hygiene issues may occur for several reasons. Lack of education, poor hand function, and poor sensation are conditions that may contribute to menses complications. Information about toxic shock syndrome should be given to clients who may not feel or be aware of infection. A sanitary napkin or pad requires less fine motor skill and is less dependent on intact sensation than a tampon. Although the client's preferences must be considered, the therapist is responsible for educating a woman about the pros and cons of using either a sanitary pad or a tampon during menstruation. Menopause complications may be increased, but this area may need further research.

A person with an impairment of bowel or bladder function may have an occasional episode of incontinence during sexual activities. If the client and the therapist discuss this possibility and how to deal with it, some embarrassment can be averted when the episode occurs. The client and the therapist can role-play to explore various scenarios, such as, "You are planning intimacy with a new partner. How will you explain your catheter and appliances to the person?" These may be awkward conversations for the therapist and the client, but dealing with these issues beforehand is usually easier than waiting for the situation to arise. Such topics must be approached with caution and discretion.

Pregnancy, Delivery, and Childcare

Before becoming pregnant, women must weigh the risks and benefits of pregnancy, childbirth, and childcare. Complications of pregnancy may affect the client's function and mobility. These complications include the potential for respiratory or kidney problems, the effect of the increased body weight on transfers, an increased possibility of **autonomic dysreflexia**, and the need for increased bladder and bowel care; all of these should be considered when pregnancy is contemplated.[69] Labor and delivery can present some special problems, such as a lack of awareness of the beginning of labor contractions. Induction of labor may be contraindicated if a person has a spinal cord injury at T6 or above and the medical staff members are not trained to deal with the respiratory problems or dysreflexia that can result. After delivery, the parent with disability will need to have modifications made to the wheelchair. The client may need consultations to achieve an optimal level of function in the parenting role.[33]

Using Shivani as an example, the therapist may help her find information about pregnancy. Introducing her to sites appropriate for an online search or encouraging her to contact Planned Parenthood or United Cerebral Palsy can help her locate the information she needs to make informed decisions. She could also ask these agencies for a list of healthcare providers who have experience with women who were pregnant and had cerebral palsy.

The therapist may then simulate situations during the first year after birth. These may include how to transport an infant, change diapers and dress the child at different stages, play with the child, bathe the child, and deal with parenting despite mobility impairments, just to name a few possible scenarios.

Sexual Surrogates

A sexual surrogate is someone trained to work with individuals to help them deal with sexual dysfunction or to explore their sexuality. Typically a surrogate works with a therapist and a client. A sexual surrogate engages in sexual behaviors with the client, often using specific techniques that have been shown to be effective. The goal is to allow the client to explore aspects of sexual response, sexual feelings, and sexual techniques in a safe environment with a professional who is trained to provide feedback and offer advice.[38] The main goal of the interaction is education.

Methods of Education

The following techniques or approaches have been used effectively to deal with the emotional aspects of sex education for people with disability.

Repeat Information

Mentioning sexual issues just once is not enough for anyone. Whether the individual has a disability or not, most people need to hear information more than once to fully understand the complexity of sexual function. This fact is especially true for people who are in crisis or who are in the process of adjustment to a disabling condition. Too much information, or more than is asked for, should not be offered at one time. Whenever possible, the therapist should try to say something positive in every conversation. Holding out hope for the restoration of function or alternative function is important. The therapist should not assume that the client understands all of the information. To verify that the client understands the information, the therapist should invite him or her to ask questions and to paraphrase what was said.

Help the Client Discover the "New" Body

With any disability, the client's body image and perception of the body are altered. In effect, the client has a **new body** and must find altered ways of moving, interpreting sensations, and performing ADLs. A large part of the therapeutic experience is directed toward helping the client discover how to use this new body as effectively as possible. The therapist can facilitate this discovery of the new body by creating situations that encourage awareness of the body through the input of sensation and function.[44] The client alone or with her or his sexual partner can accomplish this awareness through exercises that encourage exploration of the body. Exercises such as the gentle tapping or rubbing of a specific area can be developed to see if sensation exists or if the stimulation causes a change in muscle tone. Many people with a disability such as paralysis report that they have experienced nongenital orgasms[15] by stimulating other new erogenous areas, often in the area just above where sensation starts to appear. The therapist may suggest ways to use this sensation or change in tone in ADLs or may ask the client to think of ways this change in tone could be used, such as triggering reflex leg extension to help with putting on pants. This discussion stimulates problem solving by the client.

PLISSIT

The acronym **PLISSIT** stands for **p**ermission, **l**imited information, **s**pecific **s**uggestions, and **i**ntensive **t**herapy. PLISSIT is a progressive approach to guide the therapist in helping the client deal with sexual information.[4] *Permission* refers to allowing the client to feel new feelings and experiment with new thoughts or ideas regarding sexual functioning. *Limited information* refers to explaining what effect the disability can have on sexual functioning. An explanation with great detail is not usually necessary early in the counseling process. The next level of information is providing specific suggestions. It may be in the therapist's domain to give *specific suggestions* on dealing with specific problems that relate to the disability, such as positioning. This is the highest level of input the average occupational therapist should attempt without advanced education and training in sexual counseling. *Intensive therapy* should be reserved for the rare client who has an abnormal coping pattern in dealing with sexuality. An extensive counseling background is needed to provide intensive therapy; therefore, referral to a trained sex therapist is required in these situations.

Perform Activity Analysis

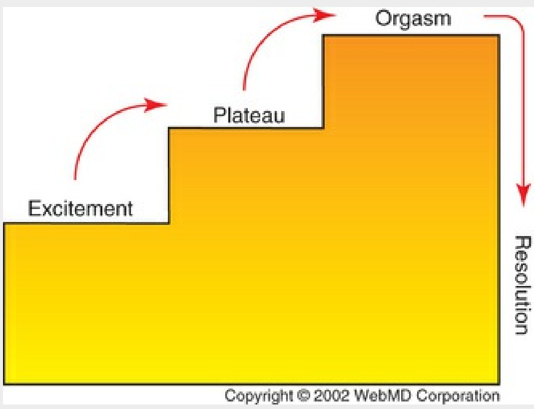
To assess the client's positioning needs, the therapist must analyze the demands of the particular activity. This analysis entails looking at the physical, psychological, social, cultural, and cognitive aspects of the client's functioning. Activity analysis should be implemented, using an objective and professional perspective. The therapist must realize that the sex act itself, if one exists, is only a small part of the act of making love and should be treated as just one more ADL that must be analyzed and with which the client needs professional assistance. The therapist must also remember that not all partners had sexual intercourse on a daily, weekly, or even yearly basis before the onset of the disability. The therapist's values and biases should not be imposed on the client. Same-sex partners, multiple partners, masturbation, or a preference for no sexual activities are some client practices that could evoke bias.

Provide Basic Sex Education

Some clients need basic sex education if they did not have the information before the onset of disability (Box 12.3). Some clients may not have been informed because of the disability, or they may be misinformed about sexual practices.[3,15,45,50] Research has shown that people with hearing impairments have substantially less information about sex than do those without hearing impairments.[68] In one study of adolescents with congenital disabilities, it was found that they were misinformed or not informed about sexual issues and that they relied on health professionals and parents to keep them informed.[6] Women who had not had sex before age 18 years may be less inclined to have sex later if they are not given sexual information.[22,29,45]

Box 12.3

The Sexual Response Cycle



The sexual response cycle has four phases: excitement, plateau, orgasm, and resolution. Both men and women experience these phases, although the timing usually is different. For example, it is unlikely that both partners will reach orgasm at the same time. In addition, the intensity of the response and the time spent in each phase varies from person to person. Understanding these differences may help partners better understand one another's bodies and responses and thus enhance the sexual experience.

Phase 1: Excitement

General characteristics of the excitement phase, which can last a few minutes to several hours, include the following:

- Muscle tension increases.
- Heart rate quickens, and breathing is accelerated.
- Skin may become flushed (blotches of redness appear on the chest and back).
- Nipples become hardened or erect.
- Blood flow to the genitals increases, resulting in swelling of the woman's clitoris and labia minora (inner lips) and erection of the man's penis.
- Vaginal lubrication begins.

• The woman's breasts become fuller, and the vaginal walls begin to swell.

• The man's testicles swell, his scrotum tightens, and he begins secreting a lubricating liquid.

Phase 2: Plateau

General characteristics of the plateau phase, which extends to the brink of orgasm, include the following:

• The changes begun in phase 1 are intensified.

• The vagina continues to swell from increased blood flow, and the vaginal walls turn a dark purple.

• The woman's clitoris becomes highly sensitive (may even be painful to touch) and retracts under the clitoral hood to avoid direct stimulation from the penis.

• The man's testicles are withdrawn up into the scrotum.

• Breathing, heart rate, and blood pressure continue to increase.

• Muscle spasms may begin in the feet, face, and hands.

• Muscle tension increases.

Phase 3: Orgasm

The orgasm is the climax of the sexual response cycle. It is the shortest of the phases and generally lasts only a few seconds. General characteristics of this phase include the following:

• Involuntary muscle contractions begin.

• Blood pressure, heart rate, and breathing are at their highest rates, with a rapid intake of oxygen.

• Muscles in the feet spasm.

• There is a sudden, forceful release of sexual tension.

• In women, the muscles of the vagina contract, and the uterus undergoes rhythmic contractions.

• In men, rhythmic contractions of the muscles at the base of the penis result in the ejaculation of semen.

• A rash, or “sex flush,” may appear over the entire body.

Phase 4: Resolution

During resolution, the body slowly returns to its normal level of functioning, and swollen and erect body parts return to their previous size and color. This phase is marked by a general sense of well-being, enhanced intimacy and, often, fatigue. Some women are capable of a rapid return to the orgasm phase with further sexual stimulation and may experience multiple orgasms. Men need recovery time after orgasm, called a *refractory period,* during which they cannot reach orgasm again. The duration of the refractory period varies among men and usually lengthens with advancing age.

Data from Kaplan HS: *The new sex therapy: active treatment of sexual dysfunctions,* New York, 1974, Routledge; and Masters WH, Johnson VE: *Human sexual response,* Boston, 1966, Little, Brown.

If the OT is not the one to educate the client or the client's partner, the therapist should anticipate the need for information and have resources available for the client to acquire the information. It is not advisable to recommend only books about sexuality and people with disabilities. Such books are useful, but their focus on the disability may be discouraging to some. Books written for the able bodied, such as *The Hite Report: A Nationwide Study of Female Sexuality,*[36] *The Hite Report on Male Sexuality,*[37] and *How to Satisfy a Woman Every Time,*[34] can be helpful. These books will not only give the client an understanding of sex, they will also show the client that he or she is normal, while minimizing the focus on the disability.

Excellent books written for individuals with disabilities also can be recommended. Some of these are *Choices: A Guide to Sexual Counseling with the Physically Disabled,*[51] *Reproductive Issues for Persons with Physical Disabilities,*[33] *The Sensuous Wheeler,*[56] *Sexuality and the Person with Traumatic Brain Injury,*[31] *Sex and Back Pain,*[35] *Sexuality and Disabilities,*[46] *Sexual Function in People with Disability and Chronic Illness,*[62] and *Enabling Romance.*[42]

Summary

This chapter began with the case of Shivani and examined some of the possible needs of people with disabilities that affect the ADLs of sexuality. This topic is a powerful one that the OT must deal with in a professional and sensitive manner. We have seen that Shivani can engage in sexual activity, become pregnant, and be a good parent. She may need assistance with finding the better positions to have sex, and she may learn to enjoy her body and sex even though she was sexually abused. All of these issues may be within the role of the OT and should be dealt with to improve the quality of life for the client.

OTs are concerned with the sexuality of their clients because sexuality is related to self-esteem, it influences the adjustment to disability, and it is an activity of daily living. As with other ADLs, a physical dysfunction can necessitate some changes in the performance of sexual activities. Education, counseling, and activity analysis can be used to solve many common sexual problems confronted by persons with physical dysfunction.

OTs can provide information and referrals to clients who are concerned with sexual issues. Trained therapists can provide counseling. Issues of sexual function, sexual abuse, and values need to be considered in providing sex education and counseling. Through activity analysis and problem solving, physical limitations that affect sexual functioning can usually be managed. Various sexual practices, modes of sexual expression, and expressions of sensuality are possible. The client needs the opportunity to explore her or his needs and acceptable options to meet those needs. The OT is one of the members of the rehabilitation team who has something to offer the client in the area of rehabilitation and sexuality and sensuality.

Review Questions

1. List at least five areas related to sensuality or sexuality that are usually the concerns of the OT.
2. What are some common attitudes of the able-bodied population about the sexuality of persons with physical dysfunction?
3. How do these attitudes affect the disabled person's perception of herself or himself and attitudes toward his or her own sexuality?
4. How is sexuality related to self-esteem and a sense of attractiveness?
5. Describe some typical questions for taking a sexual history. How can these questions be used to clarify values about sexuality?
6. How do mobility aids and assistive devices affect sexual functioning? How can this concern be managed?
7. What are some signs of potential sexual abuse of adults?
8. What are some suggestions for dealing with the following physical symptoms during sexual activity: hypertonia, low endurance, joint degeneration, and loss of sensation?
9. List some medications that may cause sexual dysfunction.
10. Discuss some issues and precautions relative to birth control for the woman with a physical disability.
11. How is a catheter managed during sexual activity?
12. What are some potential problems in pregnancy, delivery, and childcare?
13. Discuss some techniques for educating a person about sexual issues.
14. How should sexual harassment of staff members by clients be handled?

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Resources

SexualHealth.com

http://www.sexualhealth.com

Sexuality Reborn

Video available for purchase from the Kessler Medical Rehabilitation Research and Education Center

(973) 243-6812

Through the Looking Glass

http://lookingglass.org

2198 Sixth Street, Suite 100, Berkeley, CA 94710-2204

1-800-644-2666

American Association of Sex Education Counselors and Therapists

435 North Michigan Avenue, Suite 1717, Chicago, IL 60611

(312) 644-0828

Association for Sexual Adjustment in Disability

PO Box 3579, Downey, CA 90292

Coalition on Sexuality and Disability

122 East 23rd, New York, NY 10010

(212) 242-3900

Sex Information and Education Council of the United States (SIECUS)

130 West Forty-second Street, Suite 2500, New York, NY 10036

(212) 819-9770

Sexuality and Disability Training Center

University of Michigan Medical Center

Department of Physical Medicine and Rehabilitation

1500 East Medical Center Drive, Ann Arbor, MI 48109

(313) 936-7067

The Task Force on Sexuality and Disability of the American Congress of Rehabilitation Medicine

5700 Old Orchard Road, Skokie, IL 60077

(708) 966-0095

http://www.lookingglass.org

http://www.sexualhealth.org

13

Sleep and Rest

Jean S. Koketsu

CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Describe sleep architecture in the young adult population.
2. Describe how sleep architecture changes across the lifespan.
3. Describe the difference between sleep and rest.
4. Describe at least five negative consequences of poor sleep and rest in daily occupations.
5. Name at least seven techniques to promote good sleep hygiene techniques that will optimize conditions to facilitate sleep.
6. Describe the role of the occupational therapy practitioner in sleep and rest.

KEY TERMS

Circadian rhythm
Comorbid insomnia
Excessive daytime sleepiness (EDS)
Homeostasis
Hypnogram
Insomnia
Non–rapid eye movement (NREM) sleep
Polysomnograph (PSG)
Rapid eye movement (REM) sleep
Rest
Sleep
Sleep architecture
Sleep hygiene

Threaded Case Study

Mrs. Tanaka, Part 1

Mrs. Tanaka, a 63-year-old first-grade teacher born and raised in California, was diagnosed with left ischemic cerebrovascular accident (CVA), right hemiplegia. She was admitted to the in-client rehabilitation unit that specializes in clients with neurological injuries or events. She is married and lives with her husband of 40 years in a single-story house, to which she will return. Mrs. Tanaka has two adult children and three grandchildren. Her 65-year-old husband is in good health and will be her caregiver upon discharge.

Prior to the CVA, Mrs. Tanaka enjoyed working as a teacher and taking care of her grandchildren. Her status at evaluation consisted of the following: She had right hemiplegia with severe sensory and perceptual motor deficits. Her right arm was edematous, her muscles were hypotonic and dependent for movement. She was able to follow one-step verbal/gestural cues with moderate assistance. She required maximum assistance for bed mobility, dressing, hygiene, and grooming due to distractibility and impairments in trunk control, balance, awareness of her right side, and endurance. She was totally dependent for bathing, basic transfers, all instrumental activities of daily living (IADLs), and community mobility. Mrs. Tanaka tolerated 15 minutes of the team evaluation before falling asleep. The prior hospital did not note any sleep disturbance.

The occupational therapist (OT) scheduled an appointment to see Mrs. Tanaka in the morning to work on activities of daily living (ADLs), such as bed mobility, transfers, dressing, and hygiene activities. The nursing staff noted that the client had a "rough night" and slept for only 2 to 3 hours. Her hospital roommate complained to the OT that Mrs. Tanaka snores loudly and stated that she wanted to change rooms because of this. Throughout the day, Mrs. Tanaka was unable to participate in all therapies because of her sleepiness. As the first week of her rehab stay progressed, she continued to have difficulty participating in therapies because of her sleepiness.

Mrs. Tanaka, her family, and the rehab team are concerned about her inability to get restful sleep at night and to stay awake during the day, so as to fully benefit from therapies and to reach her rehab goals before returning home.

This chapter addresses sleep and rest, two occupational performance areas within the domain of OT practice.[12]

Critical Thinking Questions

1. What is the role of the occupational therapist in addressing Mrs. Tanaka's sleep disturbance?

2. What are sleep and rest, and why do OTs need to address these areas of occupation?

3. What can an OT do to help with Mrs. Tanaka's sleep difficulty?

To help guide OTs in their practice, the American Occupational Therapy Association (AOTA), the national organization representing occupational therapy in the United States, has established the Occupational Therapy Practice Framework (OTPF).[12] The OTPF is reviewed every 5 years and is considered an evolving document. The original OTPF (2002)[8] identified seven performance areas in which humans engage; in this first edition, sleep and rest were organized under the category Activities of Daily Living (ADLs). The second edition (OTPF-2 [2008]) contained several revisions,[10] and one change was reclassification of sleep and rest as its own category of occupation. In the OTPF-3, sleep and rest remains its own separate category of occupation among seven other categories. [12]

In 1922 Adolf Meyer,[113] considered one of the founders of occupational therapy, wrote that the "big four" areas in life that need to be balanced and in rhythm, even under difficult circumstances, were work, play, rest, and sleep. Many years later the OTPF-2 stated, "Unlike any other area of occupation, all people rest as a result of engaging in occupations and engage in sleep for multiple hours per day throughout their life span" (OTPF-2, p. 665).[10] Another reason cited in the OTPF-2 for categorizing sleep and rest as its own occupation was "[s]leep significantly affects all other areas of occupation."[10] (OTPF-2, p. 665). In 2007 Jonsson had suggested that providing sleep prominence in the Framework as an area of occupation promoted the consideration of lifestyle choices as an important aspect of participation and health (OTPF-2, p. 665).[10,93] As mentioned, the OTPF-3 continues to present sleep and rest prominently as an occupation.

Because sleep and rest are considered an occupation in its domain of practice, it is appropriate for an occupational therapist to address sleep and rest when treating Mrs. Tanaka.

History of Sleep and Rest in Occupational Therapy

From the earliest published writings in occupational therapy, sleep was considered to be important. In October, 1921, while presenting a paper at the Fifth Annual Meeting of the National Society for the Promotion of Occupational Therapy (now known as the American Occupational Therapy Association), Adolf Meyer stated:

There are many other rhythms which we must be attuned to: the larger rhythms of night and day, of sleep and waking hours, or hunger and its gratification, and finally the big four—work and play and rest and sleep, which our organism must be able to balance in all this actual doing, actual practice, a program of wholesome living as the basis of wholesome feeling and thinking and fancy and interests.[113]

Even though the founders of occupational therapy considered sleep and rest important for a healthy balance in life, this area seems to have been forgotten in the OT literature, and in OT practice.

Green[71] suggested that occupational therapy has paid little attention to the area of sleep because influential scholars in the field have omitted sleep definitions from classifications of occupations. Green also noted that occupational scientists are uncertain about whether sleep is considered an occupation. In his research, Green found evidence in the occupational science literature on sleep with respect to time use and of occupational therapists giving advice on sleep. However, he noted, "Coverage has been neither consistent nor comprehensive and it is unclear why sleep has been considered by so few writers."[71]

Howell and Pierce[85] suggested that Meyer's ideas about the importance of the occupations of sleep and rest were not embraced or further developed in occupational therapy because of the culture's overemphasis on productivity in industry, business, home management, and even leisure. The authors believe that the Protestant work ethic, the Industrial Revolution, and the Victorian era all played a role in shaping current Western views on restorative occupations. They pointed out that Meyer's message was ignored in Western society because "it is generally believed that valuable time is wasted while sleeping, time that could be spent more productively."[85]

In a review of OT textbooks published since 1990, Green[71] found that information on sleep was limited. He pointed out, however, that Yasuda[71,79,188] and Hammond and Jefferson[79] addressed the topic more thoroughly in chapters on fibromyalgia and rheumatoid arthritis, respectively.

More recent major textbooks used by OT students and practitioners have included chapters on the topic of sleep and rest.[101,159] Similarly, Green and Westcomb[75] edited a book on sleep in which the perspectives of various disciplines, including occupational therapy, were represented. In 2015 Green and Brown[72] edited a book focused on sleep that was intended specifically for occupational therapists.

The AOTA has produced the document "Blueprint for Entry-Level Education,"[11] which identifies key content areas that should be included in OT students' course of study. The topic of sleep and rest was included on the list of occupation-centered factors that should be included in entry-level curriculum content.

In 2013, in an opinion piece in the *British Journal of Occupational Therapy,* Fung et al.[63] proposed that "sleep (and wakefulness) should be routinely assessed and addressed as part of standard occupational therapy practice." They recommended more sleep and wakefulness education in OT curriculums; more education on sleep itself and on assessments, interventions, and tools pertaining to it, and more attendance by OTs at professional development workshops held by experts in the field. O'Donoghue and McKay[136] studied the impact of obstructive sleep apnea (OSA) on occupations in Ireland and agreed that OTs' interventions can have a significant impact on the lives of people with sleep disorders.

It should be considered that occupational therapists may be so busy helping clients in areas of occupations when the client is awake that focusing on the area of sleep may be given lower priority. For example, the areas an OT needs to address with Mrs. Tanaka are numerous and can be overwhelming for a novice practitioner, or even for an experienced OT, given the time pressures for clients to meet functional and other occupational goals. Data have shown that in-client rehabilitation stays have shortened for clients with a CVA, whereas acuity levels have risen, as evidenced by lower Functional Independence Measure (FIM) scores on admission and discharge.[70] Pressures for Mrs. Tanaka to meet her goals quickly are high.

Because sleep and rest are now identified as a category of occupation in itself; major OT textbooks cover the topic more thoroughly; and the AOTA blueprint supports sleep education and the interest of international OT researchers, it is anticipated that educational programs will cover the occupation of sleep and rest more thoroughly in their curriculums and that practicing therapists will advance their knowledge in this area.

Occupational Therapy's Definition of Sleep and Rest

Sleep

OT definitions of sleep and rest are fluid (or fluctuating), changing as more research is dedicated to this understudied occupation. For example, the OTPF-3[12] does not give a definition of **sleep** itself in the glossary, but rather describes the activities surrounding this occupation, such as preparing for sleep, tending to nighttime toileting needs, and performing nighttime caregiving for others (eg, breastfeeding). The OTPF-3 describes sleep in relation to other occupations and to its role in supporting "healthy, active engagement in other occupations"[12] (OTPF-3, p. S20).

The OTPF-2 had defined sleep as "[a] natural periodic state of rest for the mind and body, in which the eyes usually close and consciousness is completely or partially lost, so that there is a decrease in bodily movement and responsiveness to external stimuli."[10] During sleep, the brain in humans and other mammals undergoes a characteristic cycle of brain wave activity that includes intervals of dreaming.[10,167] The OTPF-2's definition of sleep included the statement that consciousness could be completely lost during sleep.[10]

The OTPF-3 alludes to sleep preparation as "preparing the physical environment for periods of unconsciousness …"[12] (OTPF-3, p. S20). However, Mahowald,[108] a sleep researcher, has stated, "There is now overwhelming evidence that the primary states of being (wakefulness, NREM sleep and REM sleep) are not mutually exclusive, but may become admixed or may oscillate rapidly, resulting in numerous clinical phenomena." Coren,[42] a psychologist and author on sleep, pointed out that at some level, our vision, hearing, and sense of touch are still functioning to some extent when we are asleep.

Human sleep is not just the opposite of wakefulness, or wakefulness the opposite of sleep.[109] It appears that consciousness is not completely lost during sleep.

Rest

In the OTPF-3, **rest** is defined as "engaging in quiet and effortless actions that interrupt physical and mental activity, resulting in a relaxed state"[12] (OTPF-3, p. S20). According to the OTPF-3, rest includes identifying a need to rest and relax, reducing involvement in taxing (physically, mentally, or socially) activities, and participating in relaxation or other activities that restore energy, calm, and renewed engagement.[12]

Nurit and Michal[134] compared how the literature of the various fields that interact with occupational therapy conceptualize rest. Psychology, they pointed out, considers rest a basic human need,[110] whereas the nursing profession differentiates between physical and mental rest. Various religions and philosophies view rest as important for restoration and focus. The researchers concluded that although the various fields may have different concepts of rest, they all concur with occupational therapy that rest is important for a healthy, balanced life.

Nurit and Michal also reviewed debates surrounding the concept of bed rest in medicine. They noted that, historically, rest was highly recommended[28,134]; however, they also pointed to research that has shown that clients on bed rest, compared to clients in ambulatory groups, may experience detrimental effects to their health.[4]

This chapter focuses on the general concept of rest, rather than the idea of physician-ordered bed rest (ie, not allowing a client out of bed for medical or safety reasons).

Sleep and Rest

The OTPF-3 explains that the concepts of both sleep and rest include "activities related to obtaining restorative rest and sleep that supports healthy active engagement in other occupations"[12] (OTPF-3, p. S20). Instead of categorizing the occupations into what she called "adopted cultural categories" of work, play, leisure, and self-care, Pierce[146] described the categories of occupation based on how the individual experiences them. She described three categories of occupation as *pleasurable,* which includes play and leisure; *productive,* which includes work; and *restorative* types of occupations, which include sleep, self-care, and quiet activities.[145,146] Among the pleasurable, productive, and restorative occupations, Howell and Pierce[85] considered restorative occupations the least recognized. In 2003 Pierce[146] stated, "In our clients, the need for improvements in the restorative quality of their occupational patterns can be critical. Without adequate restoration, productivity and pleasure also remain low."

Need to Address Sleep in Occupational Therapy

It is important to emphasize that a founding figure of the OT profession, Adolf Meyer, regarded sleep as one of the four main areas that determine whether humans can function (in addition to work, rest, and play). It is also noteworthy that the OTPF considers sleep a major human occupation.[12] Perhaps an even more compelling reason that OTs should address sleep is because it is an occupation in which every human being across the age span engages in or should engage in. Of the eight occupations listed in the OTPF-3, sleep and rest is the only one that cannot be performed by someone else or by an alternative means. The environment and actions surrounding sleep can be adapted, but the act of sleeping itself is the only occupation that cannot be adapted for an individual to function optimally, let alone survive. As Dahl[45] bluntly stated, "Sleep is not some biological luxury. Sleep is essential for basic survival, occurring in every species of living creature that has ever been studied. Animals deprived of sleep die."

As this chapter illustrates, sleep (or the lack thereof) affects almost every client population with whom OT practitioners work and within virtually every setting.

Need to Address Rest in Occupational Therapy

As mentioned previously, rest, along with sleep, is considered one of the primary occupational performance areas in the OTPF-3.[12] However, rest should not be confused with sleep. According to Dahl,[45] "Sleep is not simply rest. Mere rest does not create the restorative state of having slept." If a client such as Mrs. Tanaka "rests" during the day but does not sleep, she will still suffer the loss of sleep and therefore of all its unique restorative benefits.

Howell and Pierce[85] discussed the importance of rest in addition to sleep for physical, cognitive, and mental restoration. They noted the uniqueness of individuals in deciding which occupations are restorative, and how one person may consider a particular activity to be relaxing and calming, whereas another may not. The authors also pointed out that occupations that are highly restorative tend to have strong routines of a simple and even repetitive nature, and they are often considered pleasurable and have personal meaning to the individual based on tradition and history with the occupation.

Edlund,[57] an expert on rest, body clocks, and sleep, described four different forms of active rest that are needed in addition to sleep: physical rest, mental rest, social rest, and spiritual rest. He stated, "Rest is not useless but a major pathway to our renewal, our survival."[57] His book, *The Power of Rest: Why Sleep Alone Is Not Enough: a 30-Day Plan to Reset Your Body,* provides information on how a person can obtain those types of rest efficiently.

Sleep and Rest and Occupational Justice

Occupational justice describes the OT profession's concerns with the ability of all people, "regardless of age, ability, gender, social class or other differences"[133] to be given the opportunity to engage in occupations. Occupational justice describes concerns that OT practitioners have about the ethical, moral, and civic aspects of clients' environments and contexts.[12] Sleep is an occupation that is optimized by a safe setting and environment, especially for someone with a physical or mental disability. In a 2014 point-in-time survey of communities across the United States, 49,933 homeless veterans (8.6% of the total) were identified.[120] Significantly, 54% of these homeless veterans were found to have a mental or physical disability.

Homeless veterans tend to be male (91%), single (98%), live in a city (76%), and have a mental and/or physical disability (54%). Black veterans are substantially overrepresented among homeless veterans, comprising 39% of the total homeless veteran population, but only 11% of the total veteran population.

Sleep researchers Dement and Pelayo[52] stated, "It is a deplorable fact that in the inner portions of our large cities, we have begun to see large numbers of individuals who are homeless and who do not have a comfortable, safe place to sleep." Occupational therapists work with many people in society who may not statistically be considered homeless, but these people may live (and sleep) in substandard environments. Even other species attempt to find safe places to sleep.

History of Sleep in Society and Cultural Influences

Howell and Pierce[85] stated that one of the most significant forces to shape our current view of occupations is the Protestant work ethic, which evolved during the Protestant Reformation of the 1500s. The values of honesty, thrift, and hard work were embraced during this time in Europe. Leisure (often associated with pleasurable, "nonproductive" activities such as sleep and rest) was considered a potential temptation into sin and thus to be avoided, similar to the belief in the adage "idle hands are the devil's workshop."

In 1996 Coren[42] pointed out that the invention of the light bulb by Thomas Edison had a powerful influence over sleep and served to transform society, making shift work possible throughout the night. Prior to the introduction of the modern tungsten filament light bulb in 1913 (an inexpensive and long-lasting bulb), the average person slept 9 hours a night, as was documented by a 1910 study. The new light bulb served to "free" working people from working in darkness; but, ironically, it may have simultaneously served to reduce the hours of sleep for future generations.

The National Commission on Sleep Disorders Research, mandated by the U.S. Congress, concluded in the 1990s that the "root cause of pervasive sleep deprivation and unidentified sleep problems is the continued low level of public and professional awareness due to failure to give sleep topics adequate attention in the educational system."[52] In 2015 Dement and Pelayo[52] pointed out that international surveys conducted since the 1800s show that people in industrialized nations are sleeping less than they did a century ago. Dement and Pelayo[52] referred to studies in Japan, where surveys were conducted annually; they noted that these surveys showed an overall reduction in the daily amount of sleep of $1\frac{1}{2}$ hours since 1920.

In a poll conducted in 2009 by the U.S. National Sleep Foundation (NSF),[129] 1000 telephone interviews were conducted among a random sample of Americans in the continental United States. Respondents were at least 18 years of age and a head of the household. They were asked how many hours of sleep they needed to function at their best during the day. On average, respondents reported needing 7 hours and 24 minutes to function at their best. However, they reported getting an average of 6 hours and 40 minutes of sleep on a typical workday or weekday, almost $2\frac{1}{2}$ hours less than people had reported in 1910. The 2014 NSF poll[131] found that of 1103 adults polled who were parents of or had parental responsibility for a child aged 6 to 17 in their household, more than 90% felt that sleep was either very or extremely important for their own mood, health, and performance, in addition to the mood, health, and performance of their children. Although the parents felt that getting enough sleep was important, they acknowledged that their children were not getting enough, especially as the children got older.

These statistics point to the existence of a culture-wide "sleep debt," a point of relevance for occupational therapists, whose overarching goal, according to the OTPF-3,[12] is "achieving health, well-being, and participation in life through engagement in occupation."

Mrs. Tanaka, whose primary cultural influence is Western, has her own beliefs and values about sleep. Therefore, it is of utmost importance to identify Mrs. Tanaka's and her family's beliefs about sleep. Is sleep considered important or a waste of time?

Cultures of Sleep Practices

Sleep behavior among Western industrial societies is distinctive to that culture. In a comparative analysis of sleep among industrialized Western society and indigenous cultures, Worthman and Melby[186] pointed out several uniquely Western sleep practices, including the following:

1. Solitary sleep from early infancy, supported by cultural norms and beliefs about the risk of an overlying need for infant independence or autonomy and the need for sexual decorum

2. Consolidation of sleep into a single long bout

3. Distinct bedtimes enforced in childhood and reinforced by highly scheduled daytime hours for work or school and mechanized devices for waking

4. Housing design and construction that provide remarkably sequestered, quiet, controlled

environments for sleep in visually and acoustically isolated spaces

In contrast, non-Western sleepers habitually engage in co-sleep in shared beds or spaces.[186] In 2012 Steger[162] reported that in some cultures, it would be "simply unthinkable" to leave a baby or toddler to sleep alone in a room. Steger also pointed out that mothers in Japan are convinced that it is important to convey a sense of security and belonging to their children by sleeping with them, not firmly putting children to bed alone in a room and letting them cry themselves to sleep.

Steger[162] pointed out that in monophasic sleep cultures (one long bout of night sleep), only "marginal social groups" (eg, children or sick people) or night shift workers are allowed to sleep during the day. A "siesta culture," as described by Steger, supports biphasic sleep in which there is a predetermined time for night and midday sleep. Social life quiets down during the night and early afternoon. A "napping culture" (polyphasic sleep) occurs when there are often irregular sleep times during the day in addition to the regulated nighttime sleep. However, there are many other sleep cultures within those three basic types.

Compared to Western cultures, other cultures may have more fluid sleep schedules and more fluid sleep/wake states, and may fall asleep and remain asleep in more sensorially dynamic settings.[186] As mentioned, Western sleep areas, by design, provide minimal sensory stimulation[186] (ie, protection from the elements, minimal contact with others, climate control, and negligible noise, movement, or light). Compared to this, sleepers in other cultures may sleep exposed to the elements and co-sleep, and may be accustomed to sounds, movement, and light. For example, the Ache (Paraguay), Hiwi (southern Venezuela), Efe (Zaire), and !Kung (northwest Botswana) use fire as light, heat, and protection at night and therefore may need to tend the fire and awaken frequently to monitor it.[186]

Humans universally sleep in a recumbent position (unless ill or during infancy) but can differ widely in terms of accessories (eg, bedding).[186] For example, "foragers" (eg, Ache, Efe, !Kung) who inhabit tropical or mild climates and move regularly do not sleep on platforms but directly on the ground.[186] !Kung sleep on skin, a blanket (or nothing) over conforming sandy ground. Efe sleep on thin layers of leaves or between logs. Hiwi use hammocks. According to Worthman and Melby,[186] none of the groups listed regularly use pillowing material or coverings, whereas Westerners use an abundance of these. The minimal use of bedding by the groups listed may have to do with available technology and resources, but it may also have to do with avoidance of pests such as fleas, bedbugs, lice, or mites, which thrive in bedding material.[186]

Human beings have a tremendous diversity in sleep patterns and sleep developmental histories based on cultural background and upbringing.[186] Steger[162] suggested that four major sources of the emotional security required for relaxing and peaceful sleep shape sleep practices around the world:

1. Stability of the physical sleep environment/sleeping place

2. The presence of trusted people

3. Recurring rituals or routines

4. Social acceptance of certain sleep behavior (Fig. 13.1).

FIG 13.1 This 3½-year-old boy uses a teddy bear as a sleep aid, for comfort and a sense of security. It is considered socially acceptable at this young age, but it would not be so as he moves into the teen years and adulthood. (Courtesy Jean S. Koketsu.)

It is important for occupational therapists to be aware of a client's sleep history and culture so they can set realistic and meaningful goals for the client in the area of sleep. The OTPF-3 acknowledges that client engagement in occupations within cultural contexts influence how the occupation is organized.[12]

The occupational therapist treating Mrs. Tanaka should find out what her typical sleep habits were prior to the stroke. Did she sleep in her bed alone or with her husband? What time did she normally go to bed and wake up? Did she usually take naps? What habits or routines did she have before going to sleep or upon waking up? Did she experience interruptions during sleep, such as getting up to go to the bathroom? What kind of bed did she sleep on? What are her sheet and pillow preferences? Was there noise in the room where she slept? What are comfortable light and temperature levels for her?

Brief History of Sleep Medicine

Sleep medicine as a medical specialty is relatively new. William C. Dement, a pioneer in sleep medicine himself, considers Nathaniel Kleitman, a physiologist who started studying sleep in the 1920s, as the first to devote his professional life to the study of sleep.[49,50,52] Kleitman and Aserinsky first described **rapid eye movement (REM) sleep** in the early 1950s, and overnight electroencephalograms (EEGs) were first reported in the late 1950s by Dement and Kleitman.[51] In 1965 sleep apnea was identified in Europe, and in 1970, Dement founded the first sleep disorders center at Stanford University Hospital. The 1970s saw a proliferation of sleep disorder clinics. Since that time, sleep medicine has become a specialty in medicine; scholarly journals focusing on sleep were launched; national and international organizations that focused on sleep research and education were founded; and a congressional commission focused on sleep was mandated.

Dement and Pelayo[52] reported that there was no scholarly discipline that was the "best candidate to assume responsibility for the education of the public about sleep." They found that traditional academic organizations of colleges and universities viewed psychology and biology departments as the "obvious homes" of the topic. Fung et al.[63] argued that "occupational therapists should be equipped with a subset of skills to assess and address sleep in practice." In these researchers' view, occupational therapy seemed to be an "obvious home," or at least a good home, for this discipline.

The OTPF-3 highlights the importance of how engagement and participation in an occupation (such as sleep) occur in physical, social, cultural, and even virtual contexts, which must be considered in the process of helping people with occupational concerns. Sociologists Williams et al.[180] made note of the "medicalization" of sleep issues (ie, the "cultural framing of sleep problems as medical matters") and described how popular culture and media can play a role in defining and highlighting sleep concerns and opinions about sleep.

This chapter addresses sleep definitions and problems sometimes more from a medical perspective. However, the complex and varied dimensions of sleep must be considered; OTs cannot just "medicalize" the issue.

Definition of Sleep According to Sleep Medicine

Behavioral Definition

According to Carskadon and Dement,[36] the two defining characteristics of sleep are (1) being a reversible behavioral state and (2) demonstrating perceptual disengagement from and unresponsiveness to the environment. The perceptual disengagement is compared to the waking state in which humans are conscious or aware of various sights, sounds, smells in the world.[52] For example, Dement and Pelayo[52] pointed out that even if the eyelids are taped open, we stop seeing when we fall asleep. However, this perceptual disengagement is not unconscious and is still considered an active process. Reversibility, the other essential defining characteristic quality of sleep, means that a person could be taken out of that state relatively easily based on the stage of sleep he or she is in.[52] Other sleeplike states, such as coma, anesthesia, and hibernation, are differentiated from normal sleep because of the difference in reversibility.[52]

Dement and Pelayo[52] considered sleep a restorative process, with "sleep and wakefulness occur(ring) as complementary phases in the daily cycle of existence." Sleep is usually characterized by closed eyes, postural recumbence (lying down), and behavioral quiescence.[36] Other sleep behaviors also may occur, such as sleep talking and sleepwalking.[36]

Scientists have described several discrete stages of sleep based on brain wave patterns and eye and muscle activity. The two major types of sleep are **non–rapid eye movement (NREM) sleep** (NREM is pronounced non-rem) and REM sleep.[52] The two states (NREM and REM) exist in virtually all mammals and birds and are as distinct from each other as sleep is from the waking state.[36]

The American Academy of Sleep Medicine (AASM) characterizes the sleep stages as stage N1 (NREM 1), stage N2 (NREM 2), stage N3 (NREM 3), and stage R (REM).[88] It should be noted that from 1968 to 2007, NREM sleep was divided into four stages (stages 1 to 4); at that point, stages 3 and 4 were combined into one (N3, or slow wave sleep), according to the AASM.[52] NREM sleep accounts for 75% to 80% of total sleep time in young adults. The stages are defined by brain wave patterns from an EEG. The EEG pattern in NREM sleep is synchronous and shows wave forms called spindles and K complexes, in addition to high-voltage slow waves (Fig. 13.2). Carskadon and Dement[36] gave a shorthand definition of NREM as a relatively inactive state yet actively regulating the brain in a movable body.[36]

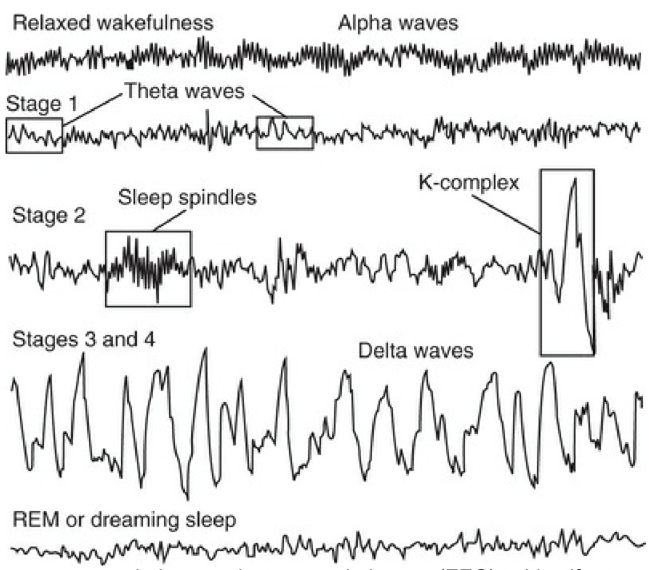

FIG 13.2 Brain waves recorded on an electroencephalogram (EEG) to identify stages of sleep. (From Epstein LJ, Mardon S: *Harvard Medical School guide to a good night's sleep*, New York, 2007, McGraw-Hill.)

REM sleep accounts for approximately 20% to 25% of total sleep time in young adults and is defined by EEG activation, muscle atonia or paralysis, and occasional bursts of rapid eye movements.[36] The eye movements are binocularly synchronous and rapid, although drifting movements may be seen.[52] REM sleep is associated with dreaming.[52] This is based on vivid dream recall reported after approximately 80% of arousals from this state of sleep.[51] Spinal motor neurons are inhibited by brainstem mechanisms that suppress postural motor tonus during REM sleep. It is believed that the body is paralyzed during REM sleep to protect dreaming individuals from physically acting out dream content and injuring themselves or others, although brief, minor position shifts or limb movements occur. Carskadon and Dement's short definition of REM sleep is an activated brain in a paralyzed body.[36]

Evidence from human beings and other species suggests that mammals have only minimal ability to thermoregulate during REM.[36] The poor ability to respond to temperature extremes during REM suggests that problems with temperature regulation may be worse later during the night, when REM sleep tends to predominate; these are important considerations for OT practitioners working with people with thermoregulation problems. Interestingly, Carskadon and Dement[36] pointed out that sweating or shivering during sleep under ambient temperature extremes occurs in NREM sleep and is limited during REM sleep.

Sleep Architecture

Polysomnography

A **polysomnograph (PSG)** is a continuous recording of specific physiological variables during sleep. It is typically performed at night during a sleep study in a sleep clinic. The PSG quantifies sleep; the AASM recommends measuring brain waves (via electroencephalogram [EEG]), eye movements (via electrooculogram [EOG]), chin and leg muscle movements (via electromyogram [EMG]), airflow, oxygen saturation, and body positions.[88] The AASM also recommends that in addition, the PSG record respiratory, arousal (wake-up), cardiac (eg, heart rate), movement, and behavioral events.[88]

The sleep stages are charted on a diagram, called a **hypnogram** (histogram, or graphical representation of sleep), made from the data collected from the PSG. The chart resembles a city skyline and is referred to as **sleep architecture** by sleep experts (Fig. 13.3). A client's sleep architecture describes the details of an individual's sleep after an overnight recording of EEG, EOG, and EMG. The histogram shows the following:

- Time needed to fall asleep (sleep latency)
- Sequence of sleep stages
- Time spent in each stage of sleep
- Total sleep time
- Number and length of nighttime wakenings[49]

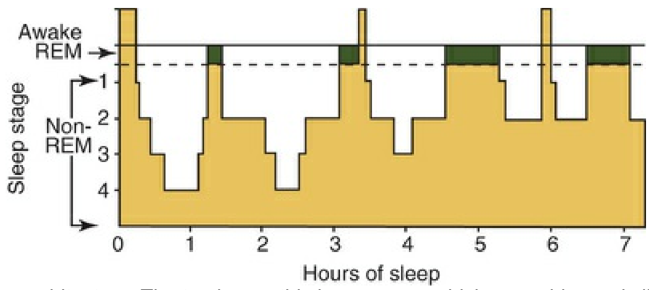

FIG 13.3 Sleep architecture. The tracing on this hypnogram, which resembles a skyline, illustrates a typical night's sleep. A hypnogram charts the sleep stages during an overnight sleep study. (From Epstein LJ, Mardon S: *Harvard Medical School guide to a good night's sleep*, New York, 2007, McGraw-Hill.)

Actigraphy

Actigraphy is another way sleep is measured. It is increasingly used in research and in the clinical care of clients with sleep issues.[117] The client wears a motion sensor on the wrist, and the sensor continuously monitors movement.[52] The data can be downloaded immediately, or the sensor can be worn for a specified period. Actigraphy is more convenient and less expensive than a PSG.[52] In recent years smart phone apps and sleep management systems have been developed to track sleep.

Progression of Normal Sleep

Normal young adults first enter sleep through NREM sleep, and REM sleep occurs 80 to 100 minutes afterward. Throughout the night, in approximately 90-minute periods, cycles of NREM and REM sleep alternate, usually with progressively increasing periods of REM sleep.[36] Box 13.1 lists the general stages of sleep and describes the bodily functions that occur during these stages.[a]

Box 13.1

Stages of NREM and REM Sleep

Non–Rapid Eye Movement (NREM) Sleep

Stage N1 (1–7 Minutes)

Stage N1 is considered transitional wakefulness to sleep onset or to rapid eye movement (REM) sleep. The body temperature begins to drop, muscles start to relax, and the eyes may move slowly from side to side. An electroencephalogram (EEG) shows brain waves slowed to 4 to 7 cycles per second *(theta waves).* A person in this phase can be easily wakened by tapping him or her or softly calling the individual's name (low arousal threshold). However, everyone experiences stage N1 differently. If awakened in this stage, one person may say he or she was asleep, whereas another may only say that he or she was drowsy. A common sign of severely disrupted sleep is an increased amount and percentage of sleep in this phase.

Stage N2 (About 10–30 Minutes)

Stage N2 follows stage N1. The eyes aren't moving much, and the heart rate and breathing are slower than when the person is awake. This is the first stage of established sleep. Brain waves are irregular; the EEG shows intermediate-sized brain waves with brief bursts of fast sleep spindles, or K-complexes, that occur about every 2 minutes. Generally, a more intense stimulus is required to arouse a person in this stage (higher arousal threshold). In the later phases of this stage, the EEG shows high-voltage slow wave activity. Overall, this stage may account for half the night.

Stage N3 (About 20–40 Minutes in the First Cycle)

Stage N3 sleep is also called *delta sleep* or *slow wave sleep* (it formerly was called stage 3 and stage 4 sleep). Breathing slows and becomes more regular, and the blood pressure and pulse fall to 20% to 30% of the waking state. The EEG shows high-amplitude slow waves. Stage N3 accounts for approximately 10% to 15% of total sleep time, but it may be undetectable in older adults, especially men.

Rapid Eye Movement (REM) Sleep

Stage R (About 1–5 Minutes in the First Cycle, Increases up to 30 Minutes)

The body temperature, blood pressure, heart rate, and respiratory rate all increase and are often irregular. The clitoris or penis may become erect. The EEG shows a dramatic decline in amplitude, which resembles the waking state. Thermoregulation is severely inhibited. Motor neurons also are inhibited, which means major muscles are paralyzed, except the diaphragm and the ocular muscles.

Note: See Fig. 13.1 for brain wave patterns during sleep. Slow wave sleep (SWS) is considered the most restorative phase for physiological repair, whereas REM sleep is believed to be necessary for memory consolidation.

Sleep Across the Age Span

Research shows that age is the strongest and most consistent factor that affects sleep stages (Fig. 13.4).[36,140] The biggest difference in sleep stages is seen in newborns, who enter from wake to sleep through the REM phase first for the first year of life (Fig. 13.5). Infants also cycle between REM and NREM, but they cycle through the phases in 50 to 60 minutes instead of the approximately 90 minutes seen in adults. At birth, active (REM) sleep accounts for approximately 50% of total sleep and declines over the first 2 years to approximately 20% to 25%.[36] Infants do not seem to have fully developed and recognizable NREM sleep until they are 2 to 6 months old.[36] Stage N3, also known as deep or slow wave sleep (SWS), is maximized in young children but decreases markedly with age in quantity and quality (Fig. 13.6). That may explain why children may be very difficult to arouse when they are in SWS in the first cycle, whereas an older adult may be easier to awaken in that phase.

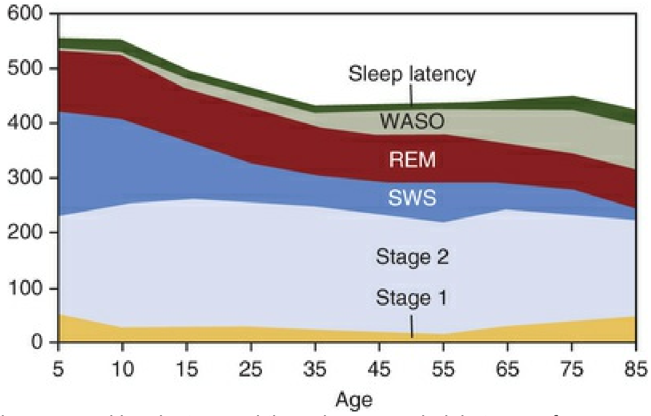

FIG 13.4 Time is measured in minutes, and the values recorded, in terms of age, are sleep latency (the time it takes to fall asleep), wake time after sleep onset (WASO), rapid eye movement (REM), slow wave sleep (SWS), and stage 1 and stage 2 sleep. Note that as we age, it takes longer to fall asleep (sleep latency increases), the time spent in deep sleep decreases, and the time spent in stages 1 and 2 increases. Also note that SWS decreases markedly during adolescence. As we age, night awakenings (WASO) also increase. (From Ohayon M, et al: Meta analysis of quantitative sleep parameters from childhood to old age in healthy individuals: developing normative sleep values across the human lifespan, *Sleep* 27:1255–1273, 2004.)

FIG 13.5 Newborns enter REM sleep first for the first year of life and cycle through REM and NREM sleep within 50–60 minutes, instead of the 90 minutes seen in adults. (Courtesy Jean S. Koketsu.)

FIG 13.6 A 22-month-old child has no social qualms about falling asleep anywhere, even on a public diaper-changing table. Young children's deep sleep is maximized, so they may be very difficult to arouse from stage N3 sleep. (Courtesy Windy Chou.)

Adolescence.

Contrary to popular belief, teenagers require more sleep than adults. As cited by Carskadon[35] and Carskadon et al.,[37] evidence shows that teenagers need at least 9 to $9\frac{1}{4}$ hours of sleep a night to maintain optimal alertness. Teenagers also have been shown to have a phase delay in the circadian timing system, which means that their biological clocks alert them to stay up late and sleep in later (eg, sleep from midnight to 9 am).[37] The quantitative change in SWS may best be seen across adolescence; SWS decreases by nearly 40% during the teen years, even while nocturnal sleep remains constant.[36] These are important considerations in OT practice in terms of clients' scheduling and optimal performance of occupations.

Adulthood and aging.

From ages 20 to 60, sleep patterns don't change as rapidly as during childhood. However, there are consistent trends that occur in sleep patterns, such as decreased sleep efficiency, decreased time in restorative deep sleep, and easier arousal during the deep sleep phase (Table 13.1). After age 60, the sleep trends of adulthood continue.[58] A hallmark of aging is an increased percentage of time in stage N1 (NREM sleep) and a decreased percentage of time in N3 (deep, SWS), particularly in men. Sleep efficiency also decreases as a person ages. Sleep efficiency is measured by dividing the actual time a person is asleep by the amount of time he or she is in bed. Sleep efficiency at approximately age 45 is 86%, and it declines to 79% for those over age 70. Brief arousals are also more common in the elderly. In addition, older adults may have an advanced sleep phase, meaning that they may get sleepy in the early evening and have a tendency to awaken early in the morning.[36]

TABLE 13.1

Sleep Changes With Aging

	Age 20	Age 40	Age 60	Age 70	Age 80
Sleep latency	16 min	17 min	18 min	18.5 min	19 min
Total sleep time	7.5 hr	7 hr	6.2 hr	6 hr	5.8 hr
Time in stage 2 sleep	47%	52%	53%	55%	57%
Time in deep sleep	20%	15%	10%	9%	7.5%
Time in REM sleep	22%	21%	20%	19%	17%
Sleep efficiency	95%	88%	84%	82%	79%

Data from Epstein LJ, Mardon S: *Harvard Medical School guide to a good night's sleep*, New York, 2007, McGraw-Hill, p 43; and Ohayan M, et al: Meta analysis of quantitative sleep parameters from childhood to old age in healthy individuals: developing normative sleep values across the human life span, *Sleep* 27:1255–1273, 2004.

Carskadon and Dement[36] reported that possibly the most notable finding about sleep in the elderly is the profound increase in interindividual variability, which precludes generalizations such as those made for young adults.

Circadian Rhythm, Homeostasis, and Allostasis

The timing of human sleep is regulated by two systems in the body: the circadian biological clock and sleep/wake homeostasis.

Circadian rhythms are approximately 24-hour cycles of behavior and physiology that are generated by biological clocks (pacemakers or oscillators).[115] The internal biological clock regulates the timing and periods of sleepiness and wakefulness, temperature, blood pressure, and the release of hormones throughout the 24-hour day without need of outside cues for the clock to persist. However, environmental stimuli known as *zeitgebers*, or "time cues," help synchronize the internal clock to the 24-hour day. Light is the most dominant zeitgeber for most species[115]; bright light has the ability to shift circadian rhythms. Blind people who may not have a conscious perception of light can still entrain to the 24-hour day because human eyes have irradiance detectors that can sense light despite the inability to produce a visual image.[143] The receptors may remain intact in many people with blindness, which allows entrainment as usual. However, people without eyes (or the receptors) often have difficulty with entrainment and may have circadian rhythm problems.[143]

The master circadian (24-hour) clock, which is located in the suprachiasmatic nucleus (SCN) in the hypothalamus of the brain, dictates when we feel sleepy and when we feel most awake. Melatonin, a naturally occurring hormone, is inhibited by light. It is secreted by the pineal gland at night, which induces sleep and has the ability to synchronize circadian rhythms (Fig. 13.7).[150]

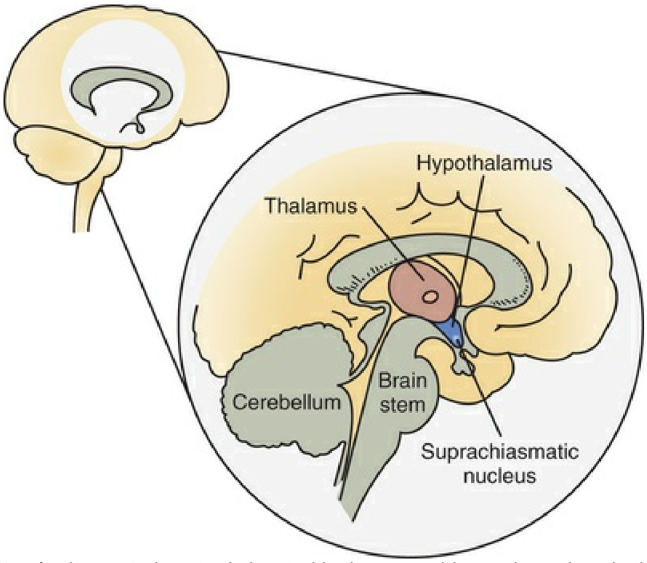

FIG 13.7 The sleep/wake control center is located in the suprachiasmatic nucleus in the hypothalamus. This "pacemaker" regulates the circadian rhythm of sleep and wakefulness. (From Epstein LJ, Mardon S: *Harvard Medical School guide to a good night's sleep*, New York, 2007, McGraw-Hill.)

The circadian rhythm for sleep and wakefulness is bimodal; the strongest desire to sleep occurs between midnight and dawn and in the midafternoon (Fig. 13.8).[58,116] This explains why people have the most difficult time staying awake between 2 and 4 in the morning and why they feel most sleepy in the afternoon after lunch. A person who is sleep deprived will feel sleepier during the afternoon dip in the circadian rhythm than if he or she had sufficient sleep. On the other hand, if a person is sleep deprived and has been awake for a long time, he or she may have difficulty falling asleep during the clock "alerting" times. This may explain the quandary of the world traveler who has flown through many time zones and wants to sleep but is unable to do so because his biological clock is telling his body to stay awake.

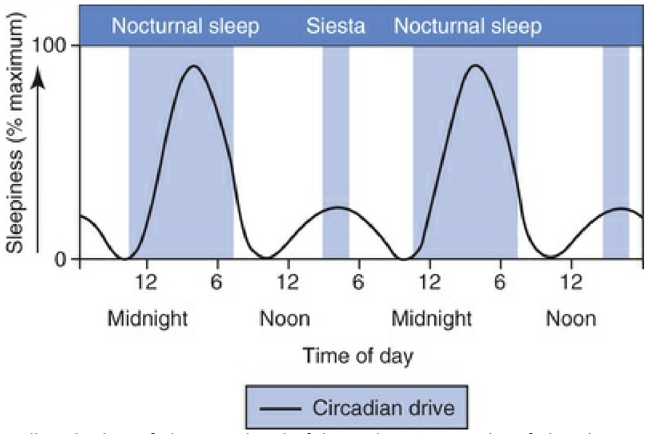

FIG 13.8 The circadian rhythm of sleep and wakefulness has two peaks of sleepiness during the 24-hour day. These peak times of sleepiness are between midnight and dawn (higher peak) and in the afternoon after the typical lunchtime. (From Epstein LJ, Mardon S: *Harvard Medical School guide to a good night's sleep*, New York, 2007, McGraw-Hill.)

All phases of normal sleep are considered to be under homeostatic control (**homeostasis**), or the tendency to maintain equilibrium. The longer a person is awake or deprived of certain sleep stages, the greater will be the drive to obtain that lost sleep or stage.[169] Stated differently, as soon as a person awakens, the sleep debt starts to accumulate. This sleep/wake homeostasis creates a drive that balances sleep and wakefulness.

A third, less understood mechanism, the allostatic process, is another factor involved in controlling the sleep/wake cycle.[143] Allostasis achieves stability of a system through many or variable physiological or behavioral changes, and it can be controlled by external forces such as social or ecological cues. Those mechanisms can override the circadian or homeostatic propensity for sleep, if necessary.[143] Social factors may include work, family, and societal structure.[143] Examples of ecological factors include habitat, light, food, warmth, shelter, and the presence of young; these are drivers that can determine the timing and duration of sleep and whether sleep actually occurs because of other pressing needs.[143] As cited by Czeisler et al.,[44] humans can override the signals of the circadian and sleep/wake system short term if they have very urgent matters to which they must attend.[44] The invention of artificial light and the alarm clock contributed to human beings' need (or desire) to override the biological clock, simply because they can or because of societal and cultural pressures to do so.

What is considered adequate sleep?

Determining what is considered adequate sleep varies widely based on age, genetics, and many other factors. Table 13.2 presents the recommendations of the National Sleep Foundation for determining how much sleep an individual needs.

TABLE 13.2
How Much Sleep Do You Need?

Age	Sleep Needs (hours)
Newborns (0–3 months)	14–17
Infants (4–11 months)	12–15
Toddlers (1–2 years)	11–14
Preschoolers (3–5 years)	10–13
School-age children (6–13 years)	9–11
Teens (14–17)	8–10
Young adults (18–25)	7–9
Adults (26–64)	7–9
Older adults (65+)	7–8

Data from the National Sleep Foundation. http://sleepfoundation.org/how-sleep-works/how-much-sleep-do-we-really-need. To view the full research report, visit SleepHealthJournal.org.

Sleep Disorders

Many sleep disorders have been researched and identified by sleep medicine researchers. Only the more common sleep disorders are reviewed here.

Insomnia

In general, **insomnia** is defined as repeated difficulty with initiating sleep or maintaining sleep, awakening earlier than desired, or having poor-quality sleep that is not restorative[56] despite adequate opportunities for sleep.[157] *The International Classification of Sleep Disorders*, third edition (ICSD-3), is the authoritative clinical text for the diagnosis of sleep disorders; the text was updated in 2014.[7] Insomnia is the most common sleep disorder and in isolation affects 30% to 50% of the general population; 9% to 15% of those report impairment in daily activities as a result.[56]

Insomnia is primarily diagnosed by clinical evaluation (by a physician) with a thorough sleep history and detailed medical, substance, and psychiatric history.[157] A diagnosis of insomnia requires an associated daytime dysfunction in addition to appropriate insomnia symptoms.[157] Because occupational therapists well understand occupations and the process of assessing function, they can provide valuable information to the treatment team on occupational performance in relation to sleep issues.[63]

Treatment for insomnia may include:

- Initially, at least one behavioral intervention is tried, such as stimulus control therapy or relaxation therapy, or a combination of cognitive therapy, stimulus control therapy, and sleep restriction therapy, with or without relaxation therapy. Cognitive behavioral therapy for insomnia (CBT-I) is a combination of cognitive therapy with behavioral treatments (eg, stimulus control, sleep restriction). Trained occupational therapists can use these therapies, but they are traditionally offered by other mental health professionals.
- Adherence to good sleep hygiene is recommended, but there is insufficient evidence to indicate that sleep hygiene alone is effective in the treatment of chronic insomnia. It is agreed that sleep hygiene education should be used in combination with other therapies. Occupational therapists can certainly provide education and training in this area.[157]

Table 13.3 presents more detailed information on possible treatments for chronic insomnia.

TABLE 13.3

Common Cognitive and Behavioral Therapies for Chronic Insomnia[a]

	Description	Instructions
Standard (generally accepted strategy that reflects a high degree of certainty based on good research)		
Stimulus control	Stimulus control is designed to extinguish the negative association between the bed and undesirable outcomes (eg, wakefulness, frustration, and worry). These negative states are frequently conditioned in response to efforts to sleep as a result of prolonged periods in bed awake. The objectives of stimulus control therapy are for the client to form a positive and clear association between the bed and sleep and to establish a stable sleep/wake schedule.	Go to bed only when sleepy; maintain a regular schedule; avoid naps; use the bed only for sleep; if unable to fall asleep (or back to sleep) within 20 minutes, remove yourself from bed and engage in a relaxing activity until drowsy, then return to bed—repeat this as necessary. *Note:* Clients should be advised to leave the bed after they have *perceived* their lack of sleeping within *approximately* 20 minutes; actual clock watching should be avoided.
Relaxation training	Relaxation training (progressive muscle relaxation, guided imagery, abdominal breathing) is designed to lower somatic and cognitive arousal states, which interfere with sleep. Relaxation training can be useful in clients displaying elevated levels of arousal and is often used with cognitive behavioral therapy (CBT).	Progressive muscle relaxation training involves methodical tensing and relaxing of different muscle groups throughout the body. Specific techniques are widely available in written and audio form.
Cognitive behavioral therapy for insomnia (CBT-I)	Cognitive therapy seeks to change the client's overvalued beliefs and unrealistic expectations about sleep. Common cognitive distortions identified and addressed in the course of treatment are "I can't sleep without medication," "I have a chemical imbalance," "If I can't sleep, I should stay in bed and rest," "My life will be ruined if I can't sleep."	A combination of cognitive therapy and behavioral treatments (eg, stimulus control, sleep restriction) is used, with or without relaxation therapy.
Guideline (moderate degree of clinical certainty and consensus)		
Multicomponent therapy (without cognitive therapy)	Multicomponent therapy is the use of various combinations of behavioral therapies (eg, stimulus control, relaxation, sleep restriction) and sleep hygiene education. Many therapists use some form of multimodal approach in treating chronic insomnia.	Determined by the healthcare provider.
Sleep restriction	Sleep restriction therapy initially limits the time in bed to the total sleep time, as derived from baseline sleep logs. This approach is intended to improve sleep continuity by using sleep restriction to enhance sleep drive. As sleep drive increases and the window of opportunity for sleep remains restricted, with daytime napping prohibited, sleep becomes more consolidated. When sleep continuity substantially improves, time in bed (TIB) is gradually increased, so as to provide sufficient sleep time for the client to feel rested during the day while preserving the newly acquired sleep consolidation. This approach is consistent with stimulus control goals in that it minimizes the amount of time spent in bed awake, which helps restore the association between bed and sleeping.	The client is instructed to do the following: • Maintain a sleep log and determine the mean total sleep time (TST) for the baseline period (eg, 1–2 weeks). • Set bedtime and wake-up times to approximate the mean TST to achieve a sleep efficiency (SE) > 85% over 7 days (to find the mean TST: Mean TST = {TST/TIB} × 100%); the goal is for the TIB (not < 5 hours) to approximate the TST. • Make weekly adjustments: • SE > 85% to 90% over 7 days: TIB can be

		increased by 15–20 minutes • SE < 80%: TIB can be further decreased by 15–20 minutes. • Repeat TIB adjustment every 7 days. *Note:* When sleep restriction is used, clients should be monitored for and cautioned about possible sleepiness.
Paradoxical intention	Paradoxical intention is a specific cognitive therapy in which the client is trained to confront the fear of staying awake and its potential effects. The objective is to eliminate a client's anxiety about sleep performance. A mental health clinician, not the occupational therapist, should address this issue.	Determined by the healthcare provider.
Biofeedback therapy	Biofeedback therapy trains the client to control some physiological variable through visual or auditory feedback. The objective is to reduce somatic arousal.	Determined by the healthcare provider.
Option (uncertain clinical use; insufficient, inconclusive, or conflicting evidence or conflicting expert opinions)		
Sleep hygiene therapy (no recommendation)	Sleep hygiene therapy involves teaching clients about healthy lifestyle practices that improve sleep. It should be used in conjunction with stimulus control, relaxation training, sleep restriction, or cognitive therapy.	Instructions include but are not limited to: keep a regular schedule; follow a healthy diet and get regular daytime exercise; create a quiet sleep environment; before bedtime, avoid napping, caffeine and other stimulants, nicotine, alcohol, excessive fluids, and stimulating activities.

[a]The American Academy of Sleep Medicine (AASM) has defined the levels *standard*, *guideline*, and *option* for recommendations on the treatment of chronic insomnia.

Adapted from Schutte-Rodin S, et al: Clinical guideline for the evaluation and management of chronic insomnia in adults, *J Clin Sleep Med* 4:487–504, 2008.

Risk factors for insomnia include advancing age; female gender; psychiatric, medical, or substance abuse problems; shift work; and possibly unemployment and lower socioeconomic status.[157] Individuals with comorbid medical and psychiatric conditions are at particularly increased risk; the insomnia rates in clients with psychiatric and chronic pain disorders are as high as 50% to 75%.[23,138,165]

The consequences of insomnia are impaired cognition, fatigue or tiredness, depressed mood or irritability, and impaired work or school performance.[102,138] Dement and Pelayo[52] described how a person with insomnia may talk about "trying" to go to sleep, whereas others say they "go" to sleep, and effort is not required.[52] People with chronic insomnia may get worse because their poor sleep leads them to think and behave negatively toward sleep. Gayle Greene, a professor of literature and women's studies, wrote a memoir about her insomnia and her lifelong search and research in this area.

The first thing to go is your sense of humor. Then goes the desire to do the things you used to do, then the desire to do anything at all. Parts of your body ache that you don't even know the names of, and your eyes forget how to focus. Words you once knew aren't there anymore, and there's less and less to say. People you once cared about fall by the way and you let them go, too.[71]

Comorbid insomnia refers to clients who have a medical or psychiatric diagnosis but also have symptoms of insomnia. Treatment begins by addressing the comorbid condition, such as treatment of major depression or pain.[157] Previously it was assumed that treating the condition would eliminate the insomnia, but it is now apparent that numerous psychological and behavioral factors develop that perpetuate the insomnia problem (Box 13.2).[157]

Box 13.2

Common Comorbid Disorders, Conditions, and Symptoms Seen With Insomnia

Neurological	Stroke, dementia, Parkinson's disease, seizure disorders, headache disorders, traumatic brain injury, peripheral neuropathy, chronic pain disorders, neuromuscular disorders
Cardiovascular	Angina, congestive heart failure, dyspnea, dysrhythmias
Pulmonary	Chronic obstructive pulmonary disease (COPD), emphysema, asthma, laryngospasm
Digestive	Reflux, peptic ulcer disease, cholelithiasis, colitis, irritable bowel syndrome
Genitourinary	Incontinence, benign prostatic hypertrophy, nocturia, enuresis, interstitial cystitis
Endocrine	Hypothyroidism, hyperthyroidism, diabetes mellitus
Musculoskeletal	Rheumatoid arthritis, osteoarthritis, fibromyalgia, Sjögren's syndrome, kyphosis
Reproductive	Pregnancy, menopause, menstrual cycle variations
Sleep disorders	Obstructive sleep apnea, central sleep apnea, restless legs syndrome, periodic limb movement disorder, circadian rhythm sleep disorders, parasomnias
Other	Allergies; rhinitis; sinusitis; bruxism; alcohol and other substance use, dependence, or withdrawal; cancer[102]; pain from any source[102]

From Schutte-Rodin S, et al: Clinical guideline for the evaluation and management of chronic insomnia in adults, *J Clin Sleep Med* 4:492, 2008.

Insomnia can be severe; it is a pervasive condition and should not be taken lightly. Most people who do not have chronic insomnia may have had the occasional sleepless night and may feel they can relate to a person whose insomnia is chronic. However, the occupational therapist working with a client with insomnia should show sensitivity and should not assume that he or she fully understands the situation; the therapist also must be able to recognize the need to refer the client to a specialist, if necessary.

Obstructive Sleep Apnea

Obstructive sleep apnea (OSA) can be a serious medical condition. It has been shown to affect 3% to 7% of men and 2% to 5% of women in the adult general population.[148] Untreated OSA impairs daytime functioning and can limit quality of life, accelerate multiple health risks, compromise public safety, and result in increased healthcare spending.[16] Despite increasing awareness by both the public and clinicians, OSA remains considerably underdiagnosed and undertreated.[16] The most common terminal events induced by OSA are heart attack, CVA, and accidents.[52] OSA is twice as common in men as in women before age 50, but the prevalence in the genders equalizes with age.[82]

OSA is one of several sleep-related breathing disorders (SRBD) that healthcare providers treat. In OSA the airway becomes blocked when a portion of the individual's airway slackens and collapses, blocking airflow. This causes the person to stop breathing and then awaken (though not usually fully wake up) throughout the night, sometimes hundreds of times. Apnea is defined as a complete cessation of airflow for a minimum of 10 seconds, regardless of whether there is oxygen desaturation or fragmented sleep. Hypopnea (shallow breathing) is defined as airflow decreased by 30% or more with oxygen desaturation of 3% to 4%.[77] The apnea/hypopnea index (AHI) is the frequency of abnormal breathing events per hour of sleep.[52] An AHI of 40 means that a person experiences complete or partial airflow blockage 40 times an hour.[52] Snoring and daytime sleepiness are prevalent symptoms of OSA (Box 13.3),[16] and recent research has shown that nocturia (waking one or more times a night to urinate) is comparable to snoring as a screening tool for OSA.[149,154] This constant awakening throughout the night can lead to severe daytime sleepiness and fatigue and higher rates of depression.[139] Furthermore, the decrease in oxygen levels throughout the night can cause an increase in blood pressure and can lead to cardiovascular disease.[52]

Box 13.3

Symptoms of Obstructive Sleep Apnea

- Snoring
- Witnessed apnea
- Excessive daytime sleepiness
- Morning headache
- Dry throat in the morning
- Depressive symptoms
- Erectile dysfunction
- Insomnia
- Impaired vigilance and memory

No treatment modalities are universally accepted or used by all clients with OSA; however, evidence indicates that several modalities can improve alertness or quality of life.[16] Currently, OSA is typically treated with a positive airway pressure (PAP) device that provides continuous positive airway pressure (CPAP, pronounced "C-pap") (Fig. 13.9), bilevel PAP (BPAP), or autotitrating PAP (APAP).[16] The client is fitted with a mask, from which a hose attaches to a generator that provides (for CPAP) a continuous flow of pressurized air through the nose to keep the airway open while the client sleeps. A variety of masks is available (Fig. 13.10), but the three general types are the nasal mask, nasal pillow, and full face mask (Fig. 13.11). CPAP has proved to be effective and is a standard for use in OSA.[103] It can be critical for reducing blood pressure in some clients[91] and has been found to eliminate apneas, improve sleep quality, reduce **excessive daytime sleepiness (EDS)**, and improve quality of life.[46] However, many people do not follow the recommendations for proper use of a CPAP; 29% to 93% of clients do not adhere to the therapeutic recommendation when adherence is defined as using the CPAP for more than 4 hours a night.[142]

FIG 13.9 Continuous positive airway pressure (CPAP) machines have dramatically decreased in size since they were first introduced. *Left,* The SleepEasy system (1985). *Right,* The DreamStation system (2016). (Courtesy Philips Respironics, Murrysville, PA.)

A

B

C

D

FIG 13.10 Sample of available CPAP masks and headgear. Three general types of masks are used for adults. A, A nasal pillow mask, for which prongs are inserted into the nostrils (AirFit P10. Airfit is a trademark of ResMed.). B, A nasal mask (AirFit N10). C, A full face mask (AirFit F10). D, Pediatric mask (the Pixi). (Courtesy ResMed, San Diego, CA.)

FIG 13.11 This man is using a full face CPAP mask, which fits over both the nose and the mouth. This type of mask is useful for "mouth breathers," for whom it is used to treat severe sleep apnea. (Courtesy iStock.com.)

Internationally, adherence has also been shown to be poor. Researchers in Tianjin, China, found adherence to CPAP therapy to be about 50%[174]; many clients did not follow through, abandoned use of the device, or did not even purchase it in the first place. Swedish researchers described nonadherence as occurring for a variety of reasons, such as dry throat, difficulty adjusting the mask, mask leakage, disturbing noise, difficulty changing sleep positions with the mask on, dry eyes, and difficulty traveling with the device.[27] Other barriers to CPAP adherence include negative attitudes toward the CPAP machine, insufficient support from healthcare personnel and family, feelings of shame about the need for CPAP, reduced freedom, a desire to avoid lifelong treatment, claustrophobic thoughts, and anxiety about the technology itself.[27]

Other primary treatments for OSA include oral appliances or dental devices provided by dentists trained in this specialty, in addition to surgery to open the airway.[16,82] Oral appliance application is relatively simple and reversible and may be used for snoring and mild OSA.[52] Examples of dental appliances include molds for the teeth to move the lower jaw forward or a tongue retainer that pulls the tongue forward.[52] Surgical procedures may include removal of nasal polyps, tonsils, or redundant palatal tissue; advancement of the mandible (cutting of the bone of upper and lower jaw and pulling structures forward), and tracheostomy.[52] Weight reduction, topical nasal corticosteroid use, and positional therapies[16,118] are all within the guidelines of the AASM as possible treatments for OSA. Positional therapy, which involves sleeping in the nonsupine position and using pillows, is most useful (ie, normalizes the AHI) for clients who have less severe OSA, are less obese, and younger.[118] A pilot study showed that use of trained "peer buddies" who were successful in CPAP use increased adherence to CPAP therapy in a group of veterans newly diagnosed with OSA.[142]

If left untreated, OSA can have severe adverse effects on a client's functioning throughout the day. When a person is chronically sleep deprived, daytime function is affected by slowed thought processes, forgetfulness, slowed responses, and difficulty concentrating.[175] Clients who had sustained a CVA and had been treated in a hospital rehabilitation program were found to have a comorbid SRBD that predicted a poorer outcome in the functional recovery rate.[38] Researchers suspect that two processes contribute to decreased cognitive functioning in clients with OSA: nocturnal hypoxia (decreased oxygen to the brain) and fragmented sleep. Furthermore, as a group, OSA clients' risk of motor vehicle accidents is increased twofold. Research has also shown that sleep-disordered breathing precedes stroke and may contribute to its development.[96]

A small, qualitative study in Ireland looked at how occupations were affected in nine people diagnosed with OSA. The six men and three women participants were interviewed, and an overarching theme emerged: sleep apnea is a life-changing condition.[136] Five subthemes representing the life-altering aspects of OSA also became apparent: occupational participation, psychological well-being, relationships, executive functioning, and treatment. Participants reported inability to fully enjoy and partake in daily life, being forced into early retirement, having worries about the future, having relational/social difficulties, memory/executive function problems, and the need to use a CPAP (described as an "albatross" that must be lugged around until death) due to OSA.[136]

Considering the functional and cognitive impairments that can result from OSA, it is important for occupational therapists to ask clients about their sleep when evaluating those who may have a secondary diagnosis of OSA or symptoms that indicate an SRBD and referral to a physician. Functional-cognitive impairments may affect follow-through on home programs, safety, and ability to meet goals, and they can diminish the quality of life.

Since the mid-1990s it has been known that 60% to 70% of all stroke clients exhibit sleep-disordered breathing (SDB) as defined by an AHI of 10 episodes per hour.[22] As cited by Alessi et al.,[3] studies of older adults admitted to rehabilitation hospitals after a stroke showed that sleep apnea is commonplace,[96] is associated with lower admission functional levels, and results in poorer outcomes.[96,177]

Could it be that Mrs. Tanaka has a history of an undiagnosed SRBD? Or is the sleep disturbance the result of the CVA and location of the brain insult? Or is poor sleep hygiene in the hospital the biggest contributor to Mrs. Tanaka's sleep problems? It is critical for the occupational therapist treating Mrs. Tanaka to keep the physician informed about the client's sleepiness during treatment and her loud snoring, both of which can be indicators of OSA.

Restless Legs Syndrome and Periodic Limb Movement Disorder

Restless legs syndrome (RLS), also known as Willis-Ekborn disease,[33] is a common disease that affects a client's ability to fall asleep and stay asleep.[18] RLS affects 10% of adults in the United States, and the prevalence increases with age. The International Restless Legs Syndrome Study Group updated its guidelines for diagnosis of the disease to the following five criteria:

- An *urge to move the legs* is usually but not always accompanied by or felt to be caused by uncomfortable sensations (eg, creepy-crawly) in the legs.
- The urge to move the legs and any unpleasant sensations begin or *worsen during periods of rest or inactivity,* such as lying down or sitting.

- The urge to move the legs and any accompanying unpleasant sensations are *partially or totally relieved by movement*, such as walking, getting up, or stretching, at least as long as the activity continues.
- The urge to move the legs and any accompanying unpleasant sensations during rest or inactivity only occur or are *worse in the evening or night* rather than during the day.
- The occurrence of the previously listed features is *not due to other medical or behavior problems* (eg, muscle pain, leg edema, arthritis, leg cramps, positional problems, or foot tapping behaviors).[5]

The clinical significance of this disorder is determined by issues or impairments in social, occupational, educational or other areas of functioning and by their impact on sleep, energy and vitality, daily activities, behavior, and cognition or mood,[5] all of which are in the realm of occupational therapy.[12]

Many clients with comorbid conditions associated with RLS are treated by occupational therapists as in-clients or out-clients and in home health, nursing home, and other settings (Fig. 13.12). RLS symptoms can occur anytime in the day during prolonged immobilization (eg, a long car drive), but they typically occur in the evening, with increasing symptoms until bedtime. The urge to move the legs results in insomnia, the effects of which can be detrimental to occupational performance.

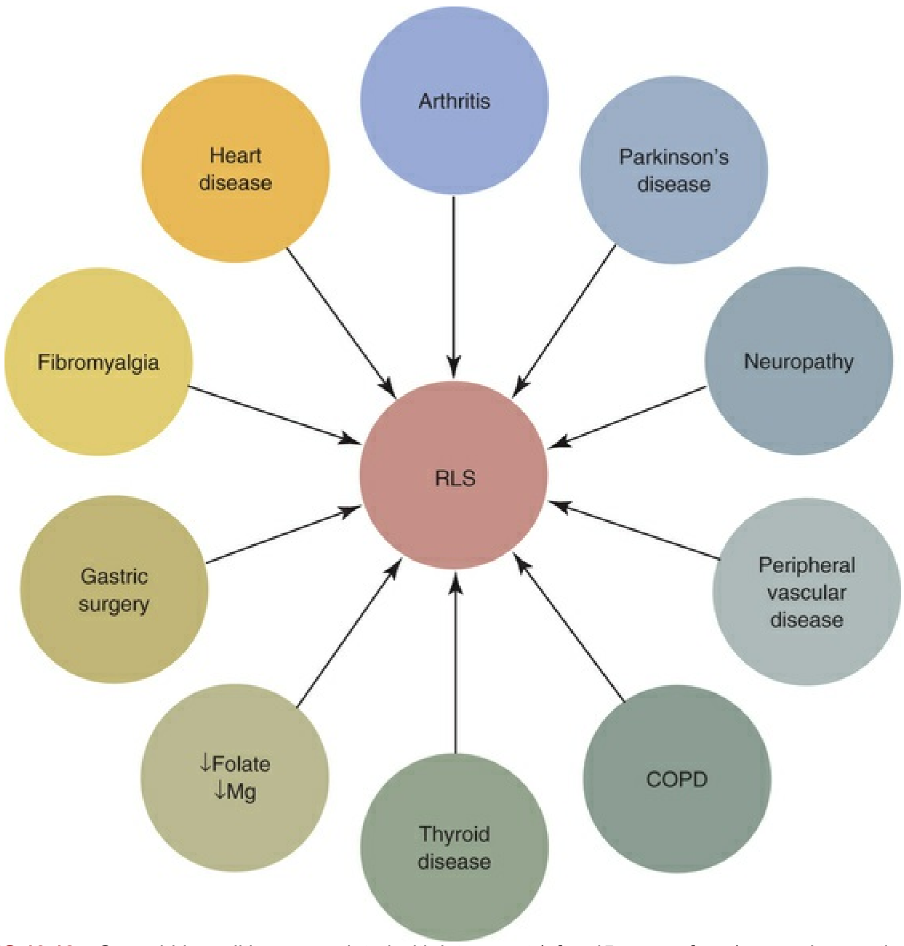

FIG 13.12 Comorbid conditions associated with late-onset (after 45 years of age) secondary restless legs syndrome (RLS). OTs treat many of these clients in their practice. *COPD*, Chronic obstructive pulmonary disease; *Mg*, magnesium. (From Avidon A: Restless legs syndrome and periodic limb movements in sleep. In Kryger MH, editor: *Atlas of clinical sleep medicine*, Philadelphia, 2010, Saunders Elsevier.)

Some believe that RLS is related to dopamine deficiency, whereas other hypotheses focus on brain iron deficiency. Current nonpharmacological treatment includes encouraging alerting (mentally challenging) activities, which have been found to relieve RLS symptoms, and avoiding caffeine, alcohol, and nicotine.[19] Because OTs focus on occupation and wellness, these are certainly areas in which practitioners can provide treatment.

Periodic limb movement disorder (PLMD) is frequently confused with RLS, but it is a different condition, although the two can coexist. PLMD affects up to 34% of clients over 60 years of age, and the prevalence increases with age. PLMD can be definitively diagnosed only with an EMG and a sleep study/PSG. In this disorder, a client has periodic episodes of repetitive and stereotyped movements of the limbs (arms or legs), which the client cannot control, during sleep. This results in client arousals or awakenings during sleep, which the client often doesn't recognize. The "creepy crawly" sensations present in RLS do not exist in PLMD. When PLMD is severe, clients experience excessive sleepiness, which can affect daytime functioning.[19]

Narcolepsy

Narcolepsy is a neurological sleep disorder characterized by EDS, cataplexy, sleep paralysis, and hypnagogic hallucinations; it is most likely an autoimmune disease.[52] Cataplexy, sleep paralysis, and hypnagogic hallucinations are abnormal manifestations of REM sleep into wakefulness.[19] The excessive sleepiness is not relieved by adequate time sleeping.[19] Cataplexy, which affects 60% to 100% of individuals with narcolepsy,[19] manifests when a person has a sudden loss of postural and muscle tone during an emotional event such as laughter, joking, anger, excitation, startle, fear, and even sex.[19,52] The person is still conscious when the cataplexy occurs, and his or her breathing is normal.[19] People with this disorder have disturbed and fragmented nocturnal sleep. Sleep paralysis occurs at the start or end of sleep and is demonstrated by the fact that a person cannot move for a few seconds or minutes.[19,52] Hypnagogic hallucinations are characterized by vivid, dreamlike experiences that occur at the onset or end of sleep; they are generally frightful and visual but can be tactile or auditory.[19] The goal of therapeutic approaches is to control the narcoleptic symptoms, maintain wakefulness and alertness during the day, and allow the client to have full participation in life.[52] Good sleep hygiene, instruction in anticipation of attacks, behavioral treatments, and support groups may be important.[52]

Parkinson's Disease and Alzheimer's Disease

Alzheimer's disease (AD) and Parkinson's disease (PD) are not sleep disorders, but they are the two most common neurodegenerative disorders in our society.[119] Sleep disturbances are commonly reported in both PD and AD,[153] especially insomnia, hypersomnia, and excessive daytime napping.[119] The most commonly seen neurodegenerative disorder in a sleep disorders clinic is Parkinson's disease.[20]

Sleep problems are common in all forms of PD.[168] Among clients with PD, 60% to 90% have sleep complaints. A majority of clients with PD have sleep complaints that adversely affect sleep, including excessive sleepiness, insomnia, nightmares, and other sleep disorders. As the severity of the disease increases, sleep complaints also increase. Foster and Dixon et al[61] pointed out that people with PD are referred to occupational therapy when significant physical disabilities are present,[54] so clients referred to an OT may already have severe sleep complaints. Gregory et al.[76] found that the chronically disturbed sleep of a person with PD can also adversely affect the coping ability and sleep quality of the person's caregivers. Improved sleep hygiene is an important treatment that can be provided to this population, in addition to training in safe bed mobility, transfer training, and adaptive equipment (eg, bedside commode) for safety in toileting tasks.[20]

Nascimento et al.[119] studied the effects of a multimodal mild to moderate physical exercise program on 35 people diagnosed with AD and 42 subjects with PD in Brazil. Examples of exercises included calisthenics, resistive, balance. and aerobic exercises performed over a 6-month period by both PD and AD clients. The results showed a reduction in IADL deficits and attenuation of sleep disturbance in both groups.

Consequences of Poor Sleep

Sleepiness

The seemingly obvious but not so obvious consequence of sleep debt is sleepiness or drowsiness. Behavioral signs of sleepiness include yawning; ptosis (drooping of the upper eyelid); reduced activity; lapses in attention; head nodding,[152] with decreased animation; and head-drop, accompanied by sudden jerking up with a startle, which may indicate a "microsleep."[52] Dement and

Pelayo[52] suggested that the "real essence" of the onset of sleepiness is the awareness that remaining alert and attentive takes effort. Besides the embarrassment that may be caused by those behaviors in a public place, there are serious consequences to sleepiness.

The terms *sleepiness, fatigue,* and *somnolence* are sometimes used interchangeably. However, sleepiness should be distinguished from fatigue. Sleepiness is a sleep state that is characterized by the tendency to fall asleep, whereas fatigue is the exhaustion that occurs after exertion.[69] As cited by Bushnik et al.,[29] another definition of fatigue is "the awareness of a decreased capacity for physical and/or mental activity due to an imbalance in the availability, utilization and/or restoration of resources needed to perform activity."[2] Although many people, including sleep experts, use the word *somnolence* and *sleepiness* interchangeably, Gooneratne et al.[69] stated that the terms should not be considered the same. Somnolence is an impaired neurological state that can lead to lethargy or coma, whereas sleepiness is a tendency to fall asleep.

Roehr et al.[152] described sleepiness as a physiological need state, much like hunger or thirst. The body's desire to sleep cannot be met by resting, eating, taking a cold shower, or exercising. It can only be met by sleep. Researchers have quantified sleepiness by how readily subjects fall asleep, by subjects rating how likely they are to fall asleep in certain situations, and by subjects rating themselves on how they feel at the moment. The Multiple Sleep Latency Test (MSLT) is considered the standard method for quantifying sleepiness and is performed by trained sleep technologists.[52,152,161] With this test, subjects are placed in a dark room on a bed. The amount of time it takes the subject to fall asleep is measured every 2 hours during the waking hours on several occasions. Severely sleep-deprived individuals fall asleep instantly (zero sleep latency). Generally, many clinicians consider an average latency of 5 to 8 minutes to be consistent with EDS, a chronic state of inability to stay awake during the day that occurs when unintended; 10 to 12 minutes or longer is considered to be within normal limits.[39]

Research has shown that those who are the most sleep deprived, as evidenced by behavioral measures, are the least accurate in rating their sleepiness. Roehr et al.[152] speculated that adaptation to the chronic sleepiness state occurs, such that some people actually forget what complete alertness feels like. The researchers also reported that for those with mild to moderate sleepiness, subjective complaints of sleepiness and even its behavioral indicators can be masked by a number of factors, such as motivation, environment, posture, activity, light, and food intake. The researchers reported, "Heavy meals, warm rooms, boring lectures, and the monotony of long-distance automobile driving unmask physiologic sleepiness when it is present, but they do not cause it."[152] However, for those with significant and severe sleep debt, the ability to override sleepiness diminishes. Even in the most exciting environment, microsleeps (brief episode of sleep, usually NREM)[52] can occur, in addition to the likelihood of sleep onset. An example would be a person falling asleep while watching a live basketball game.

A healthy individual becoming sleepy while watching a sporting event is a relatively benign problem, if it is isolated. However, research has found that sleepiness can be a detriment to functioning. One study found that excessive sleepiness in the elderly without dementia or depression was associated with self-reports of moderate impairments in activities such as housework, sports, activities in the morning or evening, and keeping pace with others.[69] This study showed strong associations between having a number of medical conditions and reporting excessive sleepiness.

Other studies have shown that activities and positioning may affect sleepiness. One study showed that sleep latency increased by 6 minutes when the subject was sitting up rather than lying down. Sleep latency has also been shown to increase by 6 minutes when subjects went for a 5-minute walk before taking the MSLT.[24,25]

Instead of investigating behaviors (of purposefully not getting enough sleep), one group of researchers examined the clinical and PSG predictors of the natural history of EDS in a random population sample. Seven and a half years after the initial data were collected from 1741 individuals (known as the Penn State Adult Cohort), 1395 of them provided follow-up data. Obesity and weight gain were found to play a key role in the development and chronicity of EDS, and weight loss was associated with its remission.[60]

Many well-known disasters have been attributed to workers who were sleep deprived, including the Exxon *Valdez* oil spill (1989), the Three-Mile Island nuclear meltdown (1979), and the *Challenger* space shuttle explosion (1986).[42,49,192]

Countermeasures, or techniques and behaviors used to counteract the drive to fall asleep, are frequently used by sleepy drivers to try to stay awake. The National Sleep Foundation's 2012 poll found that pilots and train operators use caffeine more than controls to stay awake and alert on the job.[130] Staffan's small study in Sweden[160] used social media to find subjects to investigate the kinds of countermeasures used by people to avoid falling asleep while driving. The more common countermeasures included changing seat position, pulling off the road to get fresh air, increasing the fan speed, decreasing the temperature, turning on loud music, and opening windows, among others. Staffan suggested a mismatch between what researchers suggested (short naps) and how people actually behave when sleepy on the road. The research (sponsored by Volvo) suggested the possibility that cars of the future could be designed to include seats that automatically changed position, and systems that could change the temperature in the car or announce to the driver that he or she should get a cup of coffee.[160]

All these findings have implications for occupational therapists who work with sleepy clients in setting goals and creating treatment plans.

For Mrs. Tanaka, if medical or psychiatric conditions or medication problems are ruled out, occupational therapists can help ensure the client gets adequate sleep at night. If Mrs. Tanaka's sleep problem includes a shifted circadian rhythm, light exposure during treatment and between therapies during the day may help shift her circadian pattern so that she sleeps at night, not during the day. Treatment in an upright posture in a bright room may help keep her alert longer during treatment so that she can participate in therapy during the day.

Drowsy Driving

A March, 2011, report by the U.S. National Highway Traffic Safety Administration (NHTSA) found that drowsy driving was reportedly involved in 2.2% to 2.6% of fatal car crashes annually from 2005 to 2009.[123] However, in 2014 a study conducted by the AAA Foundation for Traffic Safety found that the numbers were much higher than reported by the NHTSA.[1] The AAA foundation study focused on the 14,268 crashes that occurred from 2009 to 2013 in which a vehicle was towed. The study found that a drowsy driver was involved in 7% of crashes in which a person received treatment for injuries sustained in a crash; 13% of crashes in which a person was hospitalized; and 21% of crashes in which a person was killed. If these proportions are applied to all reported crashes nationwide, results suggest that an average of 328,000 crashes annually, including 109,000 crashes that result in injuries and 6,400 fatal crashes, involve a drowsy driver.[1]

In another study, the NHTSA looked at data collected annually from 1991 to 2007 on fatal, single-vehicle crashes in which the car ran off the road.[122] The most influential factor in the occurrence of these fatal crashes was sleepiness. The NHTSA reported that a sleepy driver's odds of being involved in a run-off-the-road crash are more than three times higher than those for a driver who is not sleepy. In comparison, the odds of a driver with alcohol in his system (blood alcohol concentration = 0.01 + grams per deciliter) being in a similar crash are almost two times higher than those for a sober driver. Currently, of the 50 states in the United States, only New Jersey (Maggie's Law, passed in 2003) and Arkansas (SB 874, passed in 2013) consider falling asleep at the wheel and fatigued driving a criminal offense in a fatal crash if the driver is found not to have slept in 24 consecutive hours.[121] As of this writing, five other states have “Drowsy Driving Awareness Days” or weeks or have enacted laws to post road signs about the dangers of drowsy driving.[121]

Drowsy driving is a serious international concern. According to data from Australia and from England, Finland, and other European nations, all of which have more consistent crash reporting procedures than the United States, drowsy driving accounts for 10% to 30% of all crashes.[128]

The NSF has reported the following groups as most at risk of being involved in a fall-asleep crash:

- Young people, especially males under 26
- Shift workers and people with long work hours
- Commercial drivers, especially long-haul drivers
- People with undiagnosed or untreated disorders (for individuals with untreated OSA, the risk of falling asleep at the wheel is up to seven times higher)
- Business travelers who drive many hours or are jet lagged[131]

Most drowsy driving crashes happen between midnight and 6:00 am or in the midafternoon during the circadian dip. They typically occur when a driver is alone; they tend to involve a single vehicle running off the road and often hitting a stationary object; and, as opposed to alcohol-related driving, there may not be any evidence of the driver braking or taking evasive maneuvers.[125]

Shift Work

Research results suggesting that shift work can be deleterious to people's health are well documented. As previously mentioned, the invention of artificial light and the Industrial Revolution changed the work world so that people could now work around the clock. The prevalence of shift work sleep disorder that results in insomnia is estimated to be about 10% of the night and rotating shift worker population.[151]

Neuromuscular Disorders and Sleep

Individuals with neuromuscular disorders are considered in a "state of vulnerability" during sleep because normal REM-related changes, such as atonia and other changes in ventilation, are magnified as a result of muscle weakness. Sleep disturbance can also be related to spasticity, poor secretion clearance, sphincter dysfunction, inability to turn, pain, and any associated or secondary autonomic dysfunction. All these factors can impair sleep and decrease daytime functioning.[68] Individuals who rely on accessory muscles to breathe (eg, those with tetraplegia) are also in a vulnerable state during sleep. Indeed, research has shown that individuals with a spinal cord injury (SCI) have a two to five times greater prevalence of SDB than that seen in the general population.[155] Researchers suggest that all clients with SCI undergo full PSG studies to better detect sleep-disordered breathing because many such cases may go undetected with a limited sleep study recording.[155] Sleep disturbance also is a common consequence of traumatic brain injury (TBI),[141] and individuals with this condition are another group of clients that OTs treat.[55]

Other Consequences of Sleep Deprivation

Young et al.[189] noted that sleep deprivation can result in a multitude of negative physical and psychological consequences, even when the person is healthy. These negative consequences include but are not limited to hypertension,[65,137] decreased postural control,[59] possible obesity, and diabetes[67,100] and decreased insulin sensitivity (seen in a group of nondiabetic white males).[183] Inadequate sleep can also result in greater likelihood of falls.[163] In older adults the consequences of poor sleep are significant; they can include overall poorer health, physical function, and cognitive function, and increased mortality.[14]

Sleep Considerations in the Hospital Setting

As mentioned previously, inadequate sleep can have serious consequences in and of itself. Acute hospitalization combined with inadequate sleep can further hinder recovery. Studies have shown that approximately half of clients admitted to general medical wards complain of sleep disruption. Young et al.[189] found that clients who were hospitalized had difficulty initiating and maintaining sleep and complained of early awakening and nonrestorative sleep. Hospital sounds have been found to disrupt sleep even in healthy individuals.[30] Buxton et al.[30] studied the effects of typical sounds present in hospital settings on 12 healthy young subjects. They found that electronic sounds designed to alert medical staff were more arousing than other sounds and that even brief frequent noises can increase heart rates, which is especially important to consider in critical care settings. These researchers stressed that their study was conducted on young, healthy subjects, and that many hospital clients are older, have a decreased quality and quantity of deep sleep, and would be less able to tolerate the noises present in hospital settings.[30] They concluded that "protecting sleep from acoustic assault in hospital settings is a key goal in advancing the quality of care for in-client medicine."[30]

Hardin[80] reported that for more than 30 years (now 35+ years), sleep abnormalities have been documented in clients in the intensive care unit (ICU). Current research continues to show that ICU sounds and lights interrupt sleep and that earplugs, eye masks, and oral melatonin improve sleep quality in healthy subjects.[86] Environmental noises and client care activities account for about 30% of awakenings in ICU clients.[64] The noise levels in ICUs are found to be especially high.[114]

Although noise in the hospital is a concern, a study by Freedman et al.[62] suggested that nursing care activities, such as taking vital signs and giving sponge baths, may actually contribute more to client awakening than the environmental conditions. Bartick et al.[21] reported similar results in their study, which found that hospital staff was the factor most responsible for sleep disruption in clients and that behavioral interventions for hospital staff members can actually reduce the use of sedatives. A qualitative study by Hopper et al.[84] of nurses and physicians working in an ICU found multiple environmental barriers to sleep; in addition, the study found that attitudinal barriers also may contribute to sleep disruption in the ICU. Attitudinal barriers included staff uncertainty about the significance of sleep, the tensions of providing protocol-driven care versus allowing the client to sleep, and lack of consensus about interventions.[84]

The etiology of sleep disturbances in the hospital or institutional setting is multifactorial and can be related to a client's medical illness, medical treatments, and the environment.[189] Clients treated in a traditional rehabilitation setting may also have a higher likelihood of sleep disturbance. In one study[107] of 31 consecutively admitted clients, diagnosed with a closed head injury (CHI), who were admitted to a brain injury unit, 68% had sleep/wake cycle disturbance. Those with the aberrations in nighttime sleep had longer stays in both the acute and rehabilitation settings—an important consideration in an era of concern over high healthcare costs.

Taking account of these factors, it is important to consider Mrs. Tanaka's sleep patterns at the facility or unit prior to admission to the rehabilitation hospital or unit. Was Mrs. Tanaka in the ICU? How long was she there prior to admission to the rehabilitation unit? Was her sleep disturbed in that setting?

To Nap or Not to Nap?

According to the NSF, napping can be categorized in three ways:

- *Planned napping:* Also known as preparatory napping, planned napping involves taking a nap before one becomes sleepy. This type of nap is used when a person knows that a later bedtime than usual is planned for that day.
- *Emergency napping:* This type of nap occurs when a person suddenly realizes that sleep is imminent and that the activity he or she is engaged in will not be possible very shortly. This type of napping can be used to help a drowsy driver or a worker who is operating dangerous machinery.
- *Habitual napping:* This type of nap is taken at the same time every day and is frequently done by children or by adults who require an afternoon nap.[127]

The research has been mixed on whether it's a good idea for a person to nap during the day. The primary concerns are that napping fragments sleep and that consolidated nighttime sleep may be disrupted as a result. A study by Alessi et al.[3] suggested that sleep disruption is common and severe among older persons receiving in-client post-acute rehabilitation and that excessive daytime napping was associated with less functional recovery for up to 3 months after admission. As cited by Woods et al.,[184] other studies have shown that naps longer than 1½ hours in the afternoon can be associated with increased falls and hip fractures,[17] more night awakenings, and higher mortality.[164] In their study of nursing home residents with moderate to severe dementia, Woods et al.[184] found that excessive daytime naps may be linked to elevated evening cortisol levels, indicative of circadian rhythm dysregulation (phase delay).

In a large population-based study of middle- to older-aged cohorts of British citizens, associations were found between daytime napping and an increased risk of mortality from all causes and respiratory diseases.[106] Another study, conducted in China, suggested an association between frequent napping and a higher prevalence of type 2 diabetes in the older population.[104]

On the other hand, some researchers are finding benefits to napping and thus recommending short naps, and other researchers have found that daytime naps do not necessarily hinder night sleep. In their study of 100 community-dwelling older adults with typical age-related health issues, Dautovich et al.[48] found that naps do not hinder consolidated night sleep. A study by Payne et al.[144] added to a growing body of evidence suggesting that even a short daytime nap can be enough to produce marked memory advantages, and that these benefits can be selective for emotionally salient and adaptive information. A study of clients with myasthenia gravis found that naps longer than 5 minutes can mitigate symptoms of fatigue.[98] A still-limited but growing body of literature suggests that a daily afternoon nap may be a safe and effective means of increasing 24-hour sleep and improving waking functions.[32] Box 13.4 presents tips on napping.

Box 13.4

How to Take a Good Nap

- Keep the nap short. A 20- to 30-minute nap may be ideal, but even a few minutes has benefits. A longer nap may lead to post-sleep grogginess ("sleep inertia").
- Find a dark, quiet, cool place. Don't waste a lot of time getting to sleep. Dimming the light and reducing noise help most people fall asleep faster.
- Plan a nap in the afternoon instead of napping haphazardly.
- Time caffeine intake so that it does not coincide with the nap.
- Don't feel guilty about taking a nap. A good, well-timed nap can actually help increase productivity.

Modified from the Harvard Health Letter: How to take a good nap, Boston, 2009, Harvard Medical School Publications.[81]

The debate over whether naps are beneficial continues. Current research seems to indicate that shorter daytime naps (eg, 20–30 minutes) may be beneficial, but overly extended daytime naps (1½–2 hours) may actually have negative health effects. More research needs to be done in this area; the OT practitioner should keep up to date on current research and not simply rely on commonly held beliefs. For example, caregivers who work in nursing homes frequently view napping during the day as good for residents with dementia. However, they may not be aware of the potentially negative consequences of extended naps.[184]

Nocturia

Nocturia is defined as waking one or more times to void (urinate) at night. It is the most common lower urinary tract symptom.[26] Booth and McMillan[26] cited prevalence studies[89,156] indicating that nocturia increases in both genders with age. The most significant consequence of nocturia is sleep disturbance, with evidence of fatigue during the day affecting energy and activity.[15] Zeitzer et al.[191] examined the sleep and toileting patterns of 147 community-dwelling older men and women with insomnia and found that more than half of all reported awakenings were associated with nocturia. The need for more trips to the toilet was associated with decreased feelings of being rested and decreased sleep efficiency; thus, nocturia compounds the negative impact of insomnia.[191]

Obayashi et al.[135] reported similar results from their large-scale study of general community-dwelling older adults in Japan. They found an association between nocturnal voiding frequency and poor objective sleep quality (lower sleep efficiency, longer duration of wakefulness after sleep onset, and shorter duration of sleep latency). Other studies have shown an association between the risk of falls and nocturia, and that caregivers and other sleeping partners also are at risk of falls during the night and day because of fatigue due to sleep disruption.[15]

In an editorial on the study by Obayashi et al.,[135] Mehra[111] pointed out that nocturia is also highly prevalent in the nonelderly population, citing a study[43] that showed that in a U.S. sample, 31% reported voiding more than once a night, and 14% reported voiding two or more times a night. Mehra suggested that more research should be done on ways interventions could influence nocturia so as to improve sleep health.

When evaluating a client's ADL status, occupational therapists should always ask the client about his or her voiding habits at night. The frequency of voiding can alert the OT practitioner to sleep disturbances or other issues. Information on voiding habits also can help the OT determine whether the client is using safe toileting practices, and whether he or she needs durable medical equipment (eg, bedside commode), adaptive equipment, routines, splint/orthotic schedules, a safe environmental setup, or possibly referral to the client's physician to address problems in this area.

Hunjan and Twiss[87] suggested that OT practitioners embrace the practice of helping clients with urinary incontinence in general, not just nocturia. They offered behavioral strategies that can be explored, including evaluating schedules; implementing timed, scheduled, or prompted voids; seeking assistance as needed; modifying the diet (with the help of a dietitian); and managing fluids and medications (in consultation with the physician or healthcare provider)—all of which may also help with nocturia.

Occupational Therapy and Sleep

In current practice, a sleep disturbance may not be the primary reason a client seeks OT services. However, because it has been established that insufficient sleep can impair or negatively affect all occupations, this is clearly an important area to consider in OT treatment in all practice settings. Based on a 2010 survey of state OT regulatory boards,[9] the AOTA estimated that there were roughly 137,000 OT practitioners in the US workforce (102,500 OTs; 34,500 OT assistants [OTAs]). These numbers are expected to grow, especially considering the aging of the population. The Department of Labor's Bureau of Labor Statistics reported that as of May, 2014, the labor force included 142,750 OT practitioners (110,520 OTs and 32,230 OTAs).[170] These numbers could be higher because self-employed OT practitioners were not included.

Occupational therapists work in many settings, including hospitals, long-term care and skilled nursing facilities, home health, out-client rehabilitation clinics, psychiatric facilities, community health programs, schools, and academia.[13] OT practitioners in all practice settings are well educated about the occupations of sleep and rest; they therefore can have a significant positive impact on the general health of society.

Occupational Therapy Evaluation

It is important to obtain a thorough occupational profile of the client during the evaluation, including the client's history and experiences, patterns, interests, values, and needs.[12] The profile also should include questions about the client's sleep and rest patterns, routines, and habits. A thorough medical history and information on whether the client has a history of sleep disorders or difficulties are other elements of the profile. A standardized, valid measure, such as the Epworth Sleepiness Scale (ESS) (Fig. 13.13) or the Pittsburgh Sleep Quality Index (PSQI),[31] can be used to collect initial and later outcome information on sleep.

Epworth Sleepiness Scale

Using the following scale, circle the *most appropriate number* for each situation.

0 = Would doze *less than once a month*
1 = *Slight* chance of dozing
2 = *Moderate* chance of dozing
3 = *High* chance of dozing

Situation	Chance of Dozing			
Sitting and reading	0	1	2	3
Watching TV	0	1	2	3
Sitting, inactive in a public place (in a theater or in a meeting)	0	1	2	3
As a passenger in a car for an hour without a break	0	1	2	3
Lying down to rest in the afternoon (when circumstances permit)	0	1	2	3
Sitting and talking to someone	0	1	2	3
Sitting quietly after a lunch without alcohol	0	1	2	3
In a car, while stopped for a few minutes in the traffic	0	1	2	3

Add the 8 numbers you have circled **Total** _______

FIG 13.13 The Epworth Sleepiness Scale has been validated in clinical settings and can be used by occupational therapists to collect information for referring a client to a physician. A score of 10 or higher indicates excessive daytime sleepiness. A score of 6 is the norm. However, clients with insomnia can have scores in the normal range. A score of 12 to 24 may indicate a severe abnormality. (Modified from Johns MW: A new method for measuring daytime sleepiness: the Epworth Sleepiness Scale, *Sleep* 14:540–545, 1991.)

Fung et al.[63] found the Functional Outcome of Sleep Questionnaire[176] to be well suited to helping OTs understand the impact of sleep on function and daily occupational performance. They also suggested use of the Daily Cognitive-Communication and Sleep Profile,[181] another self-reporting instrument that investigates sleep/wake disturbances in terms of cognition, communication, and mood.

Occupational Therapy Intervention for Sleep and Rest

Leland et al.[105] conducted a scoping review/systematic summary of the literature on sleep interventions and identified four intervention areas in which OT practitioners can help clients with sleep: (1) cognitive behavioral therapy for insomnia, (2) physical activity, (3) multicomponent interventions, and (4) other intervention strategies that improve sleep and fall within OT's scope of practice. Physical activity included a variety of activities, such as stretching, resistance training, yoga, tai chi, Qigong, dancing, and running. Examples of multicomponent interventions included sleep restriction/compression, sleep hygiene, relaxation techniques, and bright lights. Other interventions included strategies such as earplugs, eye masks, light therapy, music, and headphones to help with sleep. With all these interventions, the emphasis was on consistent focus on modifying existing habits and routines, and participation in activity that followed adherence to sleep restriction/compression.[105] Fung et al.[63] suggested that OTs can provide education and interventions such as awareness of pain, energy levels, sleepiness, fatigue, and stress levels, in addition to environmental recommendations and strategies to pace activities (also see Chapter 7, Section 2).

According to the OTPF-3,[12] the types of OT intervention include therapeutic use of occupations and activities, preparatory methods and tasks, education and training, and advocacy and group interventions. All of these interventions can be used for treating clients in the occupations of sleep and rest. They are reviewed after the discussions of the therapeutic use of self and consultation.

Therapeutic Use of Self

The therapeutic use of self is a therapeutic agent (not necessarily an "intervention") that should be integral to the practice of occupational therapy and interwoven in all interactions with clients.[12] Therapeutic use of self allows OT practitioners to develop and manage their relationships with clients by using narrative and professional reasoning, empathy, and a client-centered and collaborative focus.[12] With therapeutic use of self, the OT practitioner can demonstrate caring and concern for the client or caregivers about the amount and quality of their rest and sleep. Sleep medicine is a relatively new discipline, so many physicians do not ask their clients about their sleep or don't recognize the signs of sleep disorders or issues.[58] Therefore, because of occupational therapy's attention to occupations, routines, and life balance, the OT practitioner may be the first to ask a client or caregiver about sleep concerns.

The OT practitioner can practice "mindful empathy," a mode of observing the client's emotions, needs, and motives while remaining objective.[166] For example, instead of judging a client for canceling appointments or not fully participating in treatment, the OT should actively listen to the client and reassess the situation; this approach could reveal a sleep-deprived client.

Therapeutic use of self also means that OT practitioners must be more knowledgeable and have competency in the areas of sleep and rest so as to help clients optimize their sleep and rest patterns. Becoming knowledgeable about sleep and sleep disorders can help the OT practitioner recognize any problems that may indicate severe sleep disturbance so the client can be referred to a physician or sleep specialist.

OT practitioners can also model good sleep practices, so that they are alert, safe, and functioning at their best when working with clients. In addition, OTs need to examine their own values about sleep and rest because attitudinal barriers on the part of the healthcare staff may affect the sleep of clients.[84] For example, do you consider sleep and rest a waste of time? Is a person lazy if he or she requires a nap during the afternoon?

Developing cultural competency is a "central skill" for using oneself therapeutically.[166] As previously mentioned, recognizing and appreciating diversity in sleep and rest are important because others' definitions, patterns, practices, and environments may completely differ from our own.

Mrs. Tanaka's views about and experiences with sleep, in addition to her sleep habits and patterns of sleep, are all important considerations in her treatment. For example, if Mrs. Tanaka's family reports that she always used a night-light to sleep and was afraid of the dark, the OT practitioner should not impose complete darkness in her room at night as a sleep hygiene technique (see Chapter 7, Section 2).

Consultation

Infused throughout the OTPF is the role of the OT providing consultation as a method of service delivery versus being considered a separate intervention.[12] Consultation takes place when practitioners provide services to clients indirectly on their behalf, such as within multidisciplinary teams or community agencies.[12] Occupational therapists can provide consultation in institutional settings where a 24-hour "on" schedule is frequently in place. Typical delivery of service addressing sleep and rest could include consulting with the treatment team and staff about providing an optimal sleep environment for clients at night. Or, the OT consultant might discuss with the team the necessity of middle of the night, nonurgent blood pressure readings, sponge baths, and blood draws, and recommend they be avoided. Providing training to night-shift aides, nurses, orderlies, and caregivers in bed mobility, bed positioning, transfer techniques, and body mechanics is another common form that OT consultation can take.

The occupational therapist also can act as a consultant in worksite settings, meeting with managers and administrators about the importance of sleep for optimal functioning and safety. The OT consultant can encourage balance in life for a more productive and safer workforce. West[178] pointed out that consultation services may be particularly useful in settings that employ shift workers (eg, hospitals, factories, airlines), providers of driver education, the military, and emergency relief programs.

Certified driver rehabilitation specialists (CDRSs), who are usually OT practitioners trained in driving and community mobility and OT generalists, can educate clients and the public about the dangers of drowsy driving. Occupational therapists who are specialists in adaptive driving and evaluation of disabled or at-risk individuals are usually the most up to date about regulations and information on driving, and they can act as consultants to other OT practitioners and healthcare professionals. The CDRS also can counsel clients on driving training or driver retirement when appropriate.

Occupational Therapy Interventions in Various Practice Settings[12]

Therapeutic Use of Occupations and Activities

Occupational therapy offers an abundance of therapeutic occupations and activities that can focus on helping the client have a healthy lifestyle balance and well-planned routines to ensure adequate rest and sleep. An activity configuration or pie chart can be used with the client to review occupations that are important to the client and to assess how time is spent and the portion of time allocated to each of the occupations.

Woods et al.[184] stated that nursing home staff or caregivers can alter daytime napping behavior to prevent prolonged napping in residents. The researchers suggested increasing physical activity and activity programs to increase engagement with the environment. Interventions that maintain a more normal sleep/wake cycle may help the person with dementia maintain a more normative cortisol diurnal rhythm. Increased daytime activities may decrease excessive daytime napping and mitigate sleep dysregulation.

Activities of Daily Living

Schedules.

Consider optimal times for ADL training; for example, if the client is a “night owl,” don't schedule training in showering and dressing for 7 am. Try to schedule certain ADLs at “customary” times, especially for clients with cognitive impairment (eg, work on dressing in the morning rather than at 1:30 pm) so that they become accustomed to a routine. Consult with other team members or family members and ensure that clients are getting sleep and rest. Keep track of sleep by using a sleep chart or diary. Schedule regular daytime naps (in bed, if possible; not in a wheelchair or recliner) or rest breaks if needed. Keep the medical team informed about the client's alertness during therapies.

Dressing.

If dressing is considered a usual habit for a client, dissuade the use of pajamas during the day and have clients dress in “street” clothes. Encourage pajamas or “usual” sleeping clothes at night while the client is on a rehabilitation unit or recovering from illness or injury at home. However, it is important to note that some clients regularly wear housecoats during the day. Some cultures may also deem it necessary to wear pajamas because the client is still considered “sick.”

Hygiene and grooming.

If a client normally shaves or wears makeup during the day, encourage this as part of the morning/daytime routine, if it is important to the client. Ensure that the client and caregiver have a routine for activities to get ready for the day and to go to sleep at night.

Bed positioning, bed mobility, the bed, and bedding

- *Bed positioning.* Train the client and caregivers in bed positioning to ensure comfort and optimal functioning. Are there enough pillows? Does the head of the bed need to be elevated? Does an extremity need to be elevated? Are there other precautions that need to be followed while the client is in bed (eg, total hip, logroll)? As previously mentioned, “positional therapy” was recommended as a practice guideline for medical professionals in the treatment of OSA. This type of positioning entails keeping clients in a nonsupine position, which has been found to be useful as a secondary therapy (to PAP therapy) for people with OSA.[118]
- *Bed mobility.* Train the client and caregivers in bed mobility techniques for safety. Assist in determining the optimal bed for the client to use to facilitate sleep, with consideration for skin protection, breathing, and mobility and transfer status at the forefront. Ensure that the client has easy access to a call light, and make or request adaptations to the call light if needed. Provide adaptive equipment for safe bed mobility, such as a transfer handle, bed rails, loops on bed rails, and a trapeze, as indicated.

- *Bed*. Consider the type of bed required for safety and independence in bed mobility, transfers and even to support relationships. Factors to consider include size; height for safe transfers; height if the client tends to fall out of bed (lower bed may be safer); whether the client co-sleeps; mattress materials (some absorb and retain heat, which can be an issue for people with thermoregulation problems, such as those with severe burns or tetraplegia, or women going through menopause); whether a mechanical bed (semielectric or full-electric) is required; whether the bed helps protect the skin, requiring fewer turns at night; and how the client with mobility problems can maneuver on a particular type of mattress. For example, some clients may find it more difficult to position themselves on a foam mattress than on a spring mattress.
- *Bedding*. If the client is going to be away from home, consider whether a special quilt or blanket from home may assist him or her to sleep, or whether particular textures for sheets may be more suitable during sleep for skin protection or comfort. The 2012 National Sleep Foundation Bedroom Poll[130] of 1500 Americans between the ages of 25 and 55 found that 92% of people said that a good mattress was important for good sleep; 91% identified pillows; and 85% mentioned bedding. Seventy-eight percent of the study subjects said that sheets with a fresh scent helped them become enthusiastic about going to sleep.

OT practitioners are well versed in bed positioning, mobility, and the use of durable medical equipment (DME), in addition to environmental setup; therefore, OTs are a natural fit when it comes to addressing these areas for sleep and rest concerns.

Transfers.

Train the client, caregivers, and family members in safe techniques for transferring onto a commode or other surfaces where transfers may occur at night.

Toileting.

Consider the most appropriate times for catheterization, voiding, and a bowel program to optimize rest and sleep. Ensure that any equipment (eg, commode, urinal) is readily available by the bedside or in the toileting area. Help the client and caregivers choose incontinence products, such as seat and bed protectors, disposable underwear ("pull-up" style), diapers, and so on. Discuss with the medical team, the client, and the caregivers the optimal toileting techniques to encourage sleep at night for all concerned and for safety. For example, if transfers are difficult for a male client, with the physician's approval a condom catheter initially can be used at night for urination rather than a commode.

Showering and bathing.

Consider the optimal time for a bath or shower to encourage sleep at night or wakefulness during the day to participate in therapies or daytime activities. Perhaps a morning shower would "wake up" a client. Or, the optimal time for a client to take a shower or bath may be at night, to help with sleep. The shower increases the core temperature, which then decreases to the optimal body temperature for sleep. Safety should be the primary consideration in determining showering and bathing times.

Eating and meals.

Work on feeding activities. Encourage the client to eat meals with the rest of the family in the family dining area, as appropriate, to ensure that daily rhythms are reinstated to help distinguish day from night. Avoid allowing the client to eat in bed, even the hospital bed, if possible. The appropriate dietary and fluid intakes and their timing should be discussed with the dietitian and physician.

Instrumental Activities of Daily Living

IADLs call for more advanced skills than basic ADLs and generally require use of executive functions.[78]

Homemaking, bed making, and laundry.

The 2012 National Sleep Foundation Bedroom Poll of 1500 Americans between the ages of 25 and 55 found that nearly 9 in 10 (88%) made their beds at least a few days a week.[130] Seven in 10 (71%)

made their beds every day or almost every day. Respondents living in the Northeast, women, older respondents and those married or partnered were more likely to make their beds every day or every other day. Those who made their beds every day or almost every day were more likely than those who did so less often, or not at all, to say that they got a good night's sleep every day or almost every day (44% vs. 37%).[130] These are interesting statistics to consider because bed making as an IADL is under the domain of OT and should not be forgotten. The same poll found that 53% of respondents rated sleeping on sheets with a fresh scent an important contributor to their sleep experience. More research is needed to determine whether fresh-smelling sheets actually help people sleep better, but it is an important consideration for an OT practitioner when working on laundry tasks with clients or when considering sleep environments in industrial or home settings.

Community mobility.

If clients are no longer deemed safe to drive because of sleep disorders, OT practitioners can train them in community mobility and alternative transit (see Chapter 11, Section 3).

Home Safety Evaluation

As appropriate, perform a home evaluation to ensure that the home is safe for transfers, toileting, and ambulation at night, and to determine any equipment needs (see Chapter 10). Suggestions can be made for bed placement, and night-lights and call bells can be set up as needed. Lighting and security are also important to facilitate sleep. Blackout curtains are frequently recommended, but sufficient lighting for safety in mobility is also important, as is a clean, uncluttered sleeping area. Confer with a physical therapist about optimal ambulation devices the client can use at night. According to Solet,[159] an OT and sleep researcher at Harvard Medical School, the optimal sleep environment is quiet, dark, cool, comfortable, and clean. She recommended that the OT help adapt and organize the sleep environment. Because the body temperature drops as part of the sleep cycle, a cooler bedroom is more conducive to sleep.[159] Solet also noted that clean environments are especially important to consider for people with allergies.[159]

Healthcare environment.

Check with the nursing staff before making changes to the environment, especially in the acute hospital setting. To encourage sleep, turn off lights, encourage a quiet room, turn off the TV, and close the door fully if needed and if safe. Consider whether the client may be overstimulated if too many items are posted on the wall. However, keep in mind that photos of loved ones and personal blankets and objects may provide comfort and a sense of security to a person in the hospital. For safety, make sure the floor is clear of clutter and obstructions. Make sure the temperature in the room is comfortable for the client to sleep. Extra blankets may be needed for clients who tend to get cold. Make sure call lights, water (if allowed), and a phone are accessible to the client before leaving the room. Bed rails should be up unless the medical team states that they may be down.

Leisure Activities, Social Participation, and Restorative Activities

Try to schedule treatments outdoors so that the client is exposed to light because it is the strongest zeitgeber (time cue) and can help to reset the biological clock if it is off kilter. Collaborate with the client and family to make sure activities selected are interesting and important for the client. Clients sometimes sleep during the day because they're bored. Encourage participation in activity groups, therapeutic recreation groups, and community events if it helps the client to sleep at night. Make suggestions for and encourage quiet restful evening activities. As mentioned previously, Howell and Pierce[85] have pointed out that occupations that are highly restorative tend to have strong routines of a simple and repetitive nature, are often considered pleasurable, and have personal meaning to the individual. West[178] has suggested relaxing activities such as reading, stretching, meditating, or praying before bedtime. Use of sleep preparatory activities such as visual imagery and massage can also be used.[178] Some evidence suggests that aromatherapy with essential oils such as lavender and chamomile may have some promise in helping to induce a state of mind that assists with sleep.[179] However, continued research is needed to find evidence of its effects on sleep architecture by polysomnography.[179]

Preparatory Methods and Tasks

Instruction and training in good sleep hygiene strategies can be considered preparatory activities to facilitate sleep.

Splint, exercise schedule, and pain.

Consider client sleep when giving splinting schedule instructions. Ensure proper fit for comfort so that the client can sleep. Make sure the splint schedule doesn't interfere with sleep or that the continuous passive motion (CPM) machine, typically used with clients who require a total knee replacement, doesn't keep the client awake all night. Collaborate with physical therapy about CPM use. Make sure exercises are performed at a time that will optimize sleep at night. Consider the client's pain levels and consult with the medical staff and physicians. Talk to the client about whether he or she is unable to sleep at night because of pain, edema, or immobility.

Sleep hygiene.

Sleep hygiene refers to activities involving lifestyle choices and environmental factors that can lead to healthy sleep. "Hygiene" does not just imply cleanliness, but generally stands for everyday habits to promote good health; "sleep hygiene" emphasizes proper habits to promote healthy sleep.[52] Sleep specialists provide sleep hygiene education with the intent of providing information about lifestyles and environments that either interfere with or promote sleep. OT practitioners can also provide sleep hygiene information to support healthy, active engagement in other areas of occupation (Box 13.5).[12]

Box 13.5

Important Considerations in Sleep Hygiene (OTPF-3)

Preparation of Oneself

- Developing routines that prepare one for comfortable sleep, such as grooming, undressing/dressing, reading, listening to music to fall asleep, saying goodnight to others, meditation or prayers
- Determining the time of day and length of time desired for sleeping or the time needed to wake
- Establishing patterns that support growth and health (patterns are personally and culturally determined)

Preparation of the Environment

- Making the bed or space in which to sleep
- Providing for warmth/coolness and protection
- Setting an alarm clock
- Securing the home (eg, locking doors, closing windows or curtains)
- Turning off electronics or lights

Participation in Actual Sleep

- Stopping all activities so as to ensure the onset of sleep, napping, and dreaming
- Sustaining a sleep state without disruption
- Ensuring nighttime care of toileting needs or hydration
- Negotiating needs of others in the social environment
- Interacting with those who share the sleeping space (eg, children or partners)

- Nighttime caregiving (eg, breastfeeding)
- Participating in activities to monitor the comfort and safety of others (eg, the family) while sleeping

Data from the American Occupational Therapy Association: Occupational therapy practice framework: domain and process, ed 3, *Am J Occup Ther* 68(Suppl 1):S1–S48, 2014. http://dx.doi.org/10.5014/ajot.2014.682006.12

According to Dement and Pelayo,[52] general guidelines for sleep hygiene are:

1. Create an optimal environment for sleep.
2. Reinforce predictability.
3. Avoid substances that negatively affect the sleep/wake cycle.
4. Follow good general health practices, which favor optimal sleep.

Box 13.6 provides more specific examples for each of these four categories.[52]

Box 13.6

General Recommendations for Sleep Hygiene

1. Create an optimal environment for sleep.

- Remember that the only activities that should occur in bed are sleep and sex (avoid reading, watching TV, texting, tweeting, or using other media or computer devices in bed).[101]
- In the hour before bedtime, turn off electronics. Research has shown that blue light from a television, personal computer, or tablet screen can interfere with sleep.[66] Culture and generational differences should be considered. Kaji and Shigeta[95] found that Japanese teenagers considered their mobile device a "teddy bear" that provided reassurance that they could connect to friends if needed.[162]
- Prepare a quiet environment for sleep or use "white noise" to foster sleep.[101]
- Ensure that the environment is dark, quiet, comfortable, cool,[66] and clean.[159]

2. Reinforce predictability (and activity).

- Develop a regular sleep/wake cycle. Use an alarm clock if needed.[52]
- Develop a relaxing routine before bedtime.
- Avoid mentally stimulating or arousing activities before bedtime.[97]
- Keep a sleep diary, which is considered the gold standard for subjective sleep assessment.[34] Sleep diaries are currently not standardized. However, insomnia experts, with feedback from potential users, have created a Consensus Sleep Diary, which is considered a living document.[34] In addition, the National Sleep Foundation (NSF) has created the NSF Official Sleep Diary.[126]
- If a person can't fall asleep within a reasonable amount of time (eg, 15 minutes) while in bed, he or she should leave the bed, go to another room, or perform another activity until the individual feels sleepy. Mindfulness-based activities (eg, mental body scanning, deep breathing) may be considered for those who cannot readily hop out of bed.[94]

3. Avoid substances that negatively affect the sleep/wake cycle.

- Do not use alcohol to fall asleep. Alcohol can make snoring and obstructive sleep apnea (OSA) worse. Evidence exists that three to five glasses of alcohol in the evening can cause arousal when the effects of the alcohol wear off.[49,52]

- Do not use caffeine prior to sleep. Caffeine has a half-life of 3.5 to 5 hours, depending on a person's age, activity level, or body chemistry; this means that it could remain in the body for many hours after ingesting it.[49,112] Keep in mind that besides coffee, some teas, soft drinks, and chocolate also contain caffeine.[49,112]

- Avoid medicines that will keep a person awake at night. Confer with a prescriber about medications taken at night, particularly those that affect sleep occupations (eg, diuretics taken at night).[189]

4. Follow good general health practices (eg, exercise, diet, timing of meals), which favor optimal sleep.

- Exercise daily, but do not do vigorous exercise in the 2 hours before bedtime.[66] Research has shown that participation in an exercise training program can have positive effects on sleep quality in middle-aged and older adults.[187]

- Avoid going to bed with a full stomach; try to finish dinner at least 2 hours before bedtime.[66]

- Avoid spicy foods and heavy eating in the evening, but do not go to bed when hungry.[52]

- Limit liquids at night. Talk to a healthcare provider about this.

Education and Training

In the healthcare setting, the occupational therapist can educate and empower the client and family to set a strict visitation schedule, if necessary, to dissuade visitors from arriving at night or during scheduled rest times, which may interrupt rest and sleep. OT practitioners can help empower caregivers to limit visits to short periods, or they can help with the enforcement of visitation rules. The occupational therapist can educate caregivers about sleep and make sure they realize how important it is for them to get their own rest and sleep.

Some institutions require doors in rooms to be open at night despite the lights and noise. Education can be provided to staff about how best to facilitate sleep in these settings. Young et al.[190] suggested several strategies, including offering earplugs and eye masks, encouraging regular nocturnal sleep time, and discouraging long daytime naps. Other suggestions included encouraging the medical staff to minimize nighttime bathing, dressing changes of wounds, or other medical procedures and to avoid discussing emotionally charged topics with the client at night.

OT practitioners can also train people in pain awareness and management, energy levels (work simplification techniques), sleepiness and fatigue, time management, and cognitive behavioral techniques.[63]

OT instructors can educate their students about the consequences of sleep deprivation; as college and graduate students, they are a group known to be at risk for erratic sleep behaviors and significant sleep debt. If afternoon classes are scheduled, more “active” class activities may be required to fend off sleepiness for instructors and students during the circadian clock's “sleepiness” times. During short breaks for longer classes, instructors can encourage students to stand up, stretch, or walk around instead of remaining in their chairs to check their mobile devices. Occupational therapy and occupational science educators can coordinate assignment due dates and spread them out to encourage balance for the instructor and students and to ensure proper sleep for both.

Green et al.[74] noted that many clients complain of lack of information about the management of insomnia. Occupational therapists can provide education to the sleep-deprived public in community practice settings.

Advocacy

OT practitioners can provide services in the form of advocacy to their clients.[12] The OTPF-3 defines clients as individuals, groups, or populations.[12] Advocacy as an OT service involves more than just education; it includes follow-up and an assertive voice and action to ensure that people's needs are met. Advocacy is defined as an “act of pleading, supporting, recommending; active espousal.”[53]

For occupational therapists, advocacy can take any of the following forms.

- *Individuals:* Simply asking clients about their rest and sleep is the first step in advocacy. If the assessment indicates problems with sleep and rest, notify the physician. If indicated, recommend to the primary care physician that a sleep specialist be consulted. Inform the treatment team of poor function due to inadequate sleep. Encourage families and friends to abide by hospital visitation rules if the client lives (temporarily or permanently) in a facility. Advocate for appropriate environments for adequate rest and sleep. Through detailed documentation or calls to vendors, advocate for timeliness for appropriate DME and adaptive equipment to maximize sleep; examples include a hospital bed, mattress with skin protection, diapers, pads, urinal, and appropriate pillows. Ensure follow-through with adequate client positioning by nursing staff and caregivers; talk to the treatment team about adequate pain control to maximize sleep.
- *Groups:* Advocate for appropriate sleep and nap environments in any number of settings. For example, in day healthcare centers for frail older adults or dementia activity centers where seniors may stay all day, promote the creation of nap or rest areas. Options for reclining and lounging should be provided, in addition to just dining-type chairs. Ensure that workers, injured or not, have appropriate sleep and rest to perform their jobs. Advocate for students in OT educational settings to have adequate sleep and rest.
- *Oneself and the role of the OT profession:* Educate others on the role of OT in sleep. Advocate for more involvement of OTs in IADL, leisure, and rest activities, not just basic ADLs, so that clients will have meaningful activity to engage in during the daytime to avoid prolonged napping due to boredom. In an evidence-based review of the literature on OT intervention for people who had had a CVA, Wolf et al.[182] found an overemphasis on ADLs, with less attention paid to other areas of occupation, such as leisure, social participation, rest and sleep, and work and productivity.[182] As the authors noted, "In general, regardless of diagnosis, occupational therapy is too focused on ADL performance, which limits practitioners' role in the other areas of occupation that are meaningful to clients."[182]
- *Populations:* The NSF has produced educational materials and fact sheets to educate the public about the dangers of drowsy driving. It also created the National Sleep Foundation 2014 Drowsy Driving Advocacy Kit, which provides ideas on resources for advocacy at a statewide level.[132] School times for high school students in metropolitan Minneapolis were shifted to match adolescent circadian rhythms (ie, later school start times), and a subsequent study[171] found statistically significant improvements in graduation rates, rates of continuous enrollment, tardiness, and attendance. OT practitioners can be involved in future research in this area or in political advocacy.

In addition to individual client treatment, the topics of sleep and rest lend themselves well to group OT sessions, as is discussed in the next section. Marilyn B. Cole's book, *Group Dynamics in Occupational Therapy: The Theoretical Basis and Practice Application of Group Intervention,* fourth edition (2012), offers the beginning OT student or novice group leader a helpful seven-step format for leading groups. Experienced group leaders can also benefit from this book.

Group Interventions

OTs should develop cognitive strategies to help manage negative, anxiety-producing thoughts and concerns.[97] These strategies can be used successfully in both group and individual interventions.[73] Examples of negative, anxiety-producing thoughts are, "I'll never sleep again," or "It's already 2 o'clock in the morning, and I have to wake up in four hours." Occupational therapists can consider training in CBT-I. CBT-I usually focuses on modifying unhealthy sleep habits, reducing autonomic and cognitive arousals, altering dysfunctional beliefs and attitudes about sleep, and educating clients about healthier sleep hygiene practices. Research has supported the use of CBT in groups as a nonpharmacological treatment for sleep disturbance.[90]

In a 2013 article in *OT Practice,* a magazine published by the AOTA, Gentry and Loveland[66] discussed how an OT and a recreational therapist co-led a 10-week sleep hygiene therapy group for military veterans. The group sessions were attended by 20 to 25 members and lasted 90 minutes. The leaders led discussions on topics such as the nature of sleep, sleep-related problems. and nightmares because many members had post-traumatic stress disorder (PTSD). The group leaders reported that participants felt healthier and more engaged in daily life after attending the group sessions.

Gentry and Loveland[66] also provided suggestions for documentation and the use of Current Procedural Terminology (CPT) codes when billing for sleep-related services in the United States. CPT codes are maintained by the American Medical Association and are important for billing purposes in the United States.[66]

Determining When to Refer a Client to a Physician or Sleep Specialist

Refer the client to a physician or sleep specialist if he or she complains of any of the following conditions[58]:

- Has trouble initiating sleep or getting restful sleep for more than a month or two
- Does not feel rested despite getting the usual amount of sleep or more sleep than he or she is accustomed to getting to feel rested
- Falls asleep at inappropriate times, even though he or she is getting $7\frac{1}{2}$ to 8 hours of sleep
- Has been told that he or she snores loudly or gasps and has periods of not breathing that disrupt a bed partner or roommate
- Has to sleep in a different room because a bed partner claims the client's snoring is too disruptive
- Follows good sleep hygiene habits but still has difficulty sleeping

Other reasons to refer a client to a physician or sleep specialist are:

- Caregivers complain that the client is awake all night and sleeps all day.
- A cognitively impaired client is not able to report clearly his or her sleep habits but has obviously declined in occupational performance areas (eg, ADLs, mobility) and you suspect poor sleep.
- The client falls asleep regularly during your treatment in the daytime.

If appropriate, have the client fill out a sleepiness scale, such as the Epworth Sleepiness Scale (see Fig. 13.13), which has been validated in clinical settings.[92] A score of 10 or higher indicates EDS; a score of 6 is the norm.[192] Present the data to the client's physician, and notify him or her of the client's deficits in occupational performance or other symptoms resulting from sleep deprivation.

Summary

Historically, occupational therapists and occupational scientists have been interested in the importance of helping clients maintain a healthy, balanced lifestyle.[40] Included in that balance should be adequate sleep and rest, two “restorative” occupations.[146] According to the OTPF-2[10] and OTPF-3, the category of sleep and rest is considered a major occupational performance area that is in the domain of OT practice; accordingly, addressing this area in all practice settings is appropriate.

Occupational therapists have not traditionally treated clients whose diagnosis or problem has been primarily a sleep disorder. However, the sleep medicine literature abounds with information about the deleterious effects of sleep deprivation, including the effects on the at-risk clients occupational therapists treat daily in physical disability and other practice settings. Although occupational therapy has not focused research or practice on rest and sleep, sleep medicine research affirms what OT practitioners have known all along: Humans need to sleep, and they need to rest. Otherwise, occupational performance declines, negatively affecting a person's quality of life and health.

However, compelling evidence suggests that occupational therapists could and should put more emphasis, research, and practice into helping clients who have sleep difficulties. A study in Scotland of 38 healthcare professionals (including 19 occupational therapists) who took a 3-day course on sleep in people with Parkinson's disease showed that cognitive behavioral sleep management can be successfully transferred to healthcare professionals who were not sleep specialists.[76] Clients who were seen by the healthcare professionals who took the course reported reduced anxiety over sleep problems, better ability to manage sleep, and more of a sense of control over sleep.[76]

Solet points out that there are ten influences on sleep: exercise activity levels, sleep schedule, bed partner/pets, caffeine/alcohol/medications, psychological state, age/gender/genetics, cultural norms/social context/“lifestyle,” light/circadian drive, sleep environment and sleep debt.[159] The only area that occupational therapists cannot influence from that list is age/gender/genetics.

An emerging body of research shows that purpose in life is linked with a variety of healthy behaviors, positive health outcomes, longevity, and a lower incidence of sleep disturbances.[99] In a nationally representative sample of U.S. adults over age 50, Kim et al.[99] found that purpose showed an independent association with sleep disturbances, even after adjusting for psychological distress such as anxiety and depression. This finding may suggest that purpose is important for good sleep above and beyond the absence of negative psychological factors. Further research is needed, but interventions to enhance purpose in life could be an approach for reducing sleep disturbances.[99]

Another important client factor, spirituality, is not considered the same as religion; the OTPF-3 describes it as “the aspect of humanity that refers to the way individuals seek and express meaning and purpose …”[12] (OTPF-3, p. S7).[147] Waite[172] offered ideas on how OT practitioners can incorporate spirituality into practice.

OT practitioners are in the front lines of those working closely with clients who must cope with life-altering events. They help people face the realities of needing to change or alter their life course. OT practice emphasizes the occupational nature of humans' drive to achieve a healthful, productive, and satisfying (meaningful) life[12]; thus, OT practitioners are primed to help people find meaning through occupation, even when their lives have been drastically altered.

Reflecting on the case of Mrs. Tanaka, it is evident that OT practitioners can help make a difference in her rehabilitation outcomes by focusing on her sleep disturbance, once medical issues have been ruled out. A multitude of reasons may explain Mrs. Tanaka's sleep disturbance. The exact location of her brain injury may help the medical team determine whether the disturbance is organic, but further study may also reveal a sleep disorder. An OT practitioner who is educated and attuned to Mrs. Tanaka's sleep and rest needs can help her reach her rehabilitation goals and improve her quality of life.

Review Questions

1. What is sleep architecture?
2. How does sleep architecture change as we age?
3. What is REM sleep, and how does it differ from NREM sleep?
4. Why should OT practitioners address sleep in their practice?
5. What is the difference between sleep and rest?
6. Where does the area of sleep and rest fit into the OTPF-3?
7. What is sleep hygiene?
8. What is the Multiple Sleep Latency Test? What is the Epworth Sleepiness Scale?
9. When is it appropriate to refer a client to a physician or sleep specialist?
10. How can an occupational therapist help improve a client's sleep hygiene in a hospital setting?
11. Name at least five consequences of inadequate sleep.
12. What is obstructive sleep apnea, and what are some signs and symptoms of the disorder?

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Other Resources

American Academy of Sleep Medicine

http://www.aasmnet.org

The American Board of Sleep Medicine

http://www.absm.org

The American Sleep Association

http://www.sleepassociation.org

The Board of Registered Polysomnographers

http://www.brpt.org/

National Sleep Foundation

http://www.sleepfoundation.org

Sleep Research Society

http://www.sleepresearchsociety.org

Sleep Treatment

https://sleeptreatment.com/

[a]References 36, 52, 58, 80, 83, and 158.

14

Work Evaluation and Work Programs

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CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Understand the role of occupational therapy in the development of work programs.
2. Describe the different types of work evaluation and work programs that are currently being practiced.
3. Identify the components of an industrial rehabilitation program.
4. Understand the difference between work hardening and work conditioning.
5. Identify the aspects of a well-designed functional capacity evaluation.
6. Explain the importance of reliability and validity in the context of evaluation.
7. Understand the differences between job demands analysis, ergonomic evaluation/hazard identification, and worksite evaluation.
8. Discuss the application of job demands analysis.
9. Discuss basic ergonomic interventions.
10. Describe the components of injury prevention programs.
11. Describe school-to-work transition services.
12. Describe the purpose of a work readiness program.
13. Identify various community-based work programs.

KEY TERMS

Ergonomic evaluation
Ergonomics
Essential tasks
Functional capacity evaluation
General vocational evaluation
Industrial rehabilitation
Job demands analysis
Primary prevention
Secondary prevention
Specific vocational evaluation
System theory
Tertiary prevention
Vocational evaluation
Work conditioning
Work hardening

Work readiness program
Work-related musculoskeletal disorders
Worksite evaluations

Threaded Case Study

Joe, Lorna, and Henry, Part 1

Joe is a 26-year-old man who worked two jobs to support himself and his daughter, who lived with his ex-wife. He worked as a janitor during the day at a hotel and spa and cleaned offices at night. Because of a motor vehicle accident, he sustained a T11 spinal cord injury, which resulted in complete paralysis of his legs. This injury affected his mobility, strength, and effort, so he could not return to janitorial work because he would not be able to effectively carry out the essential functions of the job from a wheelchair. Fortunately, one of Joe's employers, the hotel and spa, liked him because he was a good worker and was willing to offer him an alternative job as a laundry attendant if he could meet the physical demands of the job. Joe was referred to occupational therapy by his physician.

Lorna is a 39-year-old single mother who has been working at the same job in a St. Louis upholstery factory for the past 20 years. Lorna's job is to pull heavy fabric tightly over a padded wooden frame and then staple the fabric to the frame. Once she is finished stapling, she pushes the piece of furniture over to a coworker, who checks her work and then wraps the piece of furniture in thick plastic. It is hard work, and her hands and back often ache at the end of the day from pulling the fabric tightly, using the heavy staple gun, and handling the awkward furniture. With the holidays approaching, Lorna and coworkers decided to put in extra hours to make some additional money to buy presents for their children. Lorna is now experiencing significant pain, numbness, and tingling in her hands. She can no longer just shake her hands out to make it go away. She is having trouble holding onto the fabric and often drops the staple gun. She has had to take a few days off work because of the pain in her back and hands.

Henry is a 42-year-old father and husband who has been supporting his family by working as a roofer for the past 15 years. On one of his work assignments he fell off the roof and sustained a traumatic brain injury and a couple of lower extremity fractures. As a result, his motor and praxis skills, sensory-perceptual skills, cognitive skills, emotional regulation skills, and communication and social skills have been affected. He has been receiving worker's compensation for 2 years; Henry now feels ready to return to some type of work but does not know what he can do. He has enough insight to know that he cannot return to roofing but would like to do something with his life.

Critical Thinking Questions

As you read through the following information on occupational therapy work evaluation and intervention, keep in mind the circumstances of Joe, Lorna, and Henry to determine which services they may benefit from most.

1. What type of evaluation and services could occupational therapy offer to assist Joe, his physician, and the employer?

2. What occupational therapy interventions can help Lorna and her work environment?

3. What work-related occupational therapy services can help Henry discover what type of work he can do at this point?

One of the most significant occupations in which adults engage is work. A stable job provides the means to fulfill the most basic physiological and safety requirements that humans need to survive and thrive: food and water, a safe place to sleep, and the security of knowing that these resources will continue to be available. For many, belonging and esteem needs are also met at the workplace. Anything that prevents an adult from participating in the occupation of work will have significant consequences for that individual's health and well-being. According to the Office of Disability Employment Policy of the U.S. Department of Labor, in 2014, 17.1% of the labor force consisted of people with disabilities. The unemployment rate for those with disabilities was 12.5%. Occupational therapy practitioners play a key role in helping workers maintain their employment despite the symptoms they experience; they also facilitate an individual's entry or reentry into the workforce.

History of Occupational Therapy Involvement in Work Programs

The therapeutic use of work has always been a core tenet of occupational therapy, since the inception of the profession.[32] Work programs have their roots in efforts to help those with mental illness during the moral treatment movement, which started in Europe in the late 18th and early 19th centuries.[77] In 1801 Philippe Pinel, one of the founders of moral treatment, introduced work treatment in the Bicentre Asylum for the Insane. He suggested that "prescribed physical exercises and manual occupations should be employed in all mental hospitals … Rigorously executed manual labor is the best method of securing good morale … The return of convalescent patients to their previous interests, to industriousness and perseverance have always been for me the best omen of a final recovery."[80] Later in the 1800s, several psychiatric settings instituted productive activity programs.

In 1914 George Barton, one of the founding fathers of the occupational therapy profession, who was disabled by tuberculosis and a foot amputation, established the Consolation House in New York.[89] This program enabled convalescents to use occupations to return to productive living.[89] Barton stated, "The purpose of work was to divert the mind, exercise the body, and relieve the monotony and boredom of illness."[83]

In 1915 Eleanor Clarke Slagle, another founder of the occupational therapy profession, was hired to create a program for persons with mental or physical disabilities that would enable them to work and become self-sufficient.[89] The program was located at Hull House, a settlement house in Chicago, and was funded by philanthropic contributions. The participants involved in the program produced goods such as baskets, needlework, toys, rugs, and cabinets while developing manual skills and receiving wages for their work.

The early leaders of occupational therapy identified the importance of work when defining the profession's focus and purpose. Adolph Meyer, a psychiatrist who emigrated from Germany at the time and was an early proponent of moral treatment, observed that healthy living involved a "blending of work and pleasure."[61] Dr. Herbert Hall helped establish a medical workshop at Massachusetts General Hospital in Boston, where clients were involved in "work cure."[30] In this workshop clients produced marketable goods and received a share of the profits. The focus of treatment in these curative workshops was to restore the impaired body part to as normal function as possible, with the goal of returning the client to work.

While this curative workshop movement was transpiring on the East Coast, similar programs were developing elsewhere in the United States. For example, at the Los Angeles County Poor Farm, now recognized as Rancho Los Amigos National Rehabilitation Center in Downey, California, "all inmates were requested to do an amount of work that was commensurate with their physical strength and mental capacity, which was determined by the admitting doctor."[27] Inmates used woodworking machinery to build a large amount of furniture, which was used at the farm. Commodes, bedside tables, wheelchair tables, park benches, cabinets, and other items were built in the shops. In later years, when there was a true occupational therapy department, patients made Navajo-type rugs, rag or braided rugs, brushes, shawls, pottery, pictures, baskets, and leatherwork (Fig. 14.1A). Patients took special occupational therapy classes "which were designed to enable those who are crippled, blinded, or otherwise handicapped to make themselves useful" by producing articles that could be used at the County Farm or sold to employees or the California Crafts and Industries Society in Los Angeles (Fig. 14.1B).[27]

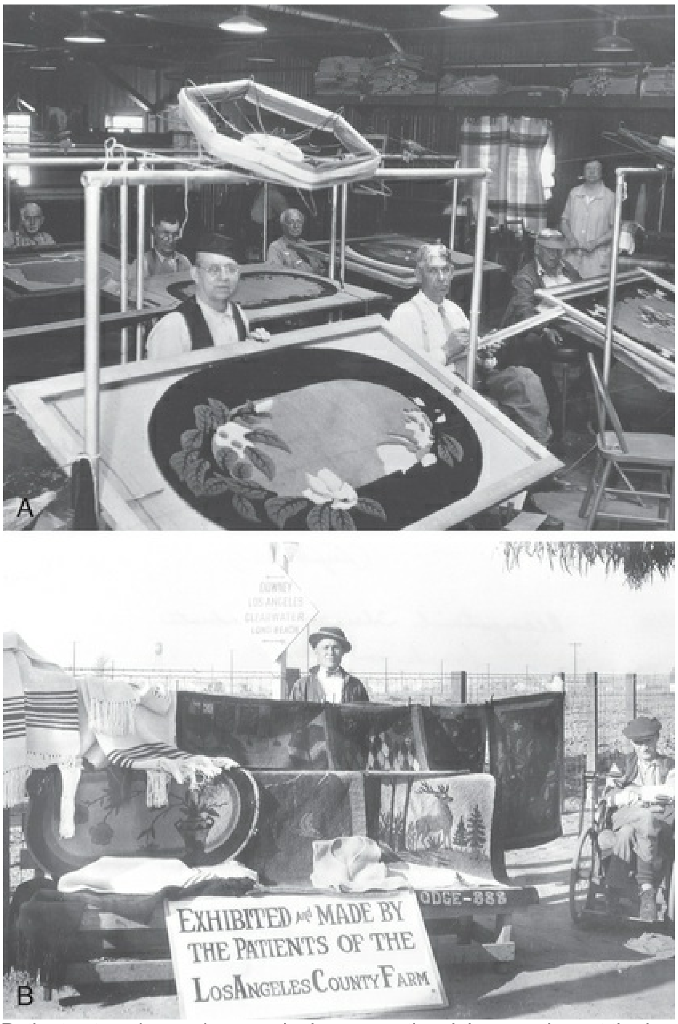


FIG 14.1 **A,** Patients at work weaving rugs in the occupational therapy shop at the Los Angeles (LA) County Poor Farm. **B,** Patients with a display of their products made at the LA County Poor Farm. (From Fliedner CA: Occupational therapy: for the body and the mind. In Rodgers GM, editor: *Centennial Rancho Los Amigos Medical Center 1888-1988,* Downey, CA, 1990, Rancho Los Amigos Medical Center.)

In the early 1900s the medical profession did not seem to consider vocational readiness programs to be important. The focus of care for persons with physical illnesses was primarily palliative and involved immobilization and bed rest. This attitude shifted after World War I, with the need to rehabilitate the large number of injured soldiers to help them become functional and gain employment.

The U.S. Federal Board for Vocational Education (FBVE) was created after adoption of the Vocational Education Act of 1917.[42] In 1918 the Division of Orthopaedic Surgery in the Medical Department of the Army organized a reconstruction program for disabled soldiers.[77] One of the founders of occupational therapy, Thomas Kidner, served as an advisor. This program led to the development of reconstruction aides, who were the precursors to occupational and physical therapists. Treatment involved both handicrafts and vocational education. The reconstruction aides used work activities to return the injured soldiers to military duty or civilian life to the highest degree possible.

In 1920 Congress passed the Civilian Rehabilitation Act of 1920 (Smith-Fess Act, Public Law 66-236). This law provided funds for vocational guidance and training, work adjustment, prostheses, and placement services.[42] If therapy was part of a medical treatment program, the law provided payment for occupational therapy services; however, it did not provide payment for physician services. Physicians either provided free services or received payment through state or volunteer contributions. This limited the use of occupational therapy services in vocational rehabilitation to the states that received supplemented federal program funds to support services such as the curative workshops.

The Social Security Act of 1935 defined rehabilitation as "the rendering of a person disabled fit to engage in a remunerative occupation."[53] This was the first attempt to provide vocational rehabilitation to the physically handicapped in the community.

In 1937 industrial therapy, called employment therapy, was born.[58] The occupational therapist used activities as treatment modalities. It was common for patients to have work assignments in the hospital that matched their experience, aptitude, and interest. Sheltered work environments within the hospital were used, including the hospital laundry, barber shop, and carpenter shop.

The term *prevocational* started appearing in the literature by the late 1930s. It referred to the use of crafts to develop skills readily transferable to industry.[101] Prevocational therapy prepared patients for the work role. Occupational therapists worked as directors, work evaluators, and prevocational therapists in work programs. In the 1940s prevocational programs and work evaluation were accepted as part of the practice of occupational therapy. Patients in acute care facilities who were physically disabled were transferred to outpatient or rehabilitation prevocational and vocational programs.

World War II brought more opportunities for occupational therapists to become involved in work programs. With the advancement of medicine and pharmacology, many injured soldiers survived their wounds. Federal funding for rehabilitating disabled veterans increased as the government discharged the disabled soldiers. This led to an increase in the development of work programs designed to evaluate and rehabilitate injured veterans.[17]

In 1943 the Barden-LaFollette Act (Public Law 78-113) modified the original provisions of the Civilian Rehabilitation Act of 1920.[42] This new law, called the Vocational Rehabilitation Act, covered many medical services, including occupational therapy and vocational guidance. Services were expanded to those with physical and mental limitations. This law also created the Office of Vocational Rehabilitation, a state and federally funded agency that is still in existence today and provides job training and placement services to people with disabilities. Industrial therapy continued in various settings as a form of vocational rehabilitation.

During the 1950s many occupational therapists believed that work evaluation belonged to a newly established profession, vocational rehabilitation, rather than to occupational therapy.[58] Occupational therapy involvement declined, and vocational counselors, vocational evaluators, and work adjusters were primarily the leaders in this field. There were, however, still a few occupational therapists who remained active in work programming.

A high point in the development of prevocational exploration and training techniques in the field of occupational therapy occurred in 1960.[42] Rosenberg and Wellerson published an article on development of the TOWER (Testing, Orientation, and Work Evaluation in Rehabilitation) system in New York.[84] The TOWER system was one of the first work sample programs to use real job samples in a simulated work environment. In 1959 Lilian S. Wegg gave the Eleanor Clarke Slagle Lecture on "Essentials of Work Evaluation," based on her experiences at the May T. Morrison Center for Rehabilitation in San Francisco. Wegg promoted the need for both sound testing procedures and training programs.[101] Florence S. Cromwell, a president of the American Occupational Therapy Association (AOTA), established norms for disabled populations on certain prevocational tests while evaluating the performance of adults with cerebral palsy at the United Cerebral Palsy Organization.[42] Cromwell continued to be an important advocate of occupational therapy–based work-related therapy in the ensuing decades.

Occupational behavioral theory, which emerged in the mid-1960s and early 1970s, offered a return to the profession's concern for occupation. Mary Reilly, an early proponent of occupational behavior theory and a 1962 Eleanor Clark Slagle lecturer, believed that productive activity as treatment was the unique contribution of occupational therapy.[42] Occupational behavior theory advocated that persons can achieve healthy living only through a balance between work, rest, and play.

The increasing number of industries in the late 1970s and early 1980s introduced a whole new arena for occupational therapists: industrial rehabilitation and work hardening.[42] Work hardening used actual work tasks in a simulated, structured work environment, generally in community-based settings.[5] Occupational therapists used their knowledge of neuromuscular characteristics, including range of motion (ROM) and endurance, along with task analysis skills and knowledge of the psychosocial aspects of work, in evaluating, planning, and implementing a work-hardening program.

In 1989 the Commission on Accreditation of Rehabilitation Facilities (CARF) developed work-hardening standards requiring an interdisciplinary approach.[15] The interdisciplinary team consisted of occupational therapists, physical therapists, psychologists, and vocational specialists.

The Americans with Disabilities Act of 1990 (ADA; Public Law 101-336) was important legislation that opened major markets for occupational therapists.[42] Occupational therapists were involved in providing both work training for persons with disabilities and assistance to employers in meeting the requirements of the ADA. This legislation continues to have important implications for work practice.[23] (See Chapter 15 for more information on the ADA.)

Also in 1990 the National AgrAbility Project (http://www.agrability.org) was established through the 1990 Farm Bill.[101] This opened up opportunities for occupational therapy practitioners to help farmers, ranchers, and other agricultural workers with disabilities safely return to work. AgrAbility funds occupational therapy practitioners' site visits to evaluate and identify what is needed for a farmer or rancher to return to work. If assistive technology or other workplace modifications are needed, various funding sources (e.g., the state's vocational rehabilitation office) usually support some or all of the recommendations that need to be implemented.

In 1992 the AOTA published a document that defined work as “all productive activities and included life roles such as homemaker, employee, volunteer, student, or hobbyist.”[4] This document was replaced in 2000 by “Occupational Therapy Services in Facilitating Work Performance.”[3] This statement asserted that “occupational therapists and occupational therapy assistants contribute to the delivery of services for the promotion and management of productive occupations as well as the prevention and treatment of work-related disability.”

In 2002 the Occupational Safety and Health Administration (OSHA) unveiled a comprehensive approach to ergonomics to reduce the incidence of musculoskeletal disorders (MSDs) in the workplace. This four-pronged, comprehensive approach includes guidelines, enforcement, outreach and assistance, and a national advisory committee on ergonomics.

Occupational therapists have traditionally consulted and continue to consult with employers and employees on making recommendations about equipment, posture, and body mechanics to prevent injuries. Ergonomic intervention continues to be an area of many opportunities for occupational therapists who have received additional training and education in the area of ergonomics.

Role of the Occupational Therapist in Work Programs

Occupational therapists (OTs) and occupational therapy assistants (OTAs) play an important role in helping individuals participate in all aspects of work. According to the "Occupational Therapy Practice Framework: Domain and Process," third edition (OTPF-3), work is an area of occupation that is defined by Christiansen and Townsend as "labor or exertion, to make, construct, manufacture, form, fashion, or shape objects, to organize, plan, or evaluate services or processes of living or governing, committed occupations that are performed with or without financial reward" (OTPF-3, p. S20).[1] Work is further described in the OTPF-3 as "employment interests and pursuits, employment seeking and acquisition, job performance, retirement preparation and adjustment, volunteer exploration, and volunteer participation" (OTPF-3, p. S20).[1] Occupational therapy practitioners provide services to those with limitations in the area of work performance. The occupational therapist focuses on identifying and analyzing the problem and selecting and/or designing appropriate assessments and interventions for solution of the problem. According to the statement "Occupational Therapy Services in Facilitating Work Performance," problems in work performance may arise from challenges related to "motor, sensory-perceptual, emotional regulation, cognitive, or communication and social performance skills or from those associated with performance patterns, the activity demands, or the context and environment."[2] Work-related services are provided by occupational therapists in a variety of settings, including, but not limited to, acute care and rehabilitation facilities, industrial and business environments, psychiatric treatment centers, schools, and community settings. The occupational therapy process involves "evaluation, treatment planning, implementation, review, and outcome monitoring."[2] This chapter describes the range of work evaluations and interventions in which occupational therapists are involved in assisting people in actively participating in meaningful work roles.

Industrial Rehabilitation

The range of services provided to injured workers and industry is often encompassed by the terms "industrial" or "occupational" rehabilitation. These terms will be used interchangeably in this chapter. **Industrial rehabilitation** includes functional capacity evaluation (FCE), vocational evaluation, job demands analysis (JDA), worksite evaluation/fitness for duty testing, preemployment screening, work hardening/conditioning, on-site rehabilitation, modified/transitional employment, education, ergonomics, wellness, health promotion, and preventive services. Occupational therapists are integral in providing these services, and this area of practice provides a tangible way for therapists to experience the tremendous reward of seeing lives changed through their efforts. The AOTA has developed a Work and Industry Special Interest Section (WISIS) for those who are involved in or wish to know more about this area of specialization.

Functional Capacity Evaluation

A **functional capacity evaluation** is an objective assessment of an individual's ability to perform work-related activity.[28,52] These functionally based tests have been used since the early 1970s to assist in making return-to-work decisions and were primarily performed by occupational and physical therapists.[38] Today, however, the results of such an evaluation can be used in many different ways, and the evaluation is performed by a multitude of disciplines. Occupational therapists are remarkably qualified to conduct FCEs because of their education and background in task analysis.[2,3] An FCE can be used to set goals for rehabilitation and readiness for return to work, assess residual work capacity, determine disability status, and screen for physical compatibility before hiring a new employee and case closure.[75]

Ethical Considerations

The FCE is a tremendous tool in the course of rehabilitation that allows a therapist to have objective findings for making thoughtful and appropriate recommendations regarding initiation, continuation, or cessation of treatment, or for referring the client to another service. Great care must be taken to ensure that the results are not derived lightly because of the enormous impact that such results can have on a person's life.[45,50]

An FCE usually consists of a review of medical records, an interview, musculoskeletal screening, evaluation of physical performance, formation of recommendations, and generation of a report.[45] Evaluation of physical performance usually takes the form of assessing the client's physiology, both cardiovascular and muscular endurance, during the course of strength, static, and dynamic tasks. The report usually contains information regarding the overall level of work, tolerance for work over the course of a day, individual task scores, job match information, level of client participation (cooperative or self-limited), and interventions for consideration.[45,50]

OT Practice Notes

The referral source for an FCE can and does vary. Physicians, attorneys, case managers, insurance carriers, and other therapists are the primary sources for FCE referrals. Some states, institutions, and insurance carriers require a physician's prescription for an FCE; therefore, it is important to be aware of each state's practice act, employer, and insurance carrier guidelines for accepting referrals. Reimbursement also varies with geographic location.

A wide variety of FCEs are currently used in practice today, both commercially available systems and evaluations developed by individual therapists or clinics (Fig. 14.2).

FIG 14.2 The EvalTech Functional Testing System, an example of a functional capacity evaluation system. (Courtesy BTE, Hanover, MD.)

FCEs can be (1) all inclusive when looking at case closure or settlement; (2) job specific when making a match between a person's abilities and the job description, such as "cashier at XYZ store" or a broader occupational title such as "cashier"; or (3) injury specific, such as an upper extremity evaluation after bilateral carpal tunnel release. Joe, the 26-year-old man with T11 paraplegia, could benefit from a job-specific FCE to determine whether he can meet the physical demands of the alternative job as a laundry attendant.

A well-designed FCE is comprehensive, standardized, practical, objective, reliable, and valid.[45,50,86]

A comprehensive FCE will include all of the physical demands of work as defined by the *Dictionary of Occupational Titles* (DOT), published by the U.S. Department of Labor and last revised in 1991 (Box 14.1).[97] The main focus of Joe's FCE will be on the physical demands of work that he can still reasonably do from the wheelchair, such as lifting, carrying, pushing, pulling, balancing, reaching, handling, fingering, feeling, talking, hearing, and seeing.

Box 14.1

Twenty Physical Demands of Work

Lifting

Standing

Walking

Sitting

Carrying

Pushing

Pulling

Climbing

Balancing

Stooping

Kneeling

Crouching

Crawling

Reaching

Handling

Fingering

Feeling

Talking

Hearing

Seeing

Data from US Department of Labor, Employment and Training Administration: *Revised dictionary of occupational titles*, vols I and II, ed 4, Washington, DC, 1991, US Government Printing Office.

It is also important for the individual being tested to understand the correlation between the test items and the functions of the job. The application of meaningful activity can improve individuals' cooperation during testing and encourage maximum effort. For example, an individual who performs secretarial duties may have difficulty understanding the need to test her ability to climb ladders if she does not actually perform this function during the course of her job.[1,75]

An FCE needs to be practical in terms of length of testing, cost, space, and report generation.[50,75]

Standardization in FCEs means having a procedure manual, task definitions and instructions, a scoring methodology, and equipment requirements and set-up.[50,52,76] This type of structure helps ensure that individuals are being assessed in a fair and consistent manner, and it demonstrates the effort to minimize observer bias. Verbal instructions are critical in establishing rapport between the evaluator and the individual being tested. During the initial interview, the tone is set for the course of the evaluation, and the individual's trust in the evaluator is implicit in maximizing cooperation and effort during the evaluation.[50] Objectivity is not limited to weights, distances, heights, or some other numerical quantity; subjective measures can be made objective with operational definitions. Objectivity during the course of an FCE does not exclude clinical judgment and decision making, but it does require the measure to be as free as possible of examiner bias.[86] This includes physical performance, in addition to client cooperation during testing. Objectivity is accomplished through standardization of the testing protocol and a structured scoring methodology.

The most important aspects of an FCE are reliability and validity of the testing protocol. Two types of reliability are deemed important in an FCE: interrater and test-retest reliability.[52] Interrater reliability in an FCE means consistency; if two therapists administer the same test to the same client, will they get the same results?[45] King and Barrett state that “test-retest reliability or intra-rater reliability refers to the stability of a score derived from one administration of an FCE to another when administered by the same rater.”[45] Being able to establish reliability is the first step in determining the validity or accuracy of the results.[86] If there is not agreement between evaluators, it is difficult to determine whose results are correct.[45] Once reliability has been proved, validity can be assessed. The term *validity* is used in many ways, often with significance placed on issues surrounding sincerity of effort. In scientific terms validity means accuracy; in other words, does the FCE provide results that truly describe how the client can perform at work?[50,86]

There are several types of validity, with content, criterion (both concurrent and predictive), and construct validity having the most impact on the results of an FCE.[45,50] Content validity is the easiest to establish in an FCE because this measure refers to whether the evaluation tests the physical demands of work, as defined by a panel of experts, by job analysis, or by a recognized document, such as the DOT.[50,52,75,97]

Criterion validity refers to whether conclusions can be drawn from the measures taken, and in an FCE this refers to whether a person can actually perform at the level demonstrated during testing.[45,50,52] Criterion validity is often determined by comparing the methodology in question with a gold standard—another instrument that has been proved to be reliable and valid.[45,50,52] This is difficult to do in an FCE because there are a limited number of available assessments with proven reliability and validity to compare against and because other methods, such as comparing the person's tested ability with the actual work level, can be seriously flawed.[50,52,56] Criterion validity includes concurrent and predictive validity.

Concurrent validity refers to the ability of a test to measure existing abilities, and in an FCE this would be demonstrated by the test's ability to determine which clients can perform at a given level and which clients cannot perform at a given level.[45,50,52]

Predictive validity is indicated by the test's capacity to predict future ability and has great value in an FCE by determining who can safely return to work and remain without injury.[45,50,59] The first FCE to be studied for validity and published in peer-reviewed literature was developed by the occupational therapist Susan Smith and has served as an important contribution to the knowledge base.[92] Without reliability and validity, a referral source cannot know whether the results of the evaluation would vary if the individual were tested by another therapist or whether the results are accurate.[45,50,52]

Vocational Evaluations

Work evaluations, or **vocational evaluations**, are "a comprehensive process that systematically uses work, real or simulated, as the focal point for vocational assessment and exploration to assist individuals in their vocational development."[25] According to CARF, the following factors are addressed in the traditional vocational evaluation model: physical and psychomotor capacities; intellectual capacities; emotional stability; interests, attitudes, and knowledge of occupational information; aptitudes and achievements (vocational and educational); work skills and work tolerances; work habits; work-related capabilities; and job-seeking skills.[35] These assessments can last from 3 to 10 consecutive days, depending on the goals of the assessment. Vocational evaluators generally conduct these types of assessments in private vocational agencies; however, some occupational therapists also have been involved in conducting these evaluations in public and private medical or nonmedical settings. Vocational rehabilitation, worker's compensation, and long-term disability carriers pay for these services, but most medical plans do not.

Standardized work samples, such as the Valpar Component Work Sample System or the Jewish Employment Vocational Services, are used to assess specific skills in the areas of data or other job-related topics (Fig. 14.3). Dexterity tests, such as the Bennett Hand Tool (Fig. 14.4), Crawford Small Parts, and Purdue Pegboard, are used to evaluate motor skills.[35] When no standardized work samples are available to assess the specific skills needed for a particular occupation, specially designed situational assessments are also used to create real-life work situations that are related to actual work tasks that would be conducted on particular jobs. For example, a person who is interested in working as a floral arranger could have her motor skills evaluated to see whether she has the coordination, energy, and strength and effort to grip and manipulate tools to cut the stems of flowers and plants and arrange them in floral containers. Individuals can also be evaluated in real worksites and perform actual job tasks that one would perform on the job.

Ethical Considerations

The tasks need to take clients' safety into account and not jeopardize their health or put them at risk for injury by allowing them to perform in an unsafe manner or push beyond their maximum level of performance.[50]

FIG 14.3 **A,** Valpar 9 Total Body Range of Motion work sample, which is used to evaluate functional abilities such as standing, bending, crouching, reaching, and gross manipulation and handling. **B,** The Valpar 10 Tri-Level Measurement is used to evaluate a person's ability to follow a multistep sequence to inspect metal parts with various jigs and tools.

FIG 14.4 The Bennett Hand Tool is a dexterity test to assess a person's ability to use hand tools.

There are generally two different types of vocational evaluation: a general vocational evaluation and a specific vocational evaluation. A **general vocational evaluation** is a comprehensive assessment to evaluate a person's potential to do any type of work. For an individual who has never worked, does not have a job to return to, or cannot return to the previous job because of a disability, this type of evaluation is beneficial in determining one's aptitudes, abilities, and interests to explore all reasonable options for work. For example, Henry, the roofer who experienced a traumatic brain injury from a fall while working, could benefit most from a general vocational evaluation to explore other options for employment. A general vocational evaluation could help identify other vocational interests and abilities by exploring a person's cognitive and motor skills and physical and mental tolerances that could be applied to a different occupation. A **specific vocational evaluation** assesses a person's readiness to return to a particular occupation. For a person who has suffered a stroke and wants to return to work as a general office clerk, a specifically tailored vocational evaluation to assess the person's ability to return to this particular type of work can be done. Clerical work samples and specially designed situational assessments that gauge the person's ability to multitask, pay attention to detail, file, answer a telephone, and take messages can be incorporated as an integral component of the vocational evaluation.

Job Demands Analysis

Assessing the physical demands of a job by JDA is often beneficial in the rehabilitation process inasmuch as recommendations for initiation or return to work require objective information about both the client's abilities and the job itself. A well-written job description that includes the essential tasks of the job, physical requirements, cognitive aptitudes, educational requirements, equipment operated, and environmental exposure assists in selecting suitable candidates for employment, setting compensation packages, and making appropriate return-to-work decisions after an injury.[8]

A JDA does not need to be confused with ergonomic evaluations or identification and abatement of hazards. A **job demands analysis** seeks to define the actual demands of the job, whereas ergonomic evaluations and hazard assessment focus more on work practice and risk for injury secondary to postural or manual material-handling extremes or excesses.[7] Certainly these areas can overlap, but it is important to be clear about the differences and the reasons behind the request for information and to use suitable methods for each.[7]

Approaches to a JDA include questionnaires, interviews, observations, and formal measurement.[7] It is common to interview incumbents or supervisors about the job requirements.[75] Such an informal approach often leads to narrative descriptions with little functional information and questionable accuracy of demand estimates.[36,62,75] As with other types of assessment, it is important to have an objective process for analyzing the demands of the job. In the context of attempting to make return-to-work decisions based on matching the results of an FCE with the job description, many FCEs include a JDA component.[50] However, these are often subjective interviews with the client and can lack accuracy regarding the physical demands.

The occupational therapist who was working with Joe contacted the employer and conducted a JDA to obtain a complete picture of the job demands and requirements of the laundry attendant position. The occupational therapist spoke to the supervisor and to other employees while they were performing the actual job at the worksite. Being able to actually observe the job being done in the real work environment allowed the occupational therapist to gather the information needed to adequately assess Joe's ability to carry out the essential functions of this job.

A standardized classification system is crucial to ensure consistency in terminology and among professionals. The DOT defines occupations in the United States, in addition to the physical demands of work (Tables 14.1 to 14.3).[97] It provides definitions of the overall level of work, strength demands, and frequency of the physical demands.[97,98] Many countries around the world use the DOT as their primary reference for generic occupational descriptions.

TABLE 14.1

Definitions for Overall Level of Work

Level of Work	Definition
Sedentary	Exerting up to 10 lb of force occasionally or a negligible amount of force frequently to lift, carry, push, pull, or otherwise move objects, including the human body. Sedentary work involves sitting most of the time but may involve walking or standing for brief periods. Jobs are sedentary if walking and standing are required only occasionally but all other sedentary criteria are met.
Light	Exerting up to 20 lb of force occasionally, up to 10 lb of force frequently, or a negligible amount of force constantly to move objects. Physical demand requirements are in excess of those for sedentary work. Even though the weight lifted may be only a negligible amount, a job should be rated light work (1) when it requires a significant degree of walking or standing, (2) when it requires sitting most of the time but entails pushing or pulling arm or leg controls, or (3) when the job requires working at a production rate pace entailing constant pushing or pulling of material even though the weight of the material is negligible. *Note:* The constant stress and strain of maintaining a production rate pace, especially in an industrial setting, can be and is physically demanding on a worker even though the amount of force exerted is negligible.
Medium	Exerting 20-50 lb of force occasionally, 10-25 lb of force frequently, or greater than negligible and up to 10 lb of force constantly to move objects. Physical demand requirements are in excess of those for light work.
Heavy	Exerting 50-100 lb of force occasionally, 25-50 lb of force frequently, or 10-20 lb of force constantly to move objects. Physical demand requirements are in excess of those for medium work.
Very heavy	Exerting force in excess of 100 lb of force occasionally, in excess of 50 lb of force frequently, or in excess of 20 lb of force constantly to move objects. Physical demand requirements are in excess of those for heavy work.

Data compiled from the US Department of Labor, Employment and Training Administration: *Revised dictionary of occupational titles*, vols I and II, ed 4, Washington, DC, 1991, US Government Printing Office; and the US Department of Labor, Employment and Training Administration: *The revised handbook for analyzing jobs*, Indianapolis, IN, 1991, JIST Works.

TABLE 14.2

Definitions of Physical Demand Frequencies

Physical Demand Frequency	Definition
Never	Activity or condition does not exist
Occasionally	Up to $\frac{1}{3}$ of the day
Frequently	

	$\frac{1}{3}$ to $\frac{2}{3}$ of the day
Constantly	$\frac{2}{3}$ to full day

Data compiled from the US Department of Labor, Employment and Training Administration: *Revised dictionary of occupational titles,* vols I and II, ed 4, Washington, DC, 1991, US Government Printing Office; and US Department of Labor, Employment and Training Administration: *The revised handbook for analyzing jobs,* Indianapolis, IN, 1991, JIST Works.

TABLE 14.3

Strength Demands of Work: Frequency of Force Exertion or Weight Carried

Strength Rating	Occasional (Up to $\frac{1}{3}$ of the Day)	Frequent ($\frac{1}{3}$ to $\frac{2}{3}$ of the Day)	Constant (Over $\frac{2}{3}$ of the Day)
Sedentary	10 lb	Negligible	Negligible
Light	20 lb	10 lb	Negligible
Medium	20-50 lb	10-25 lb	10 lb
Heavy	50-100 lb	25-50 lb	10-20 lb
Very heavy	Over 100 lb	50-100 lb	20-50 lb

Data from the US Department of Labor, Employment and Training Administration: *Revised dictionary of occupational titles,* vols I and II, ed 4, Washington, DC, 1991, US Government Printing Office.

The DOT was last revised in 1991. In the early 1990s the U.S. government made the decision not to revise the DOT again; instead, it created a new format for classifying occupations.[26] The intent was to create a more generic classification system, or framework, for defining work. The American Institutes of Research (AIR) was awarded a contract for this purpose by the Utah Department of Employment Security, acting on behalf of the U.S. Department of Labor. AIR developed O*NET, an online, searchable database for information about occupations. Although the format includes an enormous amount of data, its definitions can make it difficult for rehabilitation professionals to use in a qualitative fashion.[74] O*NET is not intended to take the place of the DOT, but rather to provide a more structured approach for "career exploration."[74] It is recommended that both the DOT and O*NET be consulted when obtaining occupational information.[26]

In terms of recent legislation that has had an impact on employment law, both the ADA and the Equal Employment Opportunities Commission (EEOC) have defined **essential tasks** as being the reason that a job exists.[6,7] The ADA further defines essential tasks as those that are highly specialized (i.e., the reason the incumbent was hired to perform the job), and for which a limited number of people are available at the job site to perform the tasks.[6] During the course of a JDA, it is important to distinguish between tasks that are essential and those that are not. This can be challenging because it is a nontraditional way for both the employee and the employer to look at the job. It is important that both hiring and return-to-work decisions be based on job descriptions that define the essential tasks to be congruent with both the ADA and EEOC language.

OT Practice Notes

In preparation for an observational JDA, an interview can be conducted on the telephone to glean initial information about the job to allow adequate research on the job title and equipment. Advance preparation also aids in selecting the personal protective equipment that needs to be worn while performing the analysis.

Jobs are composed of the tasks that are performed, the physical demands that make up the tasks, and the frequency with which the physical demands are performed, including weights handled, forces exerted, and distances both ambulated and reached.[7] The frequency of each physical demand must be weighted appropriately for the given duration of each task because there is often a significant difference in the amount of time spent on each task during the workday. For example, the job of "loader" in ABC warehouse is composed of two tasks: (1) loading crates with boxes and (2) wrapping the crate with packing tape when loaded. The loader completes 48 cycles of loading and taping in an 8-hour shift, with loading the crate taking approximately 80% of the work shift. The boxes weigh 10 pounds (lb) each. To correctly assess the overall level of work, the amount of weight lifted must be determined, in addition to the frequency of the manual materials handling.

Task 1 is composed of the physical demands of lifting, carrying, stooping, walking, reaching, handling, and standing. Task 2 is composed of walking, reaching, handling, fingering, and standing. To correctly sum the amount of the physical demands for the job of loader, one must determine how much time is spent on each physical demand within each task and then account for the proportion of the time that the task is performed during the workday. This type of assessment can be performed manually or through the use of various software protocols available in the marketplace.

Whatever methods are selected, clinicians should strive to provide an accurate picture of the job and its requirements, with an emphasis on functional demands, for easier application in the rehabilitation continuum.

Ethical Considerations

Whatever methods are selected, clinicians should strive to provide an accurate picture of the job and its requirements, with an emphasis on functional demands, for easier application in the rehabilitation continuum.

Work Hardening/Work Conditioning

The idea of using work for rehabilitation is at the very core of occupational therapy. In the 1970s the idea of occupational rehabilitation developed from the necessity of improving strategies to control work-related injuries.[19,44,51,73] Work hardening was first illustrated conceptually by Leonard Matheson, a psychologist at Rancho Los Amigos, who worked very closely with Linda Dempster, an occupational therapist, in developing his material.[44,51,73] The goal was then and remains rehabilitation of injured workers, maximization of their function, and returning them to work as quickly and safely as possible. The delivery system for this type of rehabilitation has evolved over time from a lengthy, hospital-based program, to structured interdisciplinary programs in outpatient settings, to the more progressive partnership between outpatient intervention and transitional work, in addition to rehabilitation occurring at the workplace in company-sponsored clinics. In the 1980s CARF developed guidelines for work-hardening programs and offered certification for a fee through adherence to their guidelines and periodic surveys.[19,44,51,73] In 1991 a committee of the American Physical Therapy Association (APTA) developed another set of principles for clinics that wanted to follow recognized standards but did not desire to undertake the CARF accreditation process.[19,44,51]

Work hardening refers to formal, multidisciplinary programs for rehabilitating an injured worker.[19,44,51,73] The disciplines represented on the team can often include occupational and physical therapists and assistants, psychologists, vocational evaluators and counselors, licensed professional counselors, addiction counselors, exercise physiologists, and dieticians.[19,44,51] The programs typically range from 4 to 8 weeks and consist of an entry and exit evaluation (usually an FCE or a derivative thereof), a job site evaluation, graded activity, both work simulation and strength and cardiovascular conditioning, education, and individualized goal setting and program modification, with the goal of return to work at either full or modified duty.[19,44,51] Actual equipment from the job is preferred during the work simulation to maximize cooperation of the worker and more closely replicate the actual demands of the job.[44] **Work conditioning** is more often defined as physical conditioning alone, which covers strength, aerobic fitness, flexibility, coordination, and endurance and generally involves a single discipline.[19,42,44] Job simulation may also occur during work conditioning. Both approaches involve evaluation of the worker to establish a baseline from which to plan treatment and measure progress.

Motivational issues are a constant concern and are often thought to be at the forefront of unsuccessful return to work.[91] Maladaptive behavior regarding return to work can develop in an injured worker as a result of depression, financial issues, family pressures, and feelings of being manipulated by the “system.”[91] This can lead to employer mistrust, interest in litigation, and a need to exaggerate symptoms. Fraud on the part of the injured worker is also an issue.[91] Employer indifference is a concern and can have a remarkable impact on a worker's attitude toward returning to the job.[91] Surveys of attitudes among employers have indicated that activity on the part of the employer can affect costs; as many as 90% of respondents indicated that how well the employee perceived that he or she was treated at the time of the injury was associated with decreased costs as a result of the injury.[91]

OT Practice Notes

It is essential for the therapist to recommend that the employer be involved with the employee after the injury; the employer should be encouraged to investigate injury claims that are worthy of investigation, to call to inquire about how the employee is feeling, and to consider modified duty and transitional work options to promote a successful return to work.

Think about Lorna, the upholsterer who is experiencing hand problems, and the difficulties that she is experiencing at work. An occupational therapist could evaluate her symptoms and her job description and make suggestions to the employer about modifying her job demands so that she can continue to work during treatment. This demonstrates to Lorna that her well-being matters and can help her have a positive outcome with treatment.

Ensuring a positive outcome for the injured worker requires early intervention and a customized plan of treatment to address the various areas affected by the injury, including both physical and psychosocial.[91] Incorporation of a multidisciplinary team allows the patient to have the benefit of many areas of expertise working toward his or her common good. Intervening and initiating the rehabilitation program as soon as possible after the injury dramatically increase the chance for successful return to work. Based on a study of 5620 worker's compensation beneficiaries, there was a 47% return-to-work rate in workers referred to rehabilitation within the first 3 months after injury, with a cost savings of 71%. When referred during months 4 through 6, the rates dropped to 33% for return to work and 61% for cost savings. For those referred beyond 12 months after injury, only 18% returned to work and cost savings dropped to 51%.[91]

Transitional work and modified duty programs involve a combination or a progression of acute rehabilitation and return to work at a level consistent with the individual's current ability, with the goal of returning to work at full duty or maximizing the individual's work capacity. An example of transitional duty would have a worker performing work-conditioning activities under supervision in an outpatient clinic from 8 to 10 a.m., going to the worksite and performing the less physically demanding portions of his job from 11 a.m. to 1 p.m., breaking for lunch, and then returning to the “lighter” duties of the job for the duration of the shift. More regular duty activities are added under supervision as the worker's skill and strength improve, with eventual return to full duty. This type of structure provides a much better environment for the worker to be involved in the work culture and allows coworkers and supervisors to participate in job modification and overall recovery of the injured worker.[91] Modified duty follows a similar path but typically does not include the clinical portion of the day. There are challenges to return to work at less than full duty, however; some employers do not want workers to return to the site unless they are at “100%.” It is imperative to demonstrate the benefit to the company and the employee, both economically and psychologically, of early transitional return to the long-term success of returning the employee to the workforce.

Industrial rehabilitation programs will continue to evolve as the tides of economy, industry needs, and legislation change. Occupational therapists play a key role in directing the changes that lie ahead.

Worksite Evaluations

Worksite evaluations are on-the-job assessments to determine whether an individual can return to work after the onset of a disability or whether a person can benefit from reasonable accommodations to maintain employment.[41,95] For example, a man who worked at a manufacturing company as a machine operator has a stroke, and the employer is willing to take him back as long as he can meet the physical and cognitive demands of the job. An occupational therapist can go to the worksite to evaluate the person's ability to safely and adequately operate the machinery and carry out the essential functions of the job. Consider another example. A person who previously worked as an office clerk without any difficulty is now experiencing extreme fatigue, pain, and muscle weakness with repetitive tasks as a result of post-polio syndrome. This person could benefit from a worksite evaluation to identify reasonable accommodations to allow her to continue working at this job while minimizing her symptoms. Several factors are assessed at the worksite with the worker present: the essential functions of the job, the functional assets and limitations of the worker, and the physical environment of the workplace.[55]

A worksite evaluation is usually conducted after a job analysis has been done. Larger companies may already have information on job analyses done on specific jobs. If a job analysis has not been done, the occupational therapist can conduct a job analysis if the employer is willing, or a job description could be obtained from the employer before going out to the worksite. If there is no written job description, a phone call to the supervisor/manager of the worker should be made to obtain verbal information regarding the essential functions of the job and the physical and cognitive requirements for the job. After this information has been obtained, the occupational therapist schedules a time with the employer and the worker to meet at the worksite. This is exactly what happened with Joe as he prepared to switch from the job of janitor to laundry attendant at the hotel and spa. After the occupational therapist conducted the job analysis, Joe met with both the occupational therapist and the employer at the worksite for the worksite evaluation.

When the occupational therapist meets the employer and worker at the worksite, the occupational therapist assesses the work, the worker, and the workplace.[47] The evaluation begins with an analysis of the essential functions that may require accommodation.[95] The occupational therapist should have an idea of what these functions are, based on the information obtained, before going to the worksite. The desired outcome of the work tasks should be emphasized, not just the process of performing the essential function.[95] The occupational therapist should find out certain details, such as how the outcome will be affected if a particular task is done incorrectly, in a different sequence, or omitted; whether there are quotas, standards, or time constraints that must be met[79]; and whether the frequency with which a task is done will affect the outcome.

Activity analysis is a useful tool for evaluating a person at the worksite.[11] It can be used to address all areas, including motor, sensory, cognitive, perceptual, emotional and behavioral, cultural, and social. When assessing a person's ability to carry out the essential functions of the job, the occupational therapist has expertise in breaking down the tasks and determining the parts of the task with which the worker is having difficulty or may have difficulty over the course of a workday. The occupational therapist can suggest accommodations to allow the worker to carry out the essential functions of the job.

The final step in the worksite evaluation is to assess the work environment. The environment outside the immediate work area should be evaluated (parking if driving or access to public transportation; access into the building, break room, and restroom), as well as the workstation itself. All work areas that the worker may use need to be investigated to identify obstacles and solutions to increase accessibility. The location and placement of machines, supplies, and equipment that the worker needs to access should be assessed, as well as other environmental factors such as lighting, temperature, and noise level.

Taking photographs or video recordings at the worksite can be very useful; however, permission must be obtained from both the employer and the worker to do so. The occupational therapist should also bring a tape measure to measure the height of work surfaces, width of doorways, and other factors, depending on the person's needs. Drawing a layout of the work area to scale on graph paper is also very helpful, especially when the worker is in a wheelchair. Critical measurements can be recorded on the diagram.

The outcome of the worksite evaluation is to determine whether the person can safely and adequately carry out the essential functions of the job with or without any reasonable accommodations. Ergonomic principles (addressed in the following section) should be considered and applied when recommending reasonable accommodations. The process of identifying reasonable accommodations requires cooperation between the person with the disability, the employer, and the occupational therapist.[79] Each person has valuable insights and information to contribute to the process of identifying the best accommodations. The Job Accommodation Network (JAN) is a service provided by the Office of Disability Employment Policy (ODEP), an agency of the U.S. Department of Labor, and is the best resource for assisting employers and disabled workers in making reasonable accommodations (http://askjan.org).[87] JAN's website points out that most job accommodations are not usually expensive. According to JAN, more than half of all accommodations cost nothing. JAN offers one-on-one guidance on workplace accommodations, the ADA, and self-employment options for people with disabilities. JAN consultants can be contacted both over the phone and online. JAN's toll-free number is (800) 526-7324.

The occupational therapist analyzes the need for modification of the equipment that the worker is using or modification of the workplace to help the person perform with greater efficiency, effectiveness, and safety.[5]

After the worksite evaluation has been completed, a report is prepared and sent to the qualified employee, the referring party, and the employer. The problem areas that relate to the essential job functions should be listed clearly, in addition to the accommodations necessary to solve them. If training is necessary to use a recommended accommodation, sources for the training should be identified. If commercially available equipment is recommended, exact model numbers, local sources, and approximate expenses should be provided.[95] If custom equipment needs to be fabricated, sources, cost estimates, and the amount of time required to fabricate the equipment also should be included. The report should summarize the findings of the evaluation and the accommodations that were recommended.

After Joe's worksite evaluation, it was determined that he could safely and dependably carry out the essential functions of the job from his wheelchair. Just one accommodation was recommended and implemented. Because it gets very hot in the laundry room and Joe is sensitive to the heat, the employer agreed to purchase additional fans to ventilate the room better, and to allow the door to the laundry room to be propped open. The employer agreed to schedule Joe's shift in the evening or early morning, when it was cooler, so that he would not have to work in the heat of the day.

The occupational therapy practitioner thus evaluates the worker, the work, the workplace, and the relationship among them. Therapeutic intervention is used when deficits in performance are found. The occupational therapist can modify the way that the worker performs the work or modify the work environment to allow the worker to perform optimally.

Ergonomics

All aspects of the domain of occupational therapy must be in harmony for people to fully engage in the occupation of work. The activity demands of the job and the context in which the job is performed must fit with the employee's abilities and physical/psychosocial makeup. Any mismatch between the activity demands of the job and context, individual client factors, and performance patterns will interfere with successful execution of the appropriate performance skills required to do the job.

Occupational therapists use the science of ergonomics to assist clients in fully engaging in the occupation of work. **Ergonomics** addresses human performance and well-being in relation to one's job, equipment, tools, and environment. The goal of ergonomics is to improve the health, safety, and efficiency of both the worker and the workplace.[67] The term *ergonomics* is derived from the Greek words *ergos*, meaning "work," and *nomos*, meaning "laws"—hence, the laws of work.[20] The Polish educator and scientist Wojciech Jastrzebowski (1799–1882) introduced the term ergonomics in the literature about 150 years ago.[19] However, the concept of ergonomics—that there is some connection between physical well-being and the type of work performed—is as old as humanity: "From the very first tool of the Stone Age, humans have tried to find better ways of working, taking advantage of human talents and making up for human shortcomings."[56]

The idea behind ergonomics is that every worker brings his or her own unique set of performance skills, performance patterns, and client factors to the workplace. Many times work settings and work processes are designed to satisfy space and budget limitations and the demands of productivity and aesthetics. When these designs fail to take into account the people who will be using the work setting and process, injury and inefficiency can result. Finding a way to match individual employees' strengths and limitations with the context and activity demands of a job can improve both worker safety and workplace productivity.

The principles of ergonomics help address a variety of work-related issues. Common issues include workplace and work process design, work-related stress, the disabled and aging workforces, tool and equipment design, architectural design, and accessibility. Ergonomic intervention can be applied proactively, preventing problems before they occur, or reactively, adjusting the worker-job-context "fit" when problems do occur. Many occupational therapists use ergonomic principles as part of their comprehensive rehabilitation or wellness and prevention client-centered programs. A few occupational therapists specialize in ergonomics and become professional ergonomists.

With regard to ergonomic services, the occupational therapist's client base may include the individual worker, workers in the context of employee groups, and/or the employer itself. The environment for an occupational therapist providing ergonomic services is generally at the client's place of work. These occupational therapists must become skilled in navigating what can be an unfamiliar business world with its unique lingo, social norms, and traditions. However, an occupational therapist providing ergonomic services shares a similar focus with occupational therapists in all areas of practice—that is, a focus on marketing and sale of the product (in ergonomics, wellness), cost-effectiveness, definable outcomes, and client satisfaction.

Occupational therapists are not the only professionals suited to specialize in the field of ergonomics. Ergonomics professionals come from a variety of backgrounds. It is not unusual to see ergonomists who have been academically trained in industrial hygiene, engineering, safety, business administration, human resources, medicine, physical/occupational rehabilitation, psychology, architecture, epidemiology, or computer science.[18] For the occupational therapist, the road to becoming a professional ergonomist can take many paths. Box 14.2 outlines a variety of methods for acquiring advanced knowledge and certification in the field of ergonomics.

Box 14.2

Education and Training Opportunities in Ergonomics

Education and training beyond occupational therapy entry-level practice are necessary for achieving advanced competence in ergonomics.

• University-sponsored graduate certificate programs in ergonomics are available through Texas

Women's University, Cleveland State University, University of Central Florida, and University of Massachusetts. These graduate-level courses typically require four to five courses for a total of 12 to 16 credit hours.

- Continuing education providers offer several-day courses that, on completion, allow the occupational therapist eligibility for certifications, such as the Ergonomics Evaluation Specialist available through Roy Matheson and Associates, Inc. (http://www.roymatheson.com), and the Certified Ergonomics Assessment Specialist available through the Back School of Atlanta (http://www.backschoolofatlanta.com).

- The Oxford Research Institute (http://www.oxfordresearch.org) offers the following advanced-level certifications: Certified Industrial Ergonomist, Certified Associate Ergonomist, and Certified Human Factors Engineering Professional.

- The Board of Certification in Professional Ergonomics (BCPE) (http://www.bcpe.org) offers the highest level of certification in the field of ergonomics—the Certified Professional Ergonomist. Other advanced-level certifications available through the BCPE include Associate Ergonomics Professional, Certified Ergonomics Associate, Certified Human Factors Professional, and Associate Human Factors Professional.

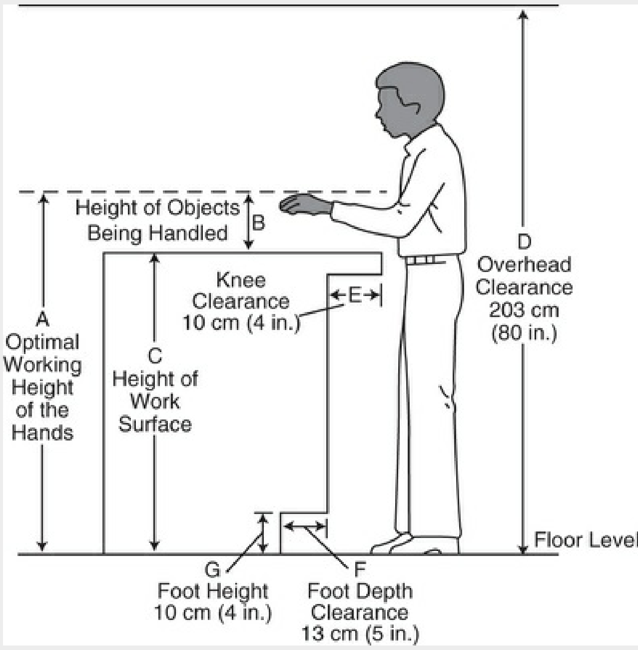
Data from Snodgrass J: Getting comfortable: developing a clinical specialty in ergonomics has its own challenges and rewards, *Rehab Manag* July:24, 2004.

For occupational therapists interested in the field of ergonomics, the holistic nature of occupational therapy training is an asset. The occupational therapist immediately understands that the goal of ergonomic intervention, or achieving a perfect fit between an individual worker and his or her job and context, is never simplistic. In the domain of occupational therapy, the worker component is composed of performance skills, performance patterns, and client factors (Box 14.3). The job component is composed of activity demands, both of the job tasks and of tools/equipment. Engaging in the occupation of work occurs in a variety of contexts, including the environment and organization, as well as the worker's personal, cultural, social, and spiritual contexts.

Box 14.3

Anthropometry

Anthropometry is the study of people in terms of their physical dimensions. It includes the measurement of human body characteristics such as size, breadth, girth, and distance between anatomical points. It also includes segment masses, centers of gravity of body segments, and ranges of motion, which are used for biomechanical analysis of work and postures. Standard anthropometric tables are available to assist designers of work areas, work surfaces, chairs, and equipment. The tables outline the average dimensions of adult men and women in the 5th, 50th, and 95th percentiles of the population. Ideally, designs should “fit” a wide range of persons between the 5th percentile (smallest people) and the 95th percentile (largest people). Retail merchandise labeled “ergonomic” is based on these anthropometric dimensions. In practice, however, few designs meet the needs of such a wide range of people, which explains why expensive equipment labeled “ergonomic” does not always produce the desired results. Professional ergonomic intervention seeks to create a better “fit” for the individual user.



An example of ergonomic chair design based on anthropometric data is presented in Fig. 14.7A.

(Reproduced with permission from Eastman Kodak Company [Adapted from Nachemson, 1975]).

Observing independent aspects of the domain offers the observer limited insight. Rather, it is the interactions between the various aspects of the domain that reveal the whole picture. This way of looking at worker performance via the interactions of all aspects of the domain of occupational therapy is known as **system theory**. Rannell Dahl, MS, OTR, explains that the "components of work systems are workers, job tasks, tools and equipment, work environments, and organizational structure, and the interactions among these components."[18] Dahl offers an excellent schematic of this concept of the ergonomics work system (Fig. 14.5).

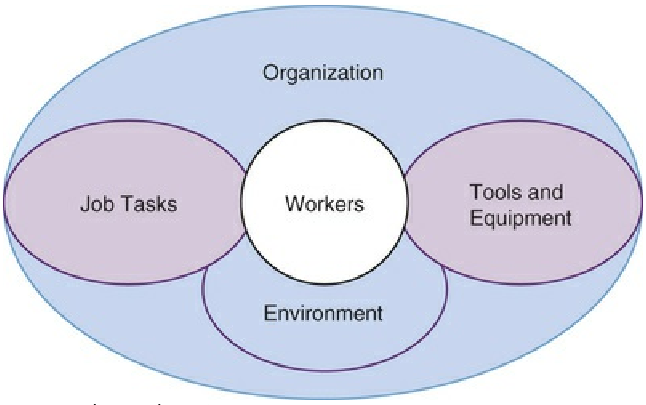


FIG 14.5 Dahl's ergonomics work system. (From Dahl R: Ergonomics. In Kornblau B, Jacobs K, editors: *Work: principles and practice*, Bethesda, MD, 2000, American Occupational Therapy Association.)

In his groundbreaking text *Conceptual Aspects of Human Factors*, David Meister explained that in human factors (ergonomics), the system concept is the belief that human performance in work can be meaningfully conceptualized only in terms of organized wholes. He emphasized the fundamental Gestalt ideas that "the whole is more than the sum of its parts, that the parts cannot be understood if isolated from the whole, and that the parts are dynamically interrelated or interdependent."[59] Occupational therapists understand that one can conceive of worker performance only in terms of the interaction between performance skills, performance patterns, context, activity demands, and client factors. The OTPF-3 supports this concept: "Engagement in occupation as the focus of occupational therapy intervention involves addressing both subjective (emotional and psychological) and objective (physically observable) aspects of performance. Occupational therapy practitioners understand engagement from this dual and holistic perspective and address all aspects of performance when providing interventions" (OTPF-3, p. 628).[1]

Occupational therapist Jeffrey Crabtree adds that it is "the subjective meaning of the interactions in the human-work-machine-environment model [that] is central to occupational therapy and ergonomics."[16]

The system theory does not discount the importance of the adequacy of independent aspects of the domain of occupational therapy. The quality of the work system can suffer if there are deficiencies or deviations in performance skills, performance patterns, context, activity demands, or individual client factors. Dahl explains that each component of the ergonomics work system (see Fig. 14.5) "has its own set of characteristics that affect the performance of the work system"[18] as a whole. It is here that ergonomic assessment and intervention seek to make a difference in the quality of our clients' engagement in the occupation of work. The ergonomic practitioner modifies and strengthens certain aspects of the system with the goal of enhancing the overall quality of the work system interactions (i.e., improving the fit between the worker and his or her job).

Although it is beyond the scope of this chapter to comprehensively review the complete array of ergonomic design considerations, the following is a discussion of selected ergonomic design principles. There are, however, a multitude of resources for occupational therapists interested in learning more about the science of ergonomics. The authors of this chapter direct you to the references listed at the end of the chapter. Additionally, readers may be interested in the ergonomics information available through OSHA (http://www.osha.gov) and NIOSH (http://www.cdc.gov/niosh/).

When discussing ergonomic design, it is important to understand that it is the relationship between the worker and work equipment, tools, or processes that is the problem, not any particular characteristic on either side. This can be confusing to an employer who orders expensive ergonomic tools and equipment for his or her workers and is disappointed when the workers continue to suffer work-related injuries and illnesses. The specialists in ergonomics must explain to their clients that a tool or piece of equipment is never in itself ergonomic; rather, it is the fit between a particular piece of equipment, tool, or process and the intended user of that equipment, tool, or process that creates a proper ergonomic situation.

Workstations

There are three major types of workstations: seated, standing, and combination sit/stand. The type of task being performed dictates the best choice. Seated workstations are best for fine assembly and writing tasks and when all required task items can be supplied and handled within comfortable arm's reach in the seated work space. Items handled in a seated workstation should not require hands to work more than 6 inches (15 cm) above the work space, and the items handled should not weigh more than 10 lb (4.5 kg). For this reason, the height of the work surface should be above elbow height for precision work. Standing workstations are appropriate for all kinds of work tasks but are preferred when downward force must be exerted (i.e., packaging and wrapping tasks) and when frequent movement or multilevel reaching is required around the work area. Items weighing more than 10 lb (4.5 kg) should be handled in a standing workstation. Work surface heights for heavy work should be 4 to 6 inches (10 to 15 cm) below elbow height for heavy work. The combination sit/stand workstation is best for jobs consisting of multiple tasks, some best done sitting and some best done standing.[22] Fig. 14.6 shows the recommended dimensions for both a seated workstation and a standing workstation.

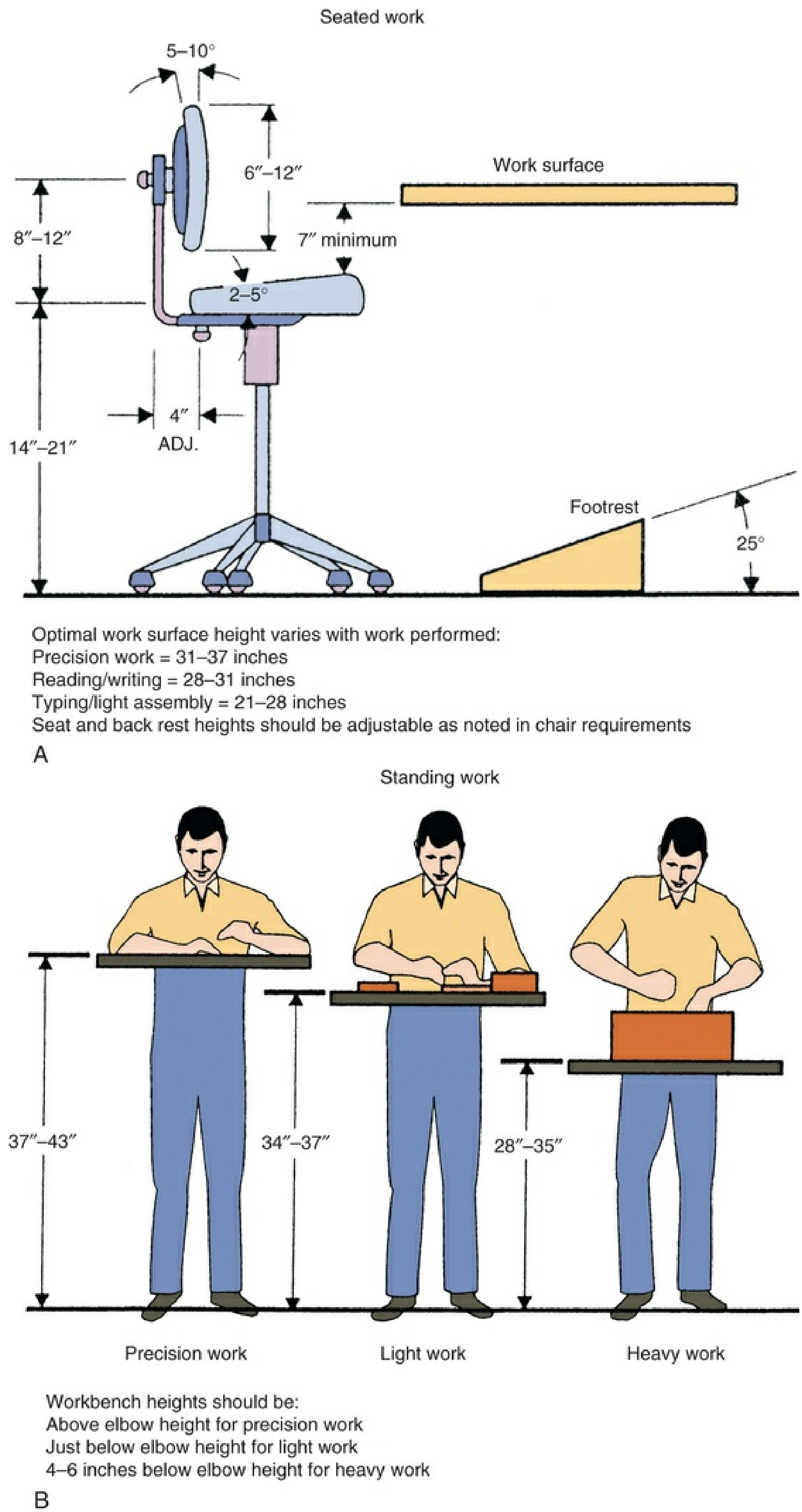
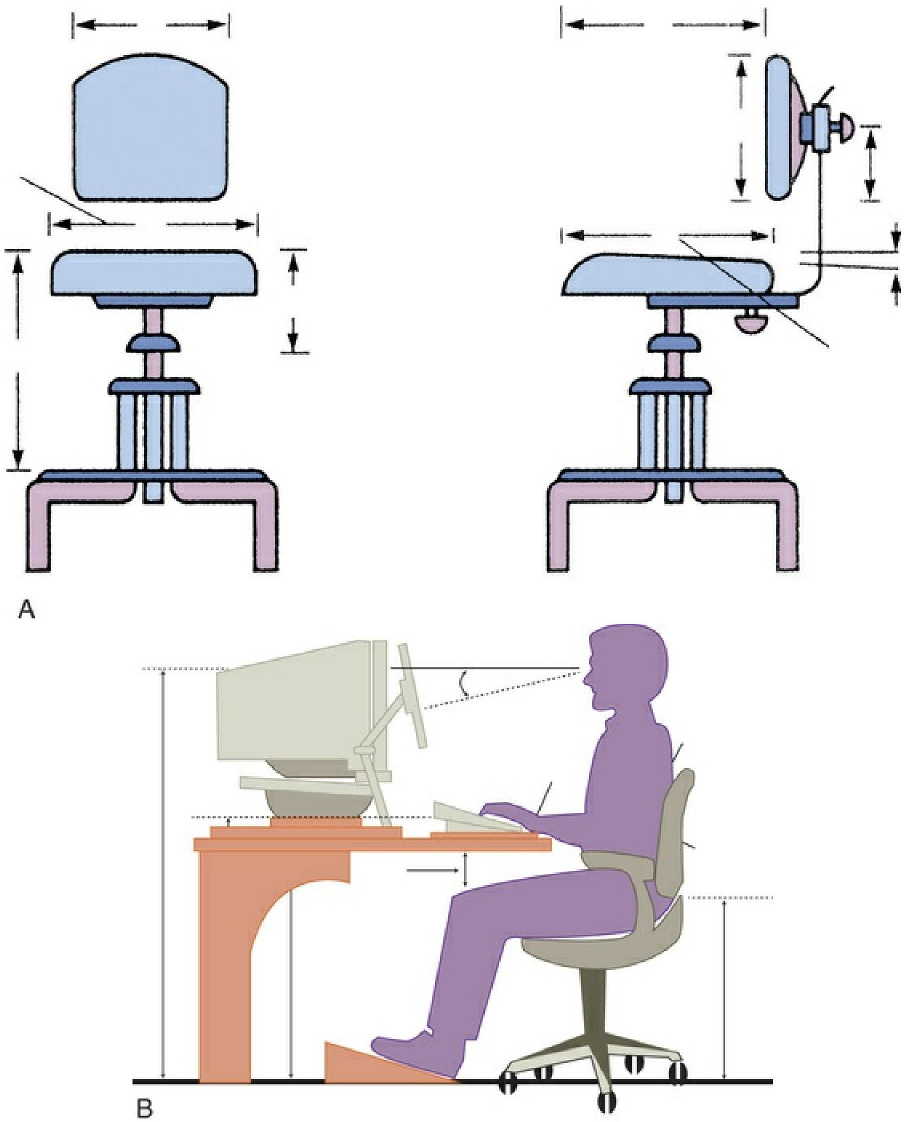


FIG 14.6 Recommended dimensions of workstations. **A,** Seated work. **B,** Standing work. (From Cohen AL, Gjessing CC, Fine LJ, et al: *Elements of ergonomics programs: a primer based on workplace evaluations of musculoskeletal disorders,* Washington, DC, 1997, US Government Printing Office.)

Seating

If seating is required, the design of the chair is of paramount importance for worker comfort and support. Poor seating leads to poor working posture. The result can be fatigue, musculoskeletal injury, and/or poor work performance. Although chair preference is highly variable among the population, there are some basic characteristics to consider. Chairs should be easily adjustable for height, backrest position, and seat pan tilt. Appropriate lumbar support is important. Seats upholstered in woven fabric are cooler and more comfortable in warmer work environments.[22] Chair casters should match the flooring (i.e., hard floor versus carpet casters). A seat pan that is too deep will cut into the back of the leg and compromise lower extremity circulation. Sitting in a chair without the feet supported will also cause pressure on the back of the legs. When the worker is seated at the workstation and performing a task, both feet should be supported on the floor or a footrest. Choosing a seat pan with a front-edge "waterfall" design will also decrease pressure on the back of the legs. Armrests are an area of controversy but should generally be provided when the work task requires the arms to be held away from the body.[37] Fig. 14.7A illustrates the recommended chair characteristics for generalized seated workstations. Fig. 14.7B illustrates a seated position for computer users.



A

B

FIG 14.7 **A,** Recommended chair characteristics. Dimensions are given from both front and side views for width *(A)*, depth *(E)*, vertical adjustability *(D)*, and angle *(I)* and for backrest width *(C)*, height *(F)*, and vertical *(H)* and horizontal *(G)* adjustability relative to the chair seat. The angle of the backrest should be adjustable horizontally from 12 to 17 inches (30 to 43 cm) by either a slide adjust or a spring and vertically from 7 to 10 inches (18 to 25 cm). Adjustability is needed to provide back support during different types of seated work. The seat should be adjustable within at least a 6-inch (15-cm) range. The height of the chair seat above the floor with this adjustment range will be determined by the workplace, with or without a footrest. **B,** Proper seated position for a computer user. (**A** reproduced with permission from Eastman Kodak Company [Adapted from Nachemson, 1975]; **B** from the Occupational Safety and Health Administration: *Working safely with video display terminals,* Washington, DC, 1997, US Government Printing Office. http://www.osha.gov/publications/osha3092.pdf.)

Visualizing the Job Task

Visual factors to consider are the location of task items and lighting. Again, recommendations depend on the type of task being performed. The goal is clear, direct viewing without straining the eyes or neck. Tasks should be located as directly in front of the worker as possible. Tasks requiring close-range viewing should be positioned 6 to 10 inches (15 to 25 cm) above the work surface. Minimum and maximum viewing distances depend on the size of the object being viewed. Bifocal eyeglass wearers have difficulty observing any object closer than 7 inches (18 cm) in front of the body that is above eye level or near the floor. Additionally, bifocal wearers have difficulty focusing on signs or dials located 24 to 36 inches (61 to 91 cm) in front of them.[20]

Three basic lighting factors need to be considered for performance of work: quantity, contrast, and glare. Lighting should be adequate for the worker to perform the job task, but not so bright that it causes discomfort. General work environment illumination is typically provided by sunlight and light fixtures at 50 to 100 foot-candles (ft-c). Computer users may find that this amount of illumination washes out the display screen and causes eyestrain. The recommended illumination level for computer workstations is 28 to 50 ft-c. Too much contrast between the task items and the surrounding areas can also stress the eyes. Therefore, the illuminance between the task items, equipment, horizontal work surface, and surrounding areas should be minimized. Finally, the color and finish of the workstation walls and equipment, as well as the arrangement of the lighting sources, should all be designed to avoid reflective glare on the job task (Fig. 14.8).[72]

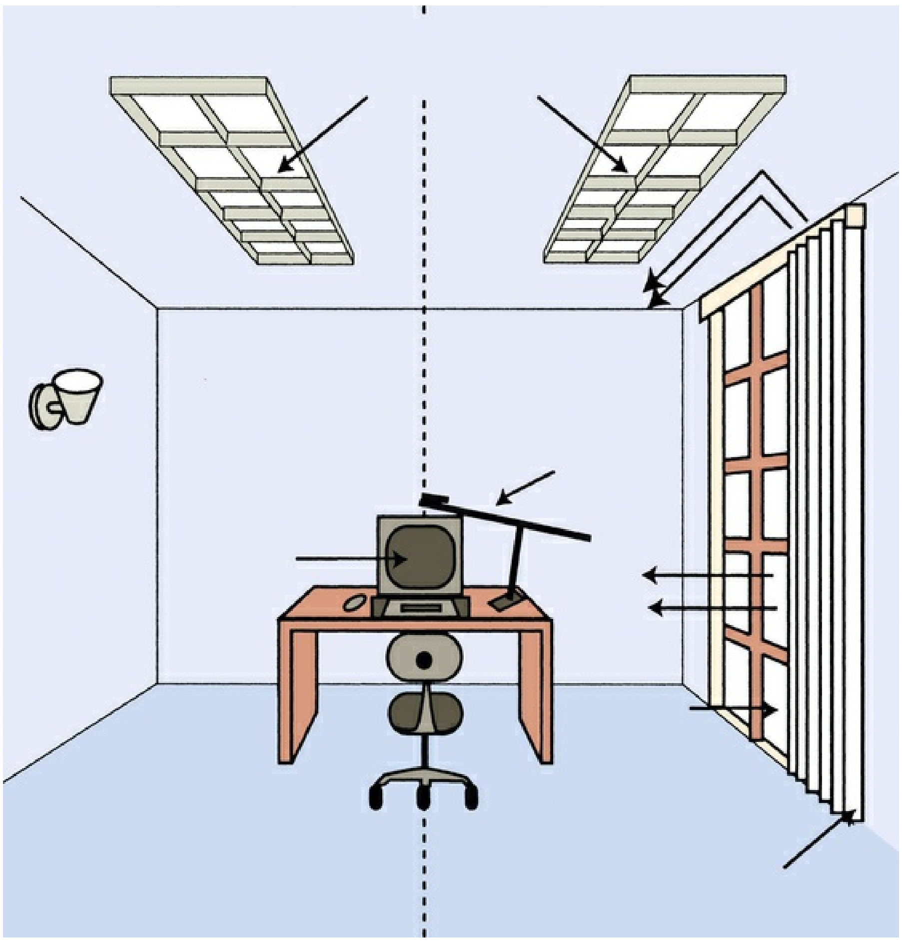


FIG 14.8 Lighting position considerations for computer workstations. Most of these lighting position principles can be applied to workstations in general. (From the Occupational Safety and Health Administration: *Working safely with video display terminals,* Washington, DC, 1997, US Government Printing Office. http://www.osha.gov/publications/osha3092.pdf.)

Tools

Tools should be designed to protect the worker from hand vibration, extreme temperatures, and soft tissue compression. Therefore, handles on tools are essential. "A properly designed tool handle should isolate the hand from contact with the tool surface, enhance tool control and stability, and serve to increase the mechanical advantage while reducing the amount of required exertion."[81] Because the average worker's hand is 4 inches (10 cm) across, the length of the tool handle must be at least 4 inches to avoid unnecessary pressure on the palm of the hand. Handles of scissors and pliers should be spring loaded to avoid trauma to the back and sides of the hands.[81]

Tool design should minimize muscular effort and awkward posturing of the upper extremity. Whenever possible, opt for power tools to minimize the human effort required. Choose tool shapes that allow the wrist to stay straight and the elbow to stay bent and close to the body during use. The shape of the tool will depend on the job task and work surface (Fig. 14.9). Tools that weigh between 10 and 15 lb (4 to 6.5 kg) cannot be held in a horizontal position more than a couple of minutes without the worker experiencing pain and fatigue. Suspension systems and counterweights should be designed for use with heavy hand tools.[81]

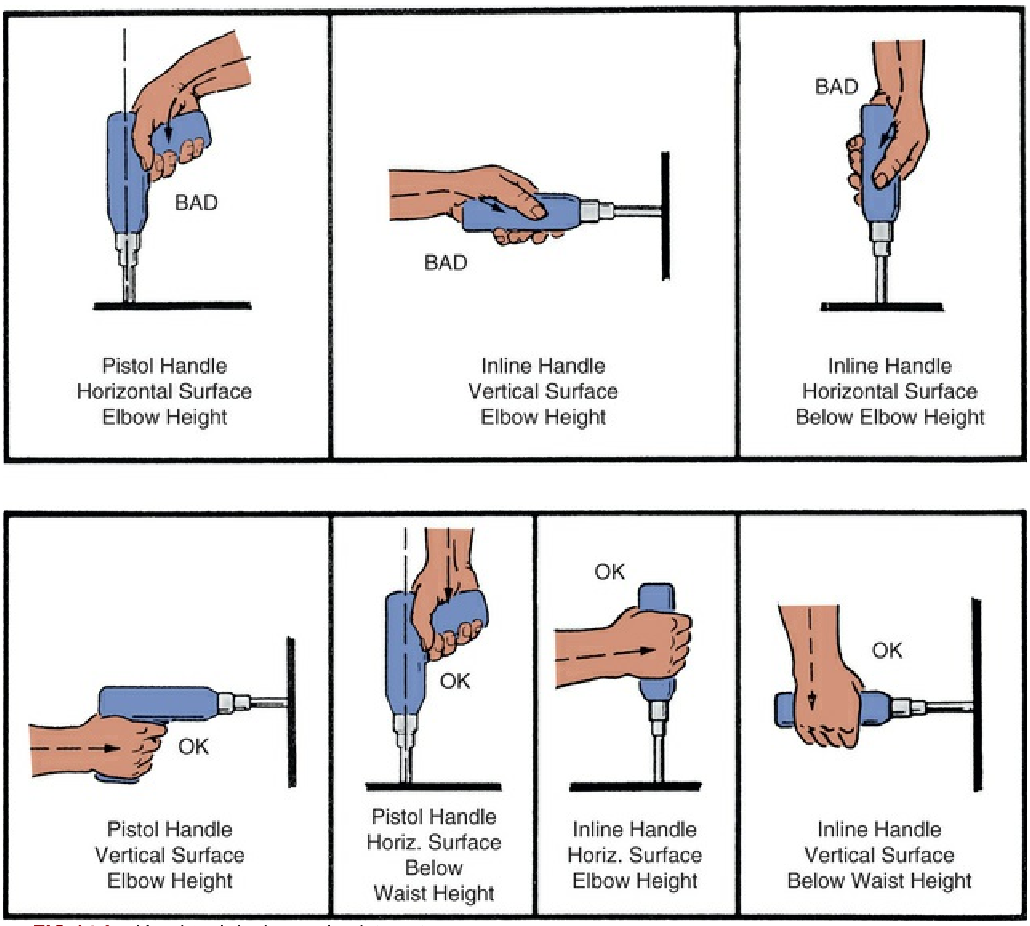


FIG 14.9 Hand tool design and wrist posture. (From Armstrong T: *An ergonomic guide to carpal tunnel syndrome,* Akron, OH, 1983, American Industrial Hygiene Association.)

Whole-body vibration can cause back pain and performance problems when the workstation vibrates, as in the case of long-distance truck drivers and in production industries using high-powered drills or saws in the work area.[14] Hand-arm vibration has been linked to vascular compromise, peripheral nerve damage, muscular fatigue, bone cysts, and central nervous system disturbances.[29] The effects of hand tool vibration should be minimized as much as possible. Use antivibration tools at low speeds when available. Ensure that tool handles and gloves fit the workers' hands. Train workers to grip tool handles as lightly as possible and allow the tool to do all the work instead of the worker adding force behind the tool. Encourage frequent rest breaks and educate workers that smoking increases the risk for vibration-related hand problems.[18,29]

Materials Handling

Concerns regarding handling materials center on back injury and include lifting, pushing, pulling, bending, and twisting. The heavier the material, the more risk for injury. Low back injuries are seldom the result of a single traumatic episode, but rather the result of repeated microtrauma that ultimately leads to injury.[33] Therefore workstation and work process design becomes integral for the safety of materials handling workers.

Design considerations for heavy lifting include the use of mechanical assist devices whenever feasible (e.g., use of a Hoyer lift for moving immobile patients in the hospital). When mechanical assist devices are not available, training in proper lifting technique and proper body mechanics is important to promote worker safety. Providing workers with back support is controversial, but many believe that the use of an elastic back support "has a preventative function, protecting the tissues … thus making injury less common."[46] Training workers and providing them with back support is only effective, however, when "supervisors and managers encourage the use of safe procedures and write policies that enforce them."[85]

The following suggestions are useful for addressing safe handling of materials. Design workstations to keep large items that require lifting off the floor. Provide platforms that will keep items at midthigh height to allow workers to stand nearly erect for lifting. Provide foot clearance so that workers can get as close to the item as possible when lifting and face the load head-on. Adjustable lift tables are excellent for this purpose. Objects should be against the torso during the lift to minimize force on the spine. Workers should never be forced to twist their torsos to lift an object. Use carts or conveyors to transport heavy materials instead of carrying them. Orient packages for easy pick-up and provide adequate handles or handhold cutouts on packages.[18]

As stated earlier, these ergonomic design principles can be applied proactively to work situations to prevent problems before they even occur. For many occupational therapists, however, introduction to ergonomic considerations comes secondarily as part of a comprehensive rehabilitation program for injured workers. After a work-related injury, ergonomic intervention is essential to the client's successful re-engagement in the occupation of work. Without the ergonomic intervention aspect, the rehabilitation process cannot be considered complete.

A significant amount of effort goes into the rehabilitation of an injured worker. Physical injuries require the attention of a medical doctor to prescribe rest, medications, and rehabilitative therapies. The occupational therapist will provide acute care of the injuries by fabricating splints, instructing workers in stretching and strengthening exercise, and using physical agent modalities such as heat and ice to calm the soft tissues in preparation for functional rehabilitative activities. Other aspects of the occupational therapy plan include educating the injured worker about the nature of the injury and training in general body mechanics and personal injury management strategies to help prevent recurrence of injury on return to work. In some cases, the injured worker will require specialized conditioning before return to work and will be referred to a work-hardening program.

When the client is ready to return to work, it is important to remember that an injured worker cannot be safely returned to the same job without ergonomic intervention.

It seems obvious that returning an injured worker to the same conditions that caused the injury will certainly result in reinjury; therefore, those conditions must be eliminated before the employee's return to work. However, ergonomic intervention is sometimes overlooked as an integral part of the rehabilitation program. The goal of ergonomic evaluation and intervention in an injured employee's work environment is to eliminate factors that contributed to the injury in the first place. If we do not eliminate the major cause of the original injury, it will not be long before the worker suffers a recurrence. If that happens, we have failed as occupational therapists to provide a successful rehabilitation process.

Ergonomic Evaluation

The **ergonomic evaluation** is an important assessment and intervention tool when used as part of a comprehensive rehabilitation or injury prevention program. This tool can be used along the entire continuum of prevention services. Ergonomic evaluation can be performed during workstation and work methods planning to assist in efforts to prevent worker injury. Ergonomic evaluation can also be performed for workers in whom symptoms of a **work-related musculoskeletal disorder** (WMSD) develop and for workers who come to therapy for rehabilitation and are ready to return to work, the goal being to prevent reinjury. Finally, ergonomic assessment can be useful in modifying a job in preparation for a disabled worker's return to work with the goal of preventing further injury related to the disability.

The ergonomic evaluation should begin with the occupational therapist scheduling a time to meet with both the worker (or workers) to be assessed and the direct supervisor of the work area. The evaluation should be scheduled during the normal work hours of the worker. The goal is to obtain the best understanding of what actually occurs during a typical work shift, so the conditions should be closely approximated. It is extremely important that the actual worker be present. The purpose of the evaluation is to look at the fit between the specific worker and the specific job methods, equipment, and setup. If any element is missing, the evaluation is of little or even no value.

Ideally the occupational therapist evaluator will arrive at the worksite and meet first with the direct supervisor of the work area to be evaluated. The supervisor will be asked to give an overview of the circumstances leading up to the request for ergonomic evaluation. The occupational therapist will want to know what kinds of injuries are occurring in the work area, when the problem started, and how many employees have been affected. The supervisor will be able to review how the organization has dealt with the problem to date. Frequently, the supervisor will also describe what sorts of psychosocial and environmental influences may be affecting the situation. Occasionally, an ergonomic assessment is requested before any problems occur at all. The supervisor may explain that the employer is just trying to be proactive. In either case, this brief encounter with the supervisor will give an observant occupational therapist evaluator a very good feel for the organization's management culture and organizational priorities.

After the supervisor interview, the occupational therapist evaluator will want to see the work area and meet the employees. The supervisor may give the evaluator a brief tour of the work area and describe the job tasks and methods that occur there. If the supervisor has identified any problem areas (areas that the supervisor thinks are contributing to injury), the supervisor should be encouraged to point these out. This part of the evaluation will give the evaluator an understanding of how management views the situation. Next, the evaluator will ask to meet with the workers.

Once alone with the workers, it is important to establish some level of trust. The evaluator will explain to the workers why the organization has asked for an ergonomic evaluation. It should be explained that the purpose of the evaluation is to make the job safer and more comfortable for the workers. The workers should be encouraged to give the evaluator a tour of the work area and to explain their job tasks. If there are any discrepancies between management's understanding of the job situation and the workers' understanding of the same, the evaluator must seek definitive clarification.

Finally, the workers should be asked to begin performing the job as normally as possible. The evaluator (to simplify the explanation, let's assume in this case that this is a woman) will explain that she will be watching and perhaps videotaping or taking notes. The evaluator should assure the workers that the information that is being recorded will be used to develop strategies to make the job tasks safer and more comfortable to perform. The evaluator must stress that she wants the workers to do the job just like any other day. The evaluator will not begin analysis of the work methods until at least 10 minutes has elapsed to allow the workers time to fall into a more normal work pattern.

The ergonomic workstation and work methods assessment should focus on identifying known risk factors for MSDs. It is often very useful to videotape the work area and work methods performed. Recording the workers performing their job tasks will allow the evaluator to return to her office and further analyze the data. If the evaluator plans to videotape any work areas or work methods, she should ask permission from the company before taping. It is becoming increasingly more difficult to gain permission for in-house videotaping because of confidentiality and trade secrets concerns. However, some companies are still willing to allow videotaping for the purpose of ergonomic evaluation. Always obtain prior written permission allowing you to videotape in-house. Box 14.4 suggests a protocol for videotaping jobs for the purpose of ergonomic evaluation.

Box 14.4

Protocol for Videotaping Jobs for Ergonomic Evaluation

The following is a guide for preparing a videotape and related task information to facilitate job analysis and assessment of risk factors for work-related musculoskeletal disorders.

Materials Needed

- Video camera and blank tapes
- Spare batteries (at least two) and battery charger
- Clipboard, pens, paper, blank checklists
- Stopwatch, strain gauge (optional) for weighing objects

Videotaping Procedures

1. To verify the accuracy of the video camera to record in real time, videotape a worker or job with a stopwatch running in the field of view for at least 1 minute. Playback of the tape should correspond to the elapsed time on the stopwatch.
2. Announce the name of the job on the voice channel of the video camera before taping any job. Restrict running time comments to the facts. Make no editorial comments.
3. Tape each job long enough to observe all aspects of the task. Tape 5 to 10 minutes for all jobs, including at least 10 complete cycles. Fewer cycles may be needed if all aspects of the job are recorded at least 3 to 4 times.
4. Hold the camera still with a tripod if available. Do not walk unless absolutely necessary.
5. Begin taping each task with a whole-body shot of the worker. Include the seat/chair and the surface that the worker is standing on. Hold this shot for 2 to 3 cycles and then zoom in on the hands/arms or other body parts that may be under stress because of the job task.
6. It is best to tape several workers to determine whether workers of varying body size adopt different postures or are affected in other ways. If possible, try to tape the best- and worst-case situations in terms of worker fit to the job. The following suspected upper body problems suggest focusing on the parts indicated:

- Wrist problems/complaints
- Hands/wrists/forearms
- Elbow problems/complaints
- Arms/elbows
- Shoulder problems/complaints
- Arms/shoulders

For back and lower limb problems, the focus would be on movements of the trunk of the body and the leg, knee, and foot areas under stress as a result of task loads or other requirements.

7. Tape from whatever angles are needed to capture the body part(s) under stress.

8. Briefly tape the jobs performed before and after the one under actual study to see how the targeted job fits into the total department process.

9. For each taped task, obtain the following information to the maximum extent possible:

- Whether the task is continuous or sporadic
- Whether the worker performs the work for the entire shift or whether there is rotation with other workers
- Measures of work surface heights and chair heights and whether adjustable
- Weight, size, and shape of handles and textures for tools in use; indications of vibration in power tool use
- Use of hand wear
- Weight of objects lifted, pushed, pulled, or carried
- Nature of the environment in which the work is performed (too cold or too hot?)

From Cohen AL, Gjessing CC, Fine LJ, et al: *Elements of ergonomics programs: a primer based on workplace evaluations of musculoskeletal disorders,* Washington, DC, 1997, US Government Printing Office.

In light of these concerns, it may be helpful to develop an ergonomic checklist to assist in performing the on-site evaluation. The checklist should include the most common ergonomic risk factors and should be tailored to the specific needs and conditions of the workplace that the occupational therapist intends to evaluate. Fig. 14.10 is an example of a typical ergonomic risk factor identification checklist. Fig. 14.11 is an example of a checklist for computer workstation evaluation. Fig. 14.12 is a typical hand tool risk factor checklist.

General Ergonomic Risk Analysis Checklist

Check the box if your answer is "yes" to the question. A "yes" response indicates that an ergonomic risk factor that requires further analysis may be present.

Manual Material Handling

- ❑ Is there lifting of loads, tools, or parts?
- ❑ Is there lowering of loads, tools, or parts?
- ❑ Is there overhead reaching for loads, tools, or parts?
- ❑ Is there bending at the waist to handle loads, tools, or parts?
- ❑ Is there twisting at the waist to handle loads, tools, or parts?

Physical Energy Demands

- ❑ Do tools and parts weigh more than 10 lbs?
- ❑ Is reaching greater than 20 inches?
- ❑ Is bending, stooping, or squatting a primary task activity?
- ❑ Is lifting or lowering loads a primary task activity?
- ❑ Is walking or carrying loads a primary task activity?
- ❑ Is stair or ladder climbing with loads a primary task activity?
- ❑ Is pushing or pulling loads a primary task activity?
- ❑ Is reaching overhead a primary task activity?
- ❑ Do any of the above tasks require five or more complete work cycles to be done within a minute?
- ❑ Do workers complain that rest breaks and fatigue allowances are insufficient?

Other Musculoskeletal Demands

- ❑ Do manual jobs require frequent, repetitive motions?
- ❑ Do work postures require frequent bending of the neck, shoulder, elbow, wrist, or finger joints?
- ❑ For seated work, do reaches for tools and materials exceed 15 inches from the worker's position?
- ❑ Is the worker unable to change his or her position often?
- ❑ Does the work involve forceful, quick, or sudden motions?
- ❑ Does the work involve shock or rapid buildup of forces?
- ❑ Is finger-pinch gripping used?
- ❑ Do job postures involve sustained muscle contraction of any limb?

Computer Workstation

- ❑ Do operators use computer workstations for more than 4 hours a day?
- ❑ Are there complaints of discomfort from those working at these stations?
- ❑ Is the chair or desk nonadjustable?
- ❑ Is the display monitor, keyboard, or document holder nonadjustable?
- ❑ Does lighting cause glare or make the monitor screen hard to read?
- ❑ Is the room temperature too hot or too cold?
- ❑ Is there irritating vibration or noise?

Environment

- ❑ Is the temperature too hot or too cold?
- ❑ Are the worker's hands exposed to temperatures less than 70° F?
- ❑ Is the workplace poorly lit?
- ❑ Is there glare?
- ❑ Is there excessive noise that is annoying, distracting, or producing hearing loss?
- ❑ Is there upper extremity or whole body vibration?
- ❑ Is air circulation too high or too low?

General Workplace

- ❑ Are walkways uneven, slippery, or obstructed?
- ❑ Is housekeeping poor?
- ❑ Is there inadequate clearance or accessibility for performing tasks?
- ❑ Are stairs cluttered or lacking railings?
- ❑ Is proper footwear worn?

Tools

- ❑ Is the handle too small or too large?
- ❑ Does the handle shape cause the operator to bend the wrist in order to use the tool?
- ❑ Is the tool hard to access?
- ❑ Does the tool weigh more than 9 pounds?
- ❑ Does the tool vibrate excessively?
- ❑ Does the tool cause excessive kickback to the operator?
- ❑ Does the tool become too hot or too cold?

Gloves

- ❑ Do the gloves require the worker to use more force when performing job tasks?
- ❑ Do the gloves provide inadequate protection?
- ❑ Do the gloves present a hazard of catch points on the tool or in the workplace?

Administration

- ❑ Is there little worker control over the work process?
- ❑ Is the task highly repetitive and monotonous?
- ❑ Does the job involve critical tasks with high accountability and little or no tolerance for error?
- ❑ Are work hours and breaks poorly organized?

FIG 14.10 General ergonomic risk analysis checklist. (From Cohen AL, Gjessing CC, Fine LJ, et al: *Elements of ergonomics programs: a primer based on workplace evaluations of musculoskeletal disorders,* Washington, DC, 1997, US Government Printing Office.)

Risk Analysis Checklist for Computer-User Workstations

"No" responses indicate potential problem areas which should receive further investigation.

1. Does the workstation ensure proper worker posture, such as		
• horizontal thighs?	☐ Yes	☐ No
• vertical lower legs?	☐ Yes	☐ No
• feet flat on floor or footrest?	☐ Yes	☐ No
• neutral wrists?	☐ Yes	☐ No
2. Does the chair		
• adjust easily?	☐ Yes	☐ No
• have a padded seat with a rounded front?	☐ Yes	☐ No
• have an adjustable backrest?	☐ Yes	☐ No
• provide lumbar support?	☐ Yes	☐ No
• have casters?	☐ Yes	☐ No
3. Are the height and tilt of the work surface on which the keyboard is located adjustable?	☐ Yes	☐ No
4. Is the keyboard detachable?	☐ Yes	☐ No
5. Do keying actions require minimal force?	☐ Yes	☐ No
6. Is there an adjustable document holder?	☐ Yes	☐ No
7. Are arm rests provided where needed?	☐ Yes	☐ No
8. Are glare and reflections avoided?	☐ Yes	☐ No
9. Does the monitor have brightness and contrast controls?	☐ Yes	☐ No
10. Do the operators judge the distance between eyes and work to be satisfactory for their viewing needs?	☐ Yes	☐ No
11. Is there sufficient space for knees and feet?	☐ Yes	☐ No
12. Can the workstation be used for either right- or left-handed activity?	☐ Yes	☐ No
13. Are adequate rest breaks provided for task demands?	☐ Yes	☐ No
14. Are high stroke rates avoided by		
• job rotation?	☐ Yes	☐ No
• self-pacing?	☐ Yes	☐ No
• adjusting the job to the skill of the worker?	☐ Yes	☐ No
15. Are employees trained in		
• proper postures?	☐ Yes	☐ No
• proper work methods?	☐ Yes	☐ No
• when and how to adjust their workstations?	☐ Yes	☐ No
• how to seek assistance for their concerns?	☐ Yes	☐ No

FIG 14.11 Risk analysis checklist for computer workstations. (From Cohen AL, Gjessing CC, Fine LJ, et al: *Elements of ergonomics programs: a primer based on workplace evaluations of musculoskeletal disorders,* Washington, DC, 1997, US Government Printing Office.)

Handtool Risk Factor Checklist

"No" responses indicate potential problem areas which should receive further investigation.

1. Are tools selected to limit or minimize		
• exposure to excessive vibration?	☐ Yes	☐ No
• use of excessive force?	☐ Yes	☐ No
• bending or twisting the wrist?	☐ Yes	☐ No
• finger pinch grip?	☐ Yes	☐ No
• problems associated with trigger finger?	☐ Yes	☐ No
2. Are tools powered where necessary and feasible?	☐ Yes	☐ No
3. Are tools evenly balanced?	☐ Yes	☐ No
4. Are heavy tools suspended or counterbalanced in ways to facilitate use?	☐ Yes	☐ No
5. Does the tool allow adequate visibility of the work?	☐ Yes	☐ No
6. Does the tool grip/handle prevent slipping during use?	☐ Yes	☐ No
7. Are tools equipped with handles of textured, non-conductive material?	☐ Yes	☐ No
8. Are different handle sizes available to fit a wide range of hand sizes?	☐ Yes	☐ No
9. Is the tool handle designed not to dig in the palm of the hand?	☐ Yes	☐ No
10. Can the tool be used safely with gloves?	☐ Yes	☐ No
11. Can the tool be used by either hand?	☐ Yes	☐ No
12. Is there a preventive maintenance program to keep tools operating as designed?	☐ Yes	☐ No
13. Have employees been trained		
• in the proper use of tools?	☐ Yes	☐ No
• when and how to report problems with tools?	☐ Yes	☐ No
• in proper tool maintenance?	☐ Yes	☐ No

FIG 14.12 Hand tool risk factor checklist. (From Cohen AL, Gjessing CC, Fine LJ, et al: *Elements of ergonomics programs: a primer based on workplace evaluations of musculoskeletal disorders,* Washington, DC, 1997, US Government Printing Office.)

Risk factors to look for include the following:

1. *Forceful exertions:* Heavy lifting, pushing, pulling, twisting, gripping, or pinching. Handling heavy tools, equipment, or products. Difficulty maintaining control of equipment or tools or lifting and moving an object of asymmetric size. Also using inappropriate or inadequate tools.

2. *Repetition:* Performing the same motion or series of motions continually or frequently for an extended period (Table 14.4).

TABLE 14.4

High-Risk Repetition Rates for the Upper Extremity

Body Part	Repetitions Per Minute
Shoulder	More than 2½
Upper part of arm/elbow	More than 10
Forearm/wrist	More than 10
Finger	More than 200

From Kilbom A: Repetitive work of the upper extremity. II. The scientific basis for the guide, *Int J Ind Erg* 14:59, 1994.

3. *Awkward or static posturing, either repetitively or for prolonged periods:* Assuming positions that place stress on the body, such as reaching above shoulder height, kneeling, squatting, leaning over a work surface, using a knife or keyboard with the wrists bent, twisting the torso while lifting, or looking at a computer monitor off to one side, which causes the neck to twist all day. Also, sitting all day at a desk with poor posture.

4. *Contact stress:* Pressing the body or part of the body (such as a hand or forearm) against hard or sharp surfaces and edges (e.g., using the hand as a hammer, resting the forearms on a sharp desk edge while typing, and using pliers with the handle pressing into the palm).

5. *Excessive vibration:* For example, from power tools or sitting in a truck cab all day while driving.

6. *Cold temperatures:* Either working in cold temperature or handling cold tools or products (e.g., construction workers outside during winter handling metal tools and equipment or meat packers or butchers handling frozen meat).

Once the workstation and work methods risk factors have been identified and the workers have had a chance to familiarize themselves with the occupational therapist, focus should turn to the psychosocial aspects of the job. Frequently these factors will surface during the evaluation process without any prompting whatsoever. Factors such as workload and productivity stressors, quality of the relationship between the workers and other coworkers and the supervisor, genuine job task enjoyment, and overall health and fitness cannot be overlooked. Work-related musculoskeletal injury is never the result of any one factor; rather, it is the accumulation of a variety of risk factors and situations that ultimately result in injury. Occupational therapists look at the entire occupational profile to determine what is occurring.

Finally, it is important to ask the workers for their perspective on problem areas or risk factors in their work area. If their perspective matches what has been identified in the ergonomic evaluation of the work area and work methods, the workers should be encouraged to share their ideas for correcting the problem. Although the occupational therapist is the expert in workstation and work methods analysis, the on-site workers know their job better than anyone. The workers have probably spent hours formulating and discussing how they would change things if ever given the chance. Ask them. Often, one will find a wealth of knowledge and many useful ideas for reducing or eliminating risk factors in the people who perform the job. It is important to exercise caution before using each suggestion. As the expert, it is the occupational therapist's responsibility to ensure that the changes implemented will serve to reduce and prevent injury. Sometimes, worker-driven suggestions inadvertently cause new problems if not assessed appropriately by the ergonomic consultant.

After the on-site evaluation, the occupational therapist returns to her office to analyze the data and prepare a report. The report will be shared with whomever requested the ergonomic evaluation. The report should contain an introduction explaining the background and purpose of the ergonomic evaluation, a description of the actual work area and work methods assessment, and finally the evaluator's findings and recommendations with clear and comprehensive information regarding how to implement the recommendations and resources for securing and purchasing any equipment or services. Job tasks found to contain several risk factors for the development of WSMD have the greatest risk for injury and should be addressed first by the company. Recommendations will focus on ways to eliminate or reduce risk factors (Table 14.5).

TABLE 14.5
Combating Ergonomic Risk Factors

Risk Factor	Suggestions for Improvement
Using Excessive Force	**Reduce Force Required to Perform Activity**
Occupational therapist lifts/transfers heavy clients several times daily	Use Hoyer lift or get help from coworker
Employee uses heavy drill in a manufacturing plant	Suspend tools from ceiling with tension wire

Chef has difficulty cutting chicken in restaurant kitchen	Provide equipment to sharpen knives after every shift
Repetition	**Reduce Prolonged Exposure to Repetitive Activity**
Multiple scans required to activate grocery scanner	Implement program for regular preventive maintenance on scanners
Executive secretary required to type 5 hours in an 8-hour workday	Alternate typing task every 30 minutes with other office tasks, such as making phone calls and filing
Awkward/Static Posturing	**Reduce or Eliminate Awkward/Static Posturing**
Medical transcriptionist types with her head turned to the right to see computer screen	Move computer monitor on desk so that it is directly in line with the computer keyboard and worker's face as she looks straight ahead
Same medical transcriptionist sits in same position all day to type	Require worker to stand and gently march in place for 60 seconds after every 30 minutes of typing; provide timer to remind worker
Grocery store checkout clerk bends at waist and grabs case of soda from bottom of cart with right hand several times daily	Teach body mechanics for proper lift technique and use of two-hand power grip
Contact Stress	**Reduce or Eliminate Contact Stress**
Typist rests her forearms on sharp desk edge to type	Provide soft wrist rest until budget allows purchase of new desk with rounded edges
Jewelry maker uses pliers with short handle to twist wires; end of handle rests in palm of hand	Provide pliers with longer handle that is gently curved to fit hand
Teacher uses side of fist to punch stapler several times daily	Provide electric stapler
Excessive Vibration	**Reduce Vibration**
Drill vibrates in hand of assembly line worker in manufacturing plant	Wrap handle of power tool in vibration-dampening tape and have the worker wear antivibration gloves that fit correctly (to avoid grasping tighter than necessary to handle tool)
Cold Temperature	**Reduce Exposure to Cold**
Construction workers outside in winter handle cold metal equipment and tools	Wrap tool and equipment handles with neoprene and provide workers with thermal gloves to wear; make sure that gloves fit the workers correctly to avoid grasping objects tighter than necessary
Meat and deli teams at grocery store handle frozen foods frequently	Provide well-fitting thermal gloves to wear when handling frozen items and provide grasping tool to use for handling smaller frozen packages

Lorna benefited from a worksite evaluation. The occupational therapist went to her worksite to observe her and the other workers perform some of the essential functions of the job in their actual work environment. Risk factors were identified, such as excessive force from pinching and pulling the fabric tightly over the padded wooden frame and from using the heavy staple gun. A significant amount of force is required to push the heavy furniture to the next workstation. Her work tasks are repetitive; for example, pulling the trigger of the staple gun and pushing and pulling the fabric and furniture all day long. Lorna and the other workers were observed to have awkward posturing with frequent bending, twisting, and squatting to move the bulky furniture around to staple the fabric down.

Lorna's employer was open to the suggestions that the occupational therapist made and was willing to make the appropriate accommodations. A special tool with a padded and curved handle to fit the shape of most hands was purchased to allow the workers to use a grasp-release motion to activate a material clamp rather than using the fingers so forcefully to pinch and pull the fabric. To lessen the amount of bending, twisting, and squatting required, it was recommended that the company purchase commercially available platforms on wheels to easily move the wooden furniture frames around. Additionally, the platforms contain a simple hydraulic lift that elevates the frame to whatever height is needed for easy stapling. The occupational therapist researched and located a resource for purchase of this helpful equipment, which facilitated the employer's timely implementation of the worksite recommendations. Worksite evaluations and ergonomic interventions can also be important aspects of a comprehensive injury prevention program, as discussed in the next section.

Injury Prevention Programs

For decades the majority of occupational therapy practice has been in the area of rehabilitation. Occupational therapists are unquestionably skilled in facilitating client independence during and/or after an injury, illness, or disease. Although it is not an entirely new concept, we are now recognizing occupational therapy's potential to facilitate and perpetuate independence before or even in avoidance of these events. As we move into the 21st century, increasing numbers of occupational therapists are broadening their practices to include wellness and prevention.

Support for this movement is ubiquitous. The 1994–1996 landmark University of Southern California Well Elderly Study supports occupational therapy's preventive intervention role in enhancing physical and mental health, occupational functioning, and life satisfaction.[40] The OTPF-3 provides further support and lists health promotion, performance maintenance, and disability prevention as occupational therapy intervention approaches that facilitate "participation in life through engagement in occupations" (OTPF-3, p. S2).[1] In 2004, AOTA President Carolyn Baum, PhD, OTR/L, FAOTA, identified several prevention-related businesses as "hot" occupational therapy emerging practice areas.[57]

With regard to occupational therapy and work, prevention can take on three forms: primary prevention, secondary prevention, and tertiary prevention. **Primary prevention** efforts help protect healthy workers against a targeted condition before the condition occurs. Interventions are directed to an entire workforce to prevent a specific work-related medical problem. **Secondary prevention** emphasizes early identification of and intervention for asymptomatic workers who have risk factors for the development of work-related medical problems, in addition to identification and treatment of workers with mild medical symptoms in the early reversible stages of injury. The goal is to identify risk factors so that they can be minimized or eliminated and to reverse any medical problems that might be developing. **Tertiary prevention** occurs after a worker suffers nonreversible injury, illness, or disease. Interventions include treatment of the medical problem, attempts to restore maximum function in the workplace, and prevention of injury, illness, or disease-related complications. The goal is to return the affected worker to gainful employment within the confines of the medical problem and to prevent further injury. Once a permanent work-related injury occurs, primary and secondary prevention measures have failed. However, early risk factor detection and intervention through secondary prevention may have minimized the severity of the permanent injury.[85,99]

Most occupational therapists are familiar with the process of tertiary prevention of work-related medical problems. Typically, the occupational therapist becomes involved after a worker suffers an injury, and it becomes the therapist's job to help the client regain maximum function in the workplace and prevent further injury. Occupational therapists are also commonly involved in secondary prevention efforts. Workers are referred with mild work-related medical conditions, and intervention is planned to reverse the symptoms. When these clients get ready to return to work, the occupational therapist may assist the client in identification and modification of risk factors to reduce the risk for reinjury. Worksite evaluation and ergonomic intervention are generally part of the process for successfully reengaging these workers.

Worksite evaluation and ergonomic intervention can also be part of a comprehensive primary prevention program designed to prevent work-related injury, illness, and disease.

Helping employers improve worker fitness, job comfort, and workplace safety reduces work-related medical problems. It can also lead to improved employee morale and increased productivity.[39] Occupational therapists, acting as consultants, can assist corporate clients in establishing injury prevention programs. This is one way that occupational therapists can incorporate the concepts of wellness and health promotion into their daily practices.

Occupational therapist Michael Melnick wrote that "the success or failure of a prevention program has less to do with specific activities implemented and more to do with the methods of implementation."[60] Melnick outlines the four characteristics that are common among successful injury prevention programs: ongoing management support, supervisor "buy in," employee participation, and ongoing support and reinforcement.[60] Melnick explains that successful prevention programs are grounded in the consultant's ability to instill in the corporate client a culture of safety and wellness. The focus should be on the process of implementing safety and wellness activities and not on the activities themselves.

One common reason that an occupational therapist might be asked to consult with an industrial client is to control the severity and incidence of WMSDs. WMSDs are a class of soft injuries affecting the muscles, tendons, and nerves. Other names for WMSDs are cumulative trauma disorders, overuse syndromes, and repetitive strain disorders. WMSDs come on slowly and develop over time. They are thought to be the result of repeated microtrauma to a body and occur when the body is denied the opportunity to adequately rest and repair itself. Common diagnoses within the class of WMSDs include carpal tunnel syndrome, de Quervain tendinitis, lateral epicondylitis, and some types of back injuries.[81]

According to the Bureau of Labor Statistics, WMSDs accounted for 29% of all workplace injuries requiring time away from work in 2007.[9a] Employers pay more than $45 billion annually in worker's compensation and other expenses associated with these disorders.[4] These statistics indicate that WMSDs are at a crisis level in the workplace. However, the financial losses to industry and the economy pale in comparison to the physical and emotional pain and suffering endured by today's injured workers.

Lorna and several of her coworkers were experiencing WMSDs. Their employer agreed to implement an in-house ergonomics program and injury prevention program at the recommendation of the occupational therapy consultant. An ergonomics team was developed that consisted of the company's chief financial officer, the stapling station supervisor, the employee health nurse, the safety manager, the occupational therapist consultant, and three employees who worked in the stapling station, including Lorna.

There are a multitude of resources available for prevention consultants interested in helping corporate clients develop effective programs for evaluating and addressing musculoskeletal concerns in the workplace. OSHA and NIOSH are excellent starting points. Box 14.5 offers information on these two government entities and provides a partial list of their ergonomic and injury prevention resource materials.

Box 14.5

OSHA and NIOSH

The Occupational Safety and Health Act of 1970 created both the National Institute for Occupational Safety and Health (NIOSH) and the Occupational Safety and Health Administration (OSHA). Although NIOSH and OSHA were created by the same act of Congress, they are two distinct agencies with separate responsibilities.

OSHA

OSHA is in the U.S. Department of Labor and, as a regulatory agency, is responsible for developing and enforcing workplace safety and health regulations. OSHA developed the following publication guidelines to assist industries in developing in-house ergonomic programs:

- Ergonomic Program Management Guidelines for Meatpacking Plants (1993) (OSHA Publication 3123)
- Guidelines for Nursing Homes: Ergonomics for the Prevention of Musculoskeletal Disorders (Revised 2009) (OSHA Publication 3182)
- Guidelines for Retail Grocery Stores: Ergonomics for the Prevention of Musculoskeletal Disorders (2004) (OSHA Publication 3192-05N)
- Guidelines for Poultry Processing: Ergonomics for the Prevention of Musculoskeletal Disorders (2004) (OSHA Publication 3213-09N)
- Guidelines for Shipyards: Ergonomics for the Prevention of Musculoskeletal Disorders (2008) (OSHA Publication 3341-03N)

These publications can be ordered at http://www.osha.gov or by calling 1-800-321-OSHA.

NIOSH

NIOSH is part of the Centers for Disease Control and Prevention (CDC) within the U.S.

Department of Health and Human Services. NIOSH is an agency established to conduct research and make recommendations for preventing work-related injury and illness. NIOSH and OSHA often work together toward the common goal of protecting worker safety and health. NIOSH currently offers several publications to assist in ergonomic intervention efforts. The following may be of interest to occupational therapy practitioners wanting to get involved in ergonomics:

- Elements of Ergonomic Programs: A Primer Based on Workplace Evaluations of Musculoskeletal Disorders (1997) (NIOSH Publication 97-117)
- Simple Solutions: Ergonomics for Construction Workers (2007) (NIOSH Publication 2007-122)
- Ergonomic Guidelines for Manual Material Handling (2007) (NIOSH Publication 2007-131)
- Safe Lifting and Movement of Nursing Home Residents (2006) (NIOSH Publication 2006-117)
- Conference Proceedings: Prevention of Musculoskeletal Disorders for Children and Adolescents Working in Agriculture (2004) (NIOSH Publication 2004-119)
- Easy Ergonomics: A Guide to Selecting Non-Powered Hand Tools (2004) (NIOSH Publication 2004-164)
- Simple Solutions: Ergonomics for Farm Workers (2001) (NIOSH Publication 2001-111)
- Ergonomic Interventions for the Soft Drink Beverage Delivery Industry (1996) (NIOSH Publication 96-109)

These publications (and others) can be ordered from the CDC-NIOSH website (http://www.cdc.gov/niosh) and also by telephone from NIOSH at 1-800-CDC-INFO (1-800-232-4636); outside the United States at 513-533-8328.

It is important to remember that every corporate client is unique and that the consultant's recommendations must work within the corporate culture, goals, and budget constraints. Melnick also reminds us that we must help our corporate clients recognize that “injury prevention consultants do not reduce injuries. This would occur only if the consultant stepped in and performed each worker's job. Rather, prevention consultants help companies reduce their losses by guiding them through various activities.”[60]

As a guiding framework, however, the injury prevention consultant will want to incorporate the following elements into the corporate plan:

- A process for the organization to initially identify the potential risk for musculoskeletal problems or other risk factors in the workplace
- A strategy for showcasing management's commitment to addressing problems and encouraging open worker involvement in problem-solving activities
- Skill training to ensure that management and workers can evaluate work areas and work methods for risk factors that could lead to musculoskeletal problems
- Protocols for gathering data to identify jobs or work conditions that are most problematic and at risk by using strategies such as ergonomic evaluation
- A strategy for developing effective controls for identified risk factors that, if left untouched, could lead to musculoskeletal injury
- Protocols for outcomes assessment to see whether the musculoskeletal injury risk factor controls have actually reduced or eliminated the problem
- A plan for establishing a healthcare management program that emphasizes the importance of early detection and treatment of MSDs because early identification and treatment of these disorders almost always reduce the severity of injury and disability and their associated costs
- A plan for minimizing future risk factors for musculoskeletal injury when new work processes and work areas are in development since it is less costly to build good design into the workplace than it is to redesign or retrofit later

These essential elements of musculoskeletal injury prevention programs are based on recommendations from both OSHA and NIOSH.[14,68-71] In the 1990s and early 2000s these two agencies developed guidelines and recommendations for public and private sector organizations seeking to establish in-house musculoskeletal injury prevention programs. These informational documents are available through OSHA and NIOSH and are an invaluable resource for occupational therapists wanting to offer prevention consulting services to address WMSDs.

Empowering Corporate Clients: The Injury Prevention Team

Corporate clients initially realize they may have a problem with WMSDs in a variety of ways. Signs of potential problems include worker reports of frequent aches and pains via employee health visits or organized symptom surveys, injury and illness trends among workers performing the same job tasks, and identification of injury risk factors as a result of preventive ergonomic job analysis.[14] Fig. 14.13 presents an example of a typical symptom survey used by companies to screen for potential work-related musculoskeletal problems. Once an organization recognizes that it has a problem with WMSDs, it must develop a strategy to address the problem. At this point, corporate clients frequently seek an injury prevention consultant to "make the problem go away."

<u>Symptoms Survey: *Ergonomics Program*</u>

Date ______/______/______/

_______ Plant   _______ Dept #   Job Name ______________________________

_______ Shift   ______________________ Hours worked/week   ______ years ______ months Time on THIS Job

Other jobs you have done in the last year (for more than 2 weeks)

_______ Plant   _______ Dept #   ______________________ Job Name   ______ months ______ weeks Time on THIS Job

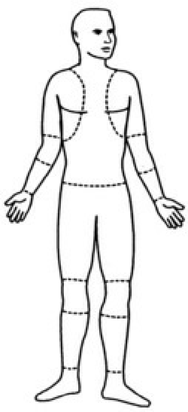
_______ Plant   _______ Dept #   ______________________ Job Name   ______ months ______ weeks Time on THIS Job

(If more than 2 jobs, include those you worked on the most)

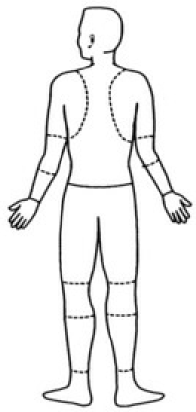
Have you had any pain or discomfort during the last year?

☐ Yes   ☐ No (If NO, stop here)

If YES, carefully shade in area of the drawing which bothers you the MOST.



Front



Back

(Continued)

(Complete a separate page for each area that bothers you)

Check Area: ☐ Neck ☐ Shoulder ☐ Elbow/Forearm ☐ Hand/Wrist ☐ Fingers
☐ Upper Back ☐ Low Back ☐ Thigh/Knee ☐ Low Leg ☐ Ankle/Foot

1. Please put a check by the words(s) that best describe your problem

☐ Aching	☐ Numbness (asleep)	☐ Tingling
☐ Burning	☐ Pain	☐ Weakness
☐ Cramping	☐ Swelling	☐ Other
☐ Loss of Color	☐ Stiffness	

2. When did you first notice the problem?__________ (month)________ (year)
3. How long does each episode last? (Mark an X along the line)

__________/__________/__________/__________/__________/
1 hour 1 day 1 week 1 month 6 months

4. How many separate episodes have you had in the last year?____________________
5. What do you think caused the problem?____________________

____

6. Have you had this problem in the last 7 days? ☐ Yes ☐ No
7. How would you rate this problem? (mark an X on the line)

NOW

____
None Unbearable

When it is the WORST

____
None Unbearable

8. Have you had medical treatment for this problem? ☐ Yes ☐ No

8a. If NO, why not?____________________

8b. If YES, where did you receive treatment?

☐ 1. Company Medical Times in past year ____________
☐ 2. Personal doctor Times in past year ____________
☐ 3. Other Times in past year ____________

Did treatment help? ☐ Yes ☐ No ____________

9. How much time have you lost in the last year because of this problem?_____days
10. How many days in the last year were you on restricted or light duty because of this problem?

_____ days

11. Please comment on what you think would improve your symptoms

____
____
____
____

FIG 14.13 Symptom surveys are sometimes used as screening tools in companies that suspect problems with work-related musculoskeletal disorders. Workers are asked to voluntarily fill out the survey. The surveys are analyzed for trends indicating similar musculoskeletal symptoms within certain work groups. If workers from a specific work group tend to have similar complaints, the job tasks and workstations should be analyzed further. (From Cohen AL, Gjessing CC, Fine LJ, et al: *Elements of ergonomics programs: a primer based on workplace evaluations of musculoskeletal disorders,* Washington, DC, 1997, US Government Printing Office.)

Corporate clients frequently seek injury prevention specialists in the hope of achieving a quick and definitive fix. However, controlling WMSDs needs to be an ongoing process of control and management. The injury prevention consultant must work toward empowering the corporate client to maintain a successful injury prevention program consistently over time. The consultant must ensure that the client company has the knowledge and skills to follow through with the program.

The role of the injury prevention consultant is to help the organization put together a team and a strategy for ongoing identification and control of risk factors for musculoskeletal injury.

In the same way that occupational therapists teach individuals to be self-sufficient in performing activities of daily living, they can also teach their corporate clients to be self-sufficient in controlling risk factors for musculoskeletal injury in the work environment. This client-centered approach has occupational therapy intervention focused on the corporate client's priority of controlling work-related injuries and their associated costs. The occupational therapy intervention plan is the development of a corporate in-house injury prevention team. Another name for this team is the ergonomics team.

Usually the injury prevention consultant will decide with corporate management who will be a part of the ergonomics team. Ideally the team will be composed of representatives from management; front-line supervisors; production workers; labor unions; employee health, safety and/or industrial hygiene; engineering; and the injury prevention/ergonomics consultant. The exact makeup of the team will vary, depending on the nature of the organization and corporate structure. The team meets and formulates a strategy for developing and implementing the injury prevention program.

Initial meetings will typically focus on the nature and scope of reported injuries and the effects that these injuries have had on production, worker's compensation and associated costs, employee retention, and employee morale. An analysis of existing medical, safety, and insurance records can be conducted for the purpose of identifying injuries associated with MSDs. Healthcare team members should be encouraged to present medical record and injury information in a way that protects the confidentiality of individual workers. The team can then determine incidence rates of MSDs and look at trends that indicate problem work areas or job tasks.

Once the scope of the problem has been analyzed, the team will decide on a plan of attack for prevention of injury. In general the magnitude and location of existing problems will suggest the magnitude and direction of the initial team efforts. The consultant will want to direct the corporate client to address the most grievous and resource-draining problems first. If, on analysis of the data, the problems seem widespread and involve a large percentage of the workforce, the plan of attack will probably be an aggressive company-wide program. On the other hand, if the problems seem to be isolated to just a few work areas or employees, the initial plan would probably be more focused and direct.[14]

Management Commitment

The industrial safety and health literature stresses that the support of management in injury prevention efforts is crucial for successful implementation and outcomes.[14] The consultant will want to ensure that management commitment to the process is genuine. If there is a lack of sincere, top-level support for the injury prevention program, a consultant would be wise to pass on his or her involvement. Consultants are judged on their record of success. Prevention efforts without management support are destined to fail.

A good injury prevention consultant knows that employees want to see evidence of management support for all new programs. One of several ways to assist corporate clients in demonstrating support to the workforce is to encourage management to issue policy statements that give injury prevention efforts equal priority with productivity standards and cost control. Management should also meet with employee or union representatives (who should ideally be part of the ergonomics team) to discuss new policy and injury prevention program plans and show evidence of committing resources to implement the injury prevention program. Goals should be set and timelines established for meeting these goals, with specific people assigned responsibility and held accountable for overseeing various aspects of the program. Finally, information about the program should be disseminated to the entire workforce, from planning, to implementation, to evaluation. Employees want and need to feel that they are a part of the organization's commitment to safety.[10,14]

Training in Risk Factor Identification/Ergonomic Evaluation and Problem Solving

Research has identified specific physical activity demands that place people at risk for the development of WMSDs: repetition, force, awkward or static posturing, prolonged direct pressure on soft tissue, vibration, exposure to cold, and inappropriate or inadequate hand tools.[14,68-71,81] Additionally, psychosocial stressors at work can contribute to the development of WMSDs.[14] Although this is an area in need of further study, these types of stressors can include excessive volume or productivity expectations, work that is "too difficult" or beyond the intellectual or emotional capacity of the employee, or a superior who does not express appreciation for a job well done. It is the combination of physical and psychosocial risk factors that the ergonomics team must address as part of an injury prevention program for WMSDs.

The ergonomics team will probably have the injury prevention consultant perform the first ergonomics evaluations at the workplace and present the first suggestions for improvement. However, key members of the injury prevention team should receive training in performing these evaluations themselves and training on how to formulate solutions. In this way the evaluation part of the process is not reliant on an outside source. The goal, eventually, is to have the injury prevention consultant step out of the picture and leave behind a self-sufficient team of in-house experts to implement an ongoing process of risk factor identification for control of MSDs.

Fig. 14.10 is an example of a general ergonomic injury risk analysis checklist. Members of the injury prevention team could be trained to use this tool to screen a variety of jobs for risk factors for musculoskeletal injury. Similarly, Fig. 14.11 is an example of a job-specific screening tool. This checklist helps evaluators identify risk factors for musculoskeletal injury in computer users. Fig. 14.12 is a hand tool analysis checklist. The injury prevention consultant or ergonomics team members could choose to modify any of these screening tools to match jobs specific to the organization.

The NIOSH publication "Elements for Ergonomics Programs 12," lists several objectives for team member training. A successfully trained team member will be able to do the following:

- Recognize risk factors for musculoskeletal injury and understand basic methods for their control
- Identify signs and symptoms of musculoskeletal injury in workers
- Understand the company's injury prevention program thoroughly and everyone's role and responsibility from top-level management to front-line worker
- Know the company's procedure for reporting identified risk factors and signs and symptoms of musculoskeletal injury
- Demonstrate the ability to perform a basic ergonomic evaluation for identifying risk factors for musculoskeletal injury
- Recommend ways to control injury risk factors based on collaboration with employees, management, and other members of the ergonomics team
- Select ways to implement and evaluate the control measures
- Demonstrate skill in team building, consensus development, and problem solving

Some companies will decide to extend training to other members of the workforce. General training can be provided to employees who may potentially be exposed to hazards for musculoskeletal injury. Training can include how to recognize and report early signs and symptoms of musculoskeletal injury, information on identifying risk factors for musculoskeletal injury both at work and outside work, and strategies for workers to protect themselves from the development of musculoskeletal injury. Supervisors should receive the same training as workers, in addition to training in techniques to reinforce proper body mechanics and other important aspects of the injury prevention program.[71]

Training the ergonomics team in skills required to sustain the injury prevention program is a substantial aspect of the consultant's role. The consultant selects or designs the training and training materials to be understandable to the layperson in accordance with the participants' educational levels and literacy ability. Consideration of language skills is also important, and attempts should be made to provide materials in the primary language of the employee.[14] Outside training courses are also valuable in bringing perspective to the organization's situation. Interaction with other companies' course attendees provides opportunities for company-to-company networking. Many resources exist for locating appropriate training courses, including NIOSH and OSHA.

Developing Risk Factor Controls

The ergonomics evaluations will identify known risk factors for the development of MSDs. Risk factors might include forceful exertions, awkward or static posturing, repetition, contact stressors, vibration, exposure to cold, and/or psychosocial stressors. These identified risk factors will be brought back to the ergonomics team for discussion. Once high-risk areas or tasks have been identified, the task of the team then becomes formulating ways to reduce or eliminate the risk factors for musculoskeletal injury.

At this point it is important to use as many front-line production workers in the problem-solving process as possible. Workers know their jobs better than anyone and may have already formulated some ideas about improving the work area or work methods. Promoting worker involvement at this point has several benefits: enhanced worker motivation and job satisfaction, added team problem-solving capabilities, greater acceptance of workplace change, and greater knowledge of the work and organization.[12,14,48,49,66]

When workers present ideas for risk factor modification, it is essential that the injury prevention consultant and the in-house ergonomics team ensure that these potential solutions are appropriate and do not carry with them any potential for creating new problems. Union representatives should ensure that the suggested solutions do not violate employee-management understandings and contracts. Engineering's role is to evaluate suggested solutions for practical and physical feasibility. Management's role is to provide input regarding the organizational and financial appropriateness of the suggested solutions.

There are a variety of ways to reduce or eliminate risk factors for musculoskeletal injury. The 1991 OSHA publication *Ergonomics Program Management Guidelines for Meatpacking Plants* outlines a variety of risk factor control strategies applicable to most any workplace situation. These strategies can be categorized as either engineering controls, work practice controls, administrative controls, or use of personal protective equipment.[71]

Engineering controls include strategies for designing or modifying the workstation, work methods, and/or tools. The goal is to eliminate or reduce excessive exertion, awkward postures, and repetition. Workstations should be designed or modified to accommodate the actual worker at that workstation. If more than one person uses a workstation, elements of the workstation should be adjustable to fit each worker and be comfortable for the workers to use. Work methods should be designed or modified to minimize static and awkward posturing, repetitive motions, and excessive force. Tools and handles should be designed for a specific job and minimize contact stress, vibration, and forceful motions/gripping by the worker's hands.[71]

Work practice controls include policies and procedures for safe and proper performance of tasks that are understood by all and enforced by supervisors. Workers should receive training in proper body mechanics, tool maintenance, and use of workstation adjustability features. New workers and those who have been away for a while should be allowed adequate break-in periods to condition and recondition their bodies for the physical demands of the job. Supervisors and management should constantly monitor the use and effectiveness of work practice controls and make adjustments in techniques, line speed, and staffing as needed to maintain a safe and healthy work environment.[71]

Selection and use of personal protective equipment should be in line with the overall injury prevention program. Equipment should be available in a variety of sizes to accommodate the size differences among workers. Proper fit is especially important for gloves because improperly fitting gloves can reduce blood flow and sensory feedback and lead to slippage and use of excessive grip and pinch force. Protection against extreme cold (below 40° F) is required to protect joints and soft tissues. Back braces and upper extremity splints should not be considered personal protective equipment. These devices are part of the medical management aspect of the program and should be used only with the advice and under the supervision of the healthcare team.[71]

Finally, administrative controls must be an option in situations in which musculoskeletal risk factors cannot be adequately reduced or eliminated via engineering controls, work practice controls, and the use of personal protective equipment. Administrative controls reduce the duration, frequency, and severity of exposure to risk factors. Methods include decreasing production rates, limiting overtime work, providing periodic rest breaks throughout the day, increasing staffing levels, and using job rotation/job enlargement to other jobs and tasks that involve the use of different muscle-tendon groups.[71]

When the team comes to a consensus on which methods to use to reduce or eliminate the risk factors for musculoskeletal injury, it is time to formulate a plan and implement the proposed solutions. However, before any changes are made, it is important to again solicit employee feedback regarding these plans, especially from employees who are not involved in the ergonomics team. Most people are resistant to change; it is human nature. Soliciting and sincerely listening to feedback improve employee buy-in for the proposed changes. Additionally, this feedback might identify implementation problems that the ergonomics team overlooked. Even the best idea for improving the comfort and safety of a job cannot be successfully implemented without employee support. Performing this step in the process is well worth the time and effort.

Medical Management Strategies

In addition to identifying risk factors for musculoskeletal injury and implementing plans to reduce or eliminate these risk factors, it is important for the ergonomics team to develop a medical management plan. Initiating early conservative medical treatment is key to minimizing serious disorder and dysfunction.[63] Workers should be trained to identify early symptoms of MSDs so that they can seek medical care. The employee health staff should formulate guidelines for the management of employees with early symptoms of MSDs. This plan might include oral antiinflammatories, splinting, rotation to light duty or time off work, and occupational therapy. The physician and/or employee health nurse will usually lead the effort in developing medical management guidelines for the organization.

As occupational therapists, it is important to understand the role and implications of upper extremity splinting of work-related injuries. The healthcare team should think about the possible ramifications of prescribing an upper extremity splint to a worker who plans to remain on the job. It is true that splinting helps rest the injured body part and that this can be helpful for recovery from a musculoskeletal injury. However, when a worker is restricted from moving (e.g., the wrist during work), the result is often that the elbow or shoulder will compensate by positioning itself awkwardly to get the task accomplished. Splinting during work may protect the wrist, but the result could be injury to the elbow, shoulder, neck, or back. Therefore splints should not be used at work unless the healthcare team understands the worker's job tasks and can ensure that using the splint will not place stress on other parts of the body.

Outcomes Assessment and Preventing Future Problems

Once the ergonomics team has implemented both efforts at controlling risk factors for musculoskeletal injury and the medical management process, the entire injury prevention program must be evaluated for effectiveness. Outcomes measures are useful in determining whether the program is working and to what extent. If the program does not seem to be working to any significant degree, the team will continue to modify its efforts until the incidence of WMSDs has declined to acceptable levels. The injury prevention program should be considered an ongoing process rather than a short-term solution to an identified incident or problem work area. Most ergonomics teams find that as soon as one problem work area is under control, another problem is identified that requires the focus of the team's efforts.

The occupational therapist is an invaluable resource for helping organizations develop in-house injury prevention programs to control risk factors related to the development of musculoskeletal injury. The occupational therapist's basic training in occupational performance analysis, problem identification, intervention planning and implementation, and outcomes assessment makes the fields of ergonomics and injury prevention ideally suited for practitioners of our profession. The NIOSH and OSHA are valuable resources for occupational therapists interested in working in ergonomics and injury prevention.

Fitness for Duty Testing

A frequent use of functional testing includes assessing a person's ability to meet certain physical requirements before being hired for a job; hence the term "fitness for duty."[78] Some preemployment testing may consist of isometric strength testing, ROM testing, or actual measurement of a person's ability to perform selected tasks from the job description. These types of testing may be known by a variety of names: Post Offer Employment Testing (POET), Post Offer Screening (POS), Pre Employment Testing (PET), Post Offer Physical (POP), Essential Function Testing (EFT) among others. This type of testing can be an integral part of a company's comprehensive injury prevention and management strategy.[78]

OT Practice Notes

Because of their task analysis training and holistic approach, occupational therapists are excellent candidates for assisting companies with expansion of plans to more effectively manage employee injuries.

When a company is looking at the overall impact of an employee injury on the bottom line, it goes much further than simply the cost associated with the injury itself. It extends beyond the medical costs to include the employee's compensation, benefit package payments, training of replacement personnel, replacement personnel wages, and overtime payment for existing personnel if they are needed for coverage. This does not include the indirect costs of diminished productivity during the period when coverage is being arranged. The total impact can be quite staggering. The cost of developing an employment screening process is significant; however, the cost savings to the company can be dramatic.[78]

The EEOC's *Uniform Guidelines on Employee Selection Procedures* sets forth guidelines for the structure and function of human resource departments within companies and businesses. The guidelines also address how an organization can select and manage employees and places strong emphasis on the necessity of policies and procedures being job related.[24,78] The EEOC also mandates that an employer's selection process not have an adverse impact on any group of people and must not discriminate on the basis of race, color, religion, gender, or national origin, as established by Title VII of the Civil Rights Act of 1964.[24,78] Meeting these criteria requires that the selection procedures demonstrate validation, be of business necessity, and be a bona fide occupational requirement.[24,78]

To be compliant with the ADA, preemployment screening must be based on an accurate job description, test only the essential functions (although not every function need be assessed), and have high face validity, often referred to as content validity (i.e., it tests what the examiner really wants to know), or closely mirror the aspects of the job for which the person is being tested.[6,78] Dynamic testing (actually replicating physical tasks from the job) is recommended; it can be conducted on-site at the company or off-site, and it needs to use equipment from the job as it is available.[78] It is vital that companies take the time to thoroughly develop their screening process to be able to defend why the screening was considered necessary, maintain awareness and vigilance in the development phase of good test design, and be prepared to explain and demonstrate the applicability of the screening to the job in question.[78]

Preemployment testing can also occur at several points in the hiring process; however, many healthcare providers and legal experts recommend conducting such testing after an offer of employment has been extended.[31,54] With postoffer screening (POS), the most advantageous progression is to interview the applicant and determine whether the person is an acceptable candidate for employment.[78] A conditional offer is extended to the applicant based on the applicant's ability to meet a variety of conditions, such as passing a drug screen, acceptable background check, and physical testing. A problem with preoffer testing is that Title 29 of the Code of Federal Regulations specifically states that medical examination is permissible "after making an offer of employment to a job applicant."[13] Monitoring blood pressure or the heart rate or inquiring about past medical history is considered to be part of a medical examination and is precluded in preoffer testing.[78]

Anything that a therapist does in the way of evaluating an applicant might be deemed medical simply because an occupational therapist is a medical professional. It is also important to look critically at any testing that is considered to be general strength testing because it has been found to be a poor predictor of potential for injury.[21,65,78] Normative databases also are of little use in making hiring decisions because, according to both the ADA and the EEOC, it does not matter whether the applicant falls into the 5th percentile or the 95th percentile; the only thing of importance is whether the applicant can perform the tasks of the job.[6,24]

If the applicant passes the screening, he or she is hired and begins working. If the applicant does not pass, the employer must assess whether the applicant has a disability as defined under the ADA (see Chapter 15).[6] If the applicant does, the employer must determine whether reasonable accommodation can be offered to the applicant so that the individual may be able to perform the job. Reasonable accommodation means providing accommodation in such a way that the employer is not placed under undue financial strain for the accommodation to be implemented. If the company can and does offer accommodation to the applicant, the hiring process is completed and the employment begins. If the company cannot offer reasonable accommodation or if the applicant does not have a disability yet fails the screening, the employer can choose to rescind the offer of employment, examine opportunities for alternative placement elsewhere in the company, or offer remediation of some type and allow the applicant to retest if certain criteria are met.[78] For example, if a nondisabled applicant does not pass the lifting portion of a POS and otherwise meets the employment criteria, the company might elect to allow the applicant 2 weeks to improve strength with the goal of returning for a retest screen in an attempt to pass the lifting portion.

Suppose Henry (the roofer in the case study) had difficulty balancing on one leg as a result of an early childhood accident but that this balance problem was not something that was readily apparent. If a POS had been conducted on Henry before he was hired at the roofing company, and balance was a component of testing for working as a roofer, his difficulty could have been detected and Henry could have been denied the job or offered alternative placement. Either way Henry would have been protected from a fall that would radically change his life.

A company does not have to test applicants for every job. Typically, it is suggested that a company survey all of its injuries and determine where the majority of injuries are occurring and if they are occurring within the first 6 months of hiring. If so, this company is a good candidate for implementing a physical screen as part of the hiring process. Once it has been determined which jobs are going to be selected for testing, the physical demands of the job must be evaluated. This can be done by survey, questionnaire, or observation (either direct or video).[7] The job description must include information that is functional in terms of physical demands, describe the essential tasks of the job, and be presented in such language that one can test for an individual's ability to perform them.[7] In the case of a company requesting that existing job descriptions be used for development of the screen, it is extremely important to document that the company provided the job descriptions and that the therapist does not assume any liability for errors in their accuracy.

Physical demand items can then be selected for testing during screening based on either the difficulty or the frequency of the item. It is not necessary to test all of the physical demands for each job. For instance, a job might include carrying 10 lb a distance of 10 feet twice a day and lifting 40 lb from pallet height to waist height 200 times per day. Testing the ability to lift 40 lb would be a better selection for testing because if the applicant is able to lift 40 lb from pallet height to waist height, it is likely that he or she will also be able to carry 10 lb a distance of 10 feet. It is important to select a method of testing the tasks that is reliable and valid and demonstrates job applicability, whether choosing from a standardized battery of physical demand tests or developing job-specific tasks to improve the applicant's understanding of the relevance of the task and defensibility of hiring decisions.[24,78]

After tasks have been selected, implementation can begin. It is suggested that a statistically significant sample of incumbents be tested to ensure that the correct demands have been selected and that the minimum requirements for each demand have been set appropriately. Once pilot testing has been completed, the screening can be administered consistently to all applicants for a given job. It is also recommended that the screening process be monitored to ensure that fair and nondiscriminatory selection of applicants is occurring and that modifications in the screening process can occur as needed.[78]

Ethical Considerations

It is imperative for the clinician to encourage companies to have written policies regarding the screening process, including how to handle screening failures.[78] It is also important to extricate the therapist from the hiring process in that all communications come from the employer, so the therapist is allowed to maintain objectivity and third-party distance from the course of action.[78] Continuing documentation and follow-up help establish a definitive paper trail demonstrating the business necessity for implementing a pre-employment screening process, the steps taken to select and analyze the job and tasks to be tested, the implementation phase, ongoing quality assurance to monitor any changes in the job and reflect subsequent changes in the screening and the actions taken to handle screening failures, reasonable accommodation, and avoidance of adverse impact.[78]

Transition Services From School to Work

Occupational therapy practitioners can make a valuable contribution to students with disabilities who are transitioning from school to the community. The 1997 amendments to the Individuals with Disabilities Education Act (IDEA) of 1990 specified that transition planning is to be part of the Individualized Education Program (IEP). Representatives from community agencies that provide postschool services, such as state-sponsored vocational rehabilitation, must join the education team. Related services, such as occupational therapy, are formal contributors to the transition planning for students who need these types of services.[94] Transition services are defined by the IDEA as "a coordinated set of activities for a student designed within an outcome-oriented process, which promotes movement from school to post-school activities, includes postsecondary education, vocational training, integrated employment (including supported employment), continuing and adult education, adult services, independent living, or community participation."[93] Occupational therapy's unique focus on occupational performance can be a strong asset to the transition team.

The three main roles that an occupational therapist will participate in are transition-related evaluation, service planning, and service implementation. The occupational therapist contributes vital information about students' performance abilities and needs in any of the transition domains: domestic, vocational, school, recreational, and community.

Transition-Related Evaluation

Effective transition-related evaluation primarily uses nonstandardized interviews, situational observation, and activity analysis approaches. These approaches are top-down, which means that they first consider what the student wants or needs to do and secondarily identify the occupational performance issues that are causing difficulties.[7] The transition team helps the student identify a positive, shared vision for the future. This can include living alone or with others in the community, attending postsecondary schools or training programs, working in a paid or volunteer job, using community services, and participating in activities of interest. The occupational therapist and other members of the team work together to identify the student's present interests and abilities within the context in which performance is expected or needed. The evaluation process also allows the team to identify areas in which the student is likely to need ongoing support and resources to achieve his or her vision and goals for the future.

Service Planning

In a collaborative transition team, the team members collectively share information and write down the student's goals.[94] The team members do not record discipline-specific goals that focus on remediating the student's underlying deficits. The occupational therapist, for example, does not need to write specific goals addressing cognitive, motor, or psychosocial skills. Instead, two or more group members work together to write the goals and work collaboratively with the student to accomplish the goals. A student with limited movement in her arms and hands may have the goal of being able to complete written assignments. The occupational therapist may take the lead in evaluating the effectiveness of using alternative writing methods such as assistive technology. Recommendations are made to the student and the team. If the team supports the recommendations, the team would assign responsibility for obtaining the equipment and also provide training to the student and other team members. Rainforth and York-Barr define collaboration as "an interactive process in which persons with varied life perspectives and experiences join together in a spirit of willingness to share resources, responsibility, and regards in creating inclusive and effective educational programs and environments for students with unique learning needs."[82]

Program Implementation

The occupational therapist provides services in collaboration with the student and his or her teachers, parents, employers, coworkers, and others as necessary to address the student's goals in the domestic, vocational, school, recreation, and community areas. Occupational therapy personnel (including the occupational therapist and the OTA) deliver transition services in the student's natural environments. Therefore occupational therapy may provide intervention in the student's school, workplace, home, or any other relevant setting in the community. Collaborative problem solving with others involved in the student's environment is essential to help the student use alternative methods to complete the necessary activities. For example, an occupational therapist may introduce and train the teacher in using assistive technology to help a student be able to access the computer at school to do written assignments. The occupational therapy practitioner may provide direct or consultative services to help minimize discrepancies in the student's abilities and the demands of any environment. Evaluating whether the student reaches his or her goals should be the outcome measure to evaluate the effectiveness of occupational therapy services.

Work Readiness Programs

Many times people who have survived a major accident or illness cannot return to their prior employment and need to explore other options for employment. For example, Henry can no longer meet the job demands of a roofer. Henry may really want to return to some type of meaningful work but needs guidance and direction to explore what his present abilities and work skills are so that he can set some realistic vocational goals.

A **work readiness program** is designed to help individuals who desire to work identify vocational options that match their interests, skills, and abilities. At Rancho Los Amigos National Rehabilitation Center in Downey, California, an occupational therapist developed and implemented an ongoing work readiness program as part of the Occupational Therapy Vocational Services. This is an 8-week program that meets two times a week for 2 hours. It consists of people with various diagnoses (e.g., stroke, traumatic brain injury, and spinal cord injury) who meet as a group. Topics addressed include work habits, goals, interests, work skills, vocational exploration, job hunting strategies, and community resources. Instruction, group discussion, and hands-on exploration of work skills via standardized work samples and situational assessments are used to help people explore their readiness to work and discover their potential for pursuing training for a different occupation. Field trips to a real business in the community are sometimes conducted to allow participants to practice actual work tasks in the community. For example, one field trip may be to a hardware store to practice dusting shelves, reorganizing and moving misplaced merchandise in the aisles and to practice visual scanning, dynamic standing balance, reaching, and bending.

Each person's program is individualized to address specific goals and interests. For example, Henry may be interested in working with a computer. He would be given the opportunity to do different work-related tasks using a computer so that he could see whether he has an aptitude for this type of work. If Henry was not familiar with the types of jobs that a person could do with a computer, he would learn how to do vocational research by using various reference books in the library or on the Internet.

A work readiness program can help people identify specific goals to pursue and develop a plan to help them work toward their goals. This program can help a person prepare for returning to work, but it does not provide a job for the participant. At the completion of the program, if a person demonstrates readiness to work, he or she can be referred to the state's Department of Rehabilitation for assistance in job training and job placement. After completing a work readiness program, the occupational therapist can provide valuable information on a person's skills, aptitudes, and interests to assist the rehabilitation counselor in developing a feasible plan for the worker. While Henry was attending the work readiness program, he identified the goal of becoming a computer support technician. Based on the vocational testing and research that he did during the program, this was determined to be a reasonable goal for him to pursue. He was referred to his state's Department of Rehabilitation for job training and job placement in his new career.

Work Activity Groups

Occupational therapists can develop and implement work-related activity groups for people with physical disabilities to build the strength and stamina, hand dexterity, standing balance and endurance to engage in productive activities. By engaging in various activities, such as woodworking, basic carpentry, ceramics, card making, sewing, and jewelry making, people can improve their physical and cognitive performance skills while producing tangible products. Participants can also learn adaptive strategies to use tools and complete tasks using one hand after a stroke, or can practice using the affected hand as an active assist to complete a bimanual task.

At Rancho Los Amigos National Rehabilitation Center, clients who have had a stroke, brain injury, spinal cord injury, or amputations due to diabetes, or who have other neurologic illnesses, manufacture handcrafted gift items which are sold in the hospital gift shop operated by volunteers who have completed the vocational program. Individuals gain confidence and self-esteem and develop new work skills and interests by participating in this program.

Community-Based Services

Historically, work-related programs took place within medical model clinics, such as rehabilitation programs or settings designed for work intervention, as opposed to the site where the worker actually performed his or her role.[90] Today work programs are increasingly being located in the community in which the participant resides or within the work setting itself.[90] This trend toward increased community practice is probably due to changes in the field of occupational therapy and external forces influencing the practice. Current thinking in occupational therapy recognizes that "occupational dysfunction is multidimensional, resulting from the interplay of biological, psychological, and ecological factors."[90] Decreasing reimbursement in medical model settings has resulted in occupational therapists exploring other options for reimbursement in the community.

Funding for most community-based programs is derived from grants or contracts through local, state, or the federal government and also from foundations. Grants are funds that are awarded for a specific purpose and a specific period, usually for research or a service project, "based on a submission of a creative original proposal."[90] Contracts also provide funding for research or service projects; however, the funding agency defines the scope of the project and requests bids from competing organizations in the community. The majority of funding for community-based programs comes from foundations; "foundations are operated by philanthropic families, corporations, or community agencies that have reserved significant amounts of money for the purpose of supporting charitable organizations and programs to address specific community needs."[90] Many associations and civic groups, such as the United Way, American Head Injury Foundation, Kiwanis Club, and others, provide funding for community projects related to specific areas of interest. It is important to note that community-based programs should develop a broad financial base with multiple funding sources for programs to "survive and thrive" in the long run.

Community Rehabilitation Programs

There are almost 600 community rehabilitation programs (CRPs) with federal contracts under the Javits-Wagner-O'Day (JWOD) program, according to Source America (formerly NISH, the National Industries for the Severely Handicapped). These community-based nonprofit organizations train and employ individuals with severe disabilities (primarily developmental disabilities and blindness) and provide quality goods and services to the federal government. The CRPs subcontract work from various industries to allow individuals with severe disabilities the opportunity to be productive, earn a competitive wage, and contribute to society. (See the Source America website [http://www.sourceamerica.org] for more details.) These programs receive most of their funding from regional centers or the Office of Vocational Rehabilitation. Although most of these programs are run by individuals who are not OT professionals, this is an area that some occupational therapists may want to explore for future involvement. There is a great need for these types of programs for individuals with other severe, chronic disabilities (e.g., brain and spinal cord injuries), but creative funding needs to be obtained to support them.

Homeless Shelter Programs

An emerging practice area for occupational therapists is working with persons who are homeless. Because of the increasing number of persons experiencing homelessness, Congress enacted the Stewart McKinney Homeless Assistance Act of 1987 (Public Law 100-77).[34] This act was designed to meet the needs of those who are homeless by providing funds for emergency shelters, food, healthcare, housing, education, job training, and other community services. The act funded a Department of Labor project to plan, implement, and evaluate the effectiveness of a comprehensive spectrum of employment, training, and other support services to help persons who are homeless to locate and sustain employment. Based on the Job Training for the Homeless Demonstration Program (JTHDP), which consisted of 63 organizations across the United States that provided comprehensive services for persons who were homeless from September, 1988, to November, 1995, the Department of Labor created a best practices guide.[90] Box 14.6 lists the findings of the JTHDP, which recommended that a sponsoring agency provide the core services or that the agency develop linkages with other local human service providers to assist persons who are homeless in obtaining and sustaining employment.

Box 14.6

Core Services to Aid Underserved Community Members

The Job Training for the Homeless Demonstration Program has defined the following as necessary services to aid the underserved members of a community:

- Case management and counseling
- Evaluation and employability development planning
- Job training services (e.g., remedial education, basic skills training, literacy instruction, job search assistance, job counseling, vocational and occupational skills training, and on-the-job training)
- Job development and placement services
- Postplacement follow-up and support services (e.g., additional job placement services, training after placement, self-help support groups, mentoring)
- Housing services (e.g., emergency housing assistance, evaluation of housing needs, referrals to appropriate housing alternatives)
- Other support services (e.g., child care, transportation, chemical dependence evaluation, counseling, and referral to outpatient or inpatient treatment as appropriate)
- Mental health evaluation, counseling, and referral to treatment
- Other healthcare services
- Clothing
- Life skills training

From Herzberg GL, et al: Work and the underserved: homelessness and work. In Kornblau BL, Jacobs K, editors: *Work: principles and practice*, Bethesda, MD, 2000, American Occupational Therapy Association.

Occupational therapists have the skills to design and implement programs that incorporate the JTHDP recommendations for best practices. Client-centered job readiness and job training programs can and have been developed for community service agencies to address the concerns of persons who are homeless. This population desires intervention services that are "sensitive, respectful, and responsive to their self-identified needs."[10]

Occupational therapy practitioners work with those who are homeless, and with agencies providing services for people who are homeless, to build skills for accessing resources, solving problems by identifying strengths and assets, and learning to critically analyze situations for win-win situations for employers and the persons who are homeless.

Welfare-to-Work Programs

Congress passed the Personal Responsibility and Work Opportunity Reconciliation Act (Public Law 104-193) in 1996 to move people from welfare to work.[10] It required welfare recipients to find work after receiving 2 years of public assistance. The Balanced Budget Act of 1997 (Public Law 105-33) provided funds for welfare-to-work grants. These grants are for training long-term recipients of welfare or public assistance to enter the job market in unsubsidized jobs. People who are most difficult to place because of multiple barriers to work, such as low academic skills, poor work history, or those who need substance abuse treatment, are the target of these grants. A substantial percentage of welfare recipients have learning problems, mental health and substance use disorders, and issues of domestic violence that interfere with their sustained employability.[90]

Welfare-to-work programs are another innovative practice area for occupational therapists.

Therapists who are interested in entering this area of practice must find out which agencies within the local or state communities control the welfare-to-work funds. Occupational therapists can subcontract with these agencies and collaborate with them. This information can be accessed from the National Governors Association (NGA) Center for Best Practices welfare reform website.[64] Private foundations that are involved in the welfare-to-work programs may also be a source of entry for occupational therapists.

There are many barriers that a person receiving welfare must face to enter into competitive employment. Lack of transportation, lack of childcare, problems with domestic violence, illiteracy, lack of housing, substance abuse, and medical needs can interfere with a welfare recipient's ability to obtain and retain a job.[10] Successful welfare-to-work programs attempt to break these barriers down. For example, programs combine basic education and job development, provide refurbished cars for transportation to work, and provide one-on-one mentoring for improving self-sufficiency. Transitioning welfare recipients to the workplace presents a challenging practice area for occupational therapists to use their creativity to design and deliver effective services to help clients set goals, explore vocational options, and introduce them to different community resources to achieve successful and continued employment.[43]

Ticket to Work

The Ticket to Work and Work Incentives Improvement Act was enacted in December, 1999. This law created a voluntary program for recipients of Supplemental Security Income (SSI) and Social Security Disability Insurance (SSDI) to receive job-related support services and encourage beneficiaries to return to work and pursue their employment goals.[96] Those who have tickets can go to any Employment Network (EN), an organizational entity (state or local, public or private) that has contracted with the Social Security Administration (SSA) to coordinate and deliver employment services, vocational rehabilitation services, and/or other support services under the Ticket to Work Program. Interested individuals can contact the Ticket to Work Help Line at 1-866-968-7842 (V)/866-833-2967 (TTY) to verify eligibility and find out how the program works. The Ticket to Work Program can also be contacted via the website http://www.yourtickettowork.com or http://www.ssa.gov/work. The Ticket to Work Program creates opportunities for occupational therapists to serve on advisory panels, work as program managers, or provide employment support services.[43] Those who are interested in learning how this program will affect their Social Security benefits can register for free Work Incentive Seminar Events (WISE) at http://www.chooseworkttw.net.

Volunteerism

Some people may not be able to return to competitive employment due to the nature or extent of their disability, but they still may be interested in participating in some type of productive activity in the community. Occupational therapy practitioners can help people identify the type of work activities they can successfully do by practicing different skills that may be done by a volunteer at a hospital, school, community center, or any place of interest. Simulated clerical tasks, such as making photocopies, collating and stapling papers, making and receiving phone calls, and data entry, can be practiced. Customer service skills, hospitality and greeting skills, and providing directions and information can be practiced. Helping people identify their strengths will give them more confidence to advocate for themselves when applying and interviewing for a volunteer position. Additionally, occupational therapy practitioners can offer practical assistance to individuals in locating a suitable volunteer site in their local community by educating them on locating the various resources available on the Internet, such as the websites http://www.volunteermatch.org and http://www.idealist.org.

Future Trends

The population of older workers is increasing, whereas the population of younger workers between 25 and 44 is decreasing.[88] The Bureau of Labor Statistics projects that by 2020, 41.4 million workers will be age 55 or older, which is 25.2% of the total labor force.[9] It is predicted that there will be a shortage of younger workers to replace the baby boomers when they retire, thereby creating a gap in the labor market. One proposal to fill this gap would be to employ more people with disabilities.[88] Occupational therapists can work with human resource managers to educate and provide resources for workplace accommodations. The Society for Human Resource Management has recently partnered with the Office of Disability Employment Policy (ODEP).[88] This collaboration reveals that human resource professionals are seeking support and services for hiring and accommodating workers with disabilities.

Baby boomers represent one of the largest percentages of the working population.[88] As they age, employers may need to be sensitive to workers for whom multiple disabilities develop that eventually may have an impact on their job performance. Changes in the workplace offer new opportunities for occupational therapists to help aging workers stay employed with their functional limitations. As older workers retire, occupational therapists can help individuals plan for their retirement and explore ways to remain active in the community by participation in leisure pursuits or volunteer activities. Occupational therapists can help older individuals identify their strengths and abilities and provide community resources to allow meaningful participation in valued occupations.

Threaded Case Study

Joe, Lorna, and Henry, Part 2

Reflecting back on the introductory case scenarios, the reader sees opportunities for the application of these comprehensive work-related occupational therapy interventions. For example, Joe's occupational therapist could conduct a job demands analysis of the laundry attendant position and a worksite evaluation at the hotel and spa where he worked before his spinal cord injury. Then the occupational therapist would determine whether Joe could successfully carry out the essential functions of that alternative job. The occupational therapist could recommend any modifications that needed to be done to make the work area wheelchair accessible. A functional capacity evaluation may be helpful to determine whether Joe could carry out any of the specific physical demands of the job on an occasional or frequent basis. Based on the results, the occupational therapist could then make recommendations to the physician and the employer for any reasonable accommodations that may be necessary for Joe to successfully return to work, in addition to informing them of any concerns regarding Joe's ability to safely meet the physical demands of the job.

After Lorna, the upholsterer with the repetitive stress hand injury, obtains a general occupational therapy evaluation and intervention for her acute injuries in the clinic, she could similarly benefit from an ergonomic assessment and intervention at her workplace. The goal of an ergonomic assessment and intervention would be to eliminate the risk factors that contributed to her original injury and to avoid recurrence of future problems. The occupational therapist could communicate with Lorna's employer about developing an in-house ergonomics and injury prevention program at the company to reduce the number of work-related musculoskeletal disorders occurring at the workplace.

Finally, contemplate the third scenario, which involves Henry. Henry needs the assistance of an occupational therapy practitioner to help him discover what type of work that he would best be suited for, while taking into consideration his present physical and cognitive abilities and limitations. He could also benefit from a comprehensive vocational evaluation to assess his cognitive and physical abilities, work habits, work skills, and work tolerances, in addition to interests and attitudes, to determine whether he could return to any other type of work. Another alternative would be for Henry to participate in a work readiness program. The same areas assessed during a vocational evaluation would also be addressed in the work readiness program; however, Henry could also benefit from a discussion on work-related topics and could receive peer interaction and feedback on his work performance, work habits, and attitudes.

Summary

This chapter has provided an overview of the varying types of work programs in which occupational therapists are currently practicing; it also has identified and discussed areas for further involvement. There are tremendous opportunities for occupational therapists and certified occupational therapy assistants to expand their role and involvement in hospitals, schools, industrial settings, and the community in general in the area of work practice. Occupational therapy practitioners are challenged to take a proactive approach in advocating the need for and benefit of these types of work-related programs in all communities, to help restore the occupation of work and the worker role in many people's lives.

Review Questions

1. How has involvement of occupational therapy in work programs evolved over the years?
2. What is the role of occupational therapy in work programs?
3. Describe the difference between an FCE and a vocational evaluation.
4. What components are usually included in an FCE report?
5. Describe the difference between work hardening and work conditioning.
6. List the common applications of the results of a JDA.
7. What interventions are used to determine whether someone is capable of returning to a specific occupation after an injury?
8. Discuss the ergonomic design considerations for workstations, seating, visualizing job tasks, tools, and materials handling.
9. List and discuss the eight important elements of corporate injury prevention plans.
10. Why are occupational therapists good candidates for assisting companies in the development of injury management programs?
11. Name and describe some innovative types of work programs in which occupational therapists can be involved in the community.

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15

Americans With Disabilities Act and Related Laws That Promote Participation in Work, Leisure, and Activities of Daily Living

Barbara L. Kornblau

CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Explain how the Americans with Disabilities Act (ADA) defines disability and how that definition may apply to clients seen by occupational therapists.
2. Compare and contrast definitions of discrimination and discuss how they may apply to clients served by occupational therapy.
3. Recognize and define specific terms used in the ADA, Fair Housing Act, and Air Carrier Access Act.
4. Discuss the roles that occupational therapy can play in advocating for clients under the ADA, Fair Housing Act, and Air Carrier Access Act.
5. Discuss the roles that occupational therapy can play in consulting with employers, places of public accommodation, airline carriers, and landlords.
6. Explain the process used to determine essential job function.
7. Analyze reasonable accommodations as an intervention strategy in occupational therapy and explain the decision-making process involved in making reasonable accommodations.
8. Outline the process for removing physical and other barriers to access in places of public accommodation and the steps necessary to perform an accessibility audit.
9. Prepare and train employers, coworkers, supervisors, airline employees, and those who work with the public to treat individuals with disabilities with dignity and respect.

KEY TERMS

Accessibility audit
Auxiliary aids
Direct threat
Discrimination
Essential job functions
Individual with a disability
Major life activities
Places of public accommodation
Qualified individual or person with a disability
Reasonable accommodations
Undue hardship

Threaded Case Study

Carlotta, Part 1

Carlotta is a 50-year-old woman with severe rheumatoid arthritis. Since her most recent exacerbation, she finds she must use a wheelchair for mobility. She has always prided herself on her independence and does not want to rely on her children or husband for assistance. She loves going to the movies, shopping, and traveling. Carlotta works as a Spanish teacher at a local high school.

She comes to the occupational therapist (OT) concerned about several things. How will she be able to participate in her work and leisure occupations from her wheelchair when some places (and people) in the community, including her classroom, are not wheelchair friendly or accessible? How will she manage airplane travel from a wheelchair? How can she independently participate in activities of daily living from a wheelchair when her landlord of 12 years will not allow her to make the changes needed in her apartment?

This chapter addresses Carlotta's concerns by expanding the concept of OT interventions to include advocacy as a key concept of intervention. As we address the occupations significant to Carlotta, we will look at three important laws for guidance and support in promoting occupational performance; we also will look to these laws to support our intervention plan. These laws are:

- The Americans with Disabilities Act (ADA),[81] including the Americans with Disabilities Act Amendments (ADAA)[82] and the 2010 ADA Standards for Accessible Design[113]
- The Air Carrier Access Act[78]
- The Fair Housing Act[94]

Each law provides an avenue for OT intervention that promotes the greater good for many individuals with disabilities. Each law also provides specific supports for our efforts to promote our client's desire to increase and improve her participation at work, at home, and in the community.

Carlotta's evaluation shows that as a person with a chronic disability, she is a very sophisticated player.[80] Over almost 25 years of living with arthritis, she has acquired many adaptive devices (eg, reachers, jar openers, bathtub benches) to make her life easier, facilitate independent participation, and prevent further damage to the joints of her hands. She requires the assistance of others for some tasks.

Her occupational profile shows that her job as a Spanish teacher at the large private school where she has worked for 18 years is very important to her.[80] She believes that she can do her job but will have some difficulty navigating the classroom in her wheelchair because of the presence of multiple levels. Her classroom is the former orchestra classroom. She also expresses concerns about continuing her weekly excursions to the movies. How can she navigate the old theater in town in which the old upstairs balcony was turned into a separate screen theater with a one-flight walk up?

Before she began to use a wheelchair herself, she saw wheelchair users at the local shopping mall struggling to get in the door, and she believes that this will present a barrier to her shopping or, as she puts it, “retail therapy.” How will she manage at the airport and aboard airplanes in her quest to find the perfect bed and breakfast (another hobby)? Finally, from her experience as an individual with a disability, she knows that she will need more adaptations in her bathroom to participate in activities of daily living. She is particularly concerned because her landlord has already told her she cannot widen the bathroom door or install grab bars in the bathtub. She is interested in finding alternatives so that she can take care of herself and not have to move. She also expressed concern about her difficulty carrying out a home aquatics program prescribed by her previous OT. She now requires assistance to get into the pool at her apartment complex, but the complex's rules do not allow guests on weekends.

Disability laws heavily influence the facilitation of participation in work, leisure, and the community. Ignoring disability laws can promote ineffective intervention plans.[80] To move forward with an intervention plan, Carlotta's OTs first must understand both the disability laws that affect the areas of concern to their client, and also the ways these laws can provide a basis for intervention.

Americans With Disabilities Act

To understand the protection the ADA affords Carlotta and the roles it provides for OTs and occupational therapy assistants (OTAs), one must first have a basic understanding of the ADA, its definitions, and how the courts have interpreted the law. Congress passed the ADA in 1990 in an effort to reduce **discrimination** against individuals with disabilities and promote their inclusion in the mainstream of society. The law's antidiscrimination provisions cover employment, certain state and local government services, public accommodations, communications, and public transportation. This chapter explores Title I (employment), Title II (state and local government services), and Title III (public accommodations) and how they affect OT practice.

Title I: Employment

Before the ADA became law, the Rehabilitation Act of 1973 prohibited discrimination against qualified individuals with disabilities in employment by three categories of employers: (1) the federal government, (2) employers who contract with the federal government to provide goods and service, and (3) employers who were recipients or beneficiaries of federal funding.[104]

Congress extended that protection by expanding it to private employers who are not dependent on federal funding by passing the ADA in 1990. Because one of Carlotta's concerns is her work and whether she can continue to participate in her work from a wheelchair, knowledge of Title I of the ADA can provide a foundation for OT intervention.

Title I of the ADA prohibits discrimination against individuals with disabilities in employment with private, nongovernment employers who have 15 or more employees. In a nutshell, the prohibition against discrimination in Title I states:

No covered entity shall discriminate against a qualified individual on the basis of disability in regard to job application procedures, the hiring, advancement, or discharge of employees, employee compensation, job training, and other terms, conditions, and privileges of employment.[74]

To understand this statement, one must understand the terms used by answering the following questions:

- Who is considered “an individual with a disability” under the ADA?
- What is a “qualified individual with a disability” under the ADA?
- What is considered “discrimination” under the ADA?

The ADA refers to “individuals with disabilities,” as opposed to “disabled individuals” to give voice to politically correct terminology that stresses the individual first, not the disability. It defines the phrase **individual with a disability** broadly under three umbrella categories, which are considered in the court cases discussed in the next section.

Changes in the ADA

When Congress passed the original ADA, it intended to create an inclusive society in which people with disabilities would work, engage in everyday community activities, and benefit from state and local benefits and services side by side and on the same basis as people without disabilities.[81] Looking back, on the 25th anniversary of the ADA, we see that individuals with disabilities have achieved success in gaining access to participation in the community and government benefits and services.

Employment under Title I has proved to be the biggest disappointment with the ADA. Greeted with great fanfare by the disability community, the courts took a civil rights bill intended to provide employment rights for people with disabilities and decimated its intent. Though originally given a broad mandate by Congress and intended to cover all who fit within the definition of “individual with a disability,” the Supreme Court and lower courts chipped away at these protections and narrowed the definition of “individuals with a disability.”

Ruling on three cases in one day, the Supreme Court severely restricted protection for individuals with disabilities in the employment arena.[79] For example, the Court ruled that individuals were not considered persons with disabilities if they used ameliorative measures to reduce the impact of their disabling condition.[101] The lower courts interpreted this to mean that someone with diabetes who took insulin was not considered a person with a disability.[93]

In *McClure v. General Motors Corp*., 75 Fed. Appx. 983 (5th Cir. 2003), the court held that Mr. McClure's fascioscapulohumeral muscular dystrophy, which prevented him from lifting his arms above his shoulders and required him to use an accommodation to perform his job as a mechanic, did not make him a person with a disability. The court stated, "But the evidence [of limitations from his fascioscapulohumeral muscular dystrophy] does not show that these differences rise to the level of severe restrictions."[98] Like Carlotta, Mr. McClure had many adaptive devices that "ameliorated the effects"[98] of his disability and its impact on everyday activities.

The lower courts also interpreted the Supreme Court's restrictions as imposing significant restrictions on individuals with intellectual disabilities. As presented in *Littleton v. Wal-Mart,*[97] Mr. Littleton had an intellectual disability and, with the assistance of a job coach, went for an interview with Wal-Mart for a shopping cart attendant position. Although arrangements were made in advance for the job coach to attend the interview, when they arrived, Wal-Mart's personnel would not allow the job coach to attend the interview. Mr. Littleton did not get the job. The court acknowledged that Mr. Littleton had an intellectual disability, which it referred to as "mental retardation," a term now considered offensive. In denying Mr. Littleton a trial and declaring that he was not an individual with a disability, the court said in its opinion, "He has pointed to no evidence which would create a genuine issue of material fact regarding whether he was substantially limited in the major life activity of learning because of his mental retardation [now referred to as intellectual disability]."[97] The Supreme Court refused to hear Mr. Littleton's appeal. (128 S.Ct. 302 [2007]0.

The court also said that episodic conditions, such as epilepsy, did not qualify as a disability. For example, in *Todd v. Academy Corp.*,[108] the court found that Mr. Todd was not an individual with a disability because the effects of his seizures were not substantial, since they lasted "only" 10 to 15 seconds and did not occur frequently enough.[108] In another case, *EEOC v. Sara Lee,*[92] the court held that the employee was not entitled to a reasonable accommodation from the employer because the employee took medications for seizures and therefore was not a person with a disability.[92]

The Supreme Court further limited the rights of people with disabilities when it reviewed what it means to be "substantially limited in a major life activity" in the case of *Williams v. Toyota Motor Mfg*.[115] Mrs. Williams had tendinitis and cumulative trauma syndrome. The Court declared that people with disabilities had to have multiple limitations in their everyday activities to be considered a person with a disability; one limitation was not enough.[115]

As a result of these decisions, the ADA faded into a hollow promise for people with disabilities in employment. Its definitions were meaningless. Its safeguards no longer provided protection for people with any disability. Veterans returning from the wars in Iraq and Afghanistan with limb loss feared that employers could discriminate against them and that the courts would not stand behind them because of the mitigating effect of their prostheses. Carlotta could have found herself without the ADA's protection because her wheelchair and adaptive aids mitigated the impact of her arthritis.

The disability advocacy community lobbied Congress to change the law to restore Congress' original intent to ensure that people with disabilities could work and not face unnecessary discrimination. These efforts led to the passage of the ADA Amendments Act (ADAAA), which specifically rejects the Supreme Court's decisions and broadens the definitions portion of the ADA to return the law to its original intent: a broad scope of protection under the ADA.[74] It also extended all of its changes to the Rehabilitation Act of 1973.[82]

The first definition states that with reference to individuals, disability means "(i) A physical or mental impairment that substantially limits one or more of the major life activities of such individual."[41] A physical or mental impairment includes "any physiological disorder or condition, cosmetic disfigurement or anatomical loss affecting one or more of the following body systems: neurological, musculoskeletal, special sense organs, respiratory (including speech organs), cardiovascular, reproductive, digestive, genito-urinary, hemic and lymphatic, skin, and endocrine."[44] The revised definition of physical or mental impairment included most of the traditional medical diagnoses seen by OTs in the individuals they treat; including, for example, individuals with multiple sclerosis, spinal cord injury, cerebrovascular accident (CVA), cerebral palsy, and arthritis—Carlotta's condition—which affects the musculoskeletal system. Mental or psychological impairments included "any mental or psychological disorder, such as an intellectual disability [formerly termed 'mental retardation'], organic brain syndrome, emotional or mental illness, and specific learning disabilities."[45]

The ADAAA broadened the meaning of the phrase "substantially limits" based on Congress' finding that the former regulation that defined "substantially limited" to mean "significantly restricted" was inconsistent with congressional intent because the standard was too high.[81,83] The ADAAA specified that the term "substantially limits" be interpreted consistently with the findings and purposes of the ADAAA enacted in 2008.[84]

The implementing regulations incorporated the policies that Congress outlined in the ADAAA into a series of rules to help define "substantially limiting." The closest one to an actual definition states:

An impairment is a disability within the meaning of this section if it substantially limits the ability of an individual to perform a major life activity as compared to most people in the general population. An impairment need not prevent, or significantly or severely restrict, the individual from performing a major life activity in order to be considered substantially limiting. Nonetheless, not every impairment will constitute a disability within the meaning of this section.[48]

The remaining rules explained how to interpret this general rule. As Congress intended, the rule was to be interpreted "broadly in favor of expansive coverage"[48] so that people such as Carlotta were covered by the ADA. Furthermore, the ADAAA required that lawsuits brought under the ADA focus on whether employers "complied with their obligations and whether discrimination has occurred, not whether an individual's impairment substantially limits a major life activity."[48] Accordingly, the threshold issue of whether an impairment "substantially limits" a major life activity should not demand extensive analysis.[48]

At the same time, the regulations say that the "determination of whether an impairment substantially limits a major life activity requires an individualized assessment."[47] This is an area where OTs can provide consultation. If Carlotta must prove that she is an individual with a disability, the OT can help provide the individualized assessment of her disability and specify the major life activities limited by her arthritis. The regulations reiterate that the standard used for this assessment is lower than the previous "substantially limited" standard.[47]

The regulations also say that the "comparison of an individual's performance of a major life activity to the performance of the same major life activity by most people in the general population usually will not require scientific, medical, or statistical analysis."[49] However, an individual with a disability, such as Carlotta, could present "scientific, medical, or statistical evidence" to show the comparison, which could include evidence from an OT assessment.[49]

The other rules governing "substantially limited" incorporated the specific concerns that Congress expressed in the law to address the problems created by the Supreme Court cases: mitigating measure, impairment that is episodic or in remission, and impairment in only one major life activity. Under the ADAAA, the ameliorative effects of mitigating measures would no longer play a role in the determination of whether an impairment substantially limited a major life activity.[50] Congress specified examples of mitigating measures as follows[84]:

1. "medication, medical supplies, equipment, or appliances, low-vision devices (which do not include ordinary eyeglasses or contact lenses), prosthetics including limbs and devices, hearing aids and cochlear implants or other implantable hearing devices, mobility devices, or oxygen therapy equipment and supplies"

2. "use of assistive technology"

3. "reasonable accommodations or **auxiliary aids** or services"

4. "learned behavioral or adaptive neurological modifications"

An episodic impairment or one that is in remission is considered a disability "if it would substantially limit a major life activity when active."[51] An impairment need limit only one major life activity to be considered a substantially limiting impairment.[52] For Carlotta, this means that none of the following circumstances—her use of assistive technology, a limitation only in walking, and remission of her arthritis—would prevent her from qualifying as substantially limited or a person with a disability.

Major life activities include many areas of occupation and functions related to activities of daily living (ADLs), including "but … not limited to, caring for oneself, performing manual tasks, seeing, hearing, eating, sleeping, walking, standing, sitting, reaching, lifting, bending, speaking, breathing, learning, reading, concentrating, thinking, communicating, interacting with others, and working."[46] Another category of major life activities includes "operation of a major bodily function, including functions of the immune system, special sense organs and skin; normal cell growth; and digestive, genitourinary, bowel, bladder, neurological, brain, respiratory, circulatory, cardiovascular, endocrine, hemic, lymphatic, musculoskeletal, and reproductive functions. The operation of a major bodily function includes the operation of an individual organ within a body system."[46]

Sometimes, when determining whether a person is limited in a major life activity, one may want to look at the condition under which individuals perform the activities, the manner in which they perform them, and/or how long it takes individuals to perform them.[48] However, the regulations give examples of certain disabilities that one could easily conclude will substantially limit at least the major life activity indicated in Box 15.1.

Box 15.1

Impairments That Substantially Limit Major Life Activities

- Deafness substantially limits hearing.
- Blindness substantially limits seeing.
- An intellectual disability (formerly termed mental retardation) substantially limits brain function.
- Partially or completely missing limbs or mobility impairments requiring the use of a wheelchair substantially limit musculoskeletal function.
- Autism substantially limits brain function.
- Cancer substantially limits normal cell growth.
- Cerebral palsy substantially limits brain function.
- Diabetes substantially limits endocrine function.
- Epilepsy substantially limits neurological function.
- Human immunodeficiency virus (HIV) infection substantially limits immune function.
- Multiple sclerosis substantially limits neurological function.
- Muscular dystrophy substantially limits neurological function.
- Major depressive disorder, bipolar disorder, posttraumatic stress disorder, obsessive compulsive disorder, and schizophrenia substantially limit brain function.

Adapted from 29 CFR §1630.2 (j)(3)(i-iii).

The OT evaluation provides the information the court will want to use to make a determination whether an individual is substantially limited in major life activities. OTs may find themselves assisting employers, attorneys, and others by providing this information, if requested.

The OT evaluation of Carlotta shows that she has arthritis, which substantially limits the major life activity of walking. Carlotta's arthritis also substantially limits her musculoskeletal function. She has difficulty participating in or is unable to participate in a variety of tasks related to everyday living. In light of these limitations, she probably falls under the first definition of disability.

The second definition of an individual with a disability under the ADA includes someone who has a record of having had such an impairment, as described in the first definition.[42] This category includes individuals with a history of a disabling condition, such as a person who had multiple sclerosis that is now in remission, or a person who has been cured of hepatitis C.

The third definition of an individual with a disability includes situations in which a person is regarded as having a substantially limiting impairment that is a perception of a disability based on myths, misperceptions, fears, and stereotypes.[43] For example, suppose a morbidly obese individual, Sue, seeks a promotion to a position that requires frequent trips out of town. The person empowered to decide whether Sue gets that promotion assumes that Sue will have difficulty managing the traveling because of her size. The manager is concerned that Sue will struggle with walking through the airports, breathing, and other nonsedentary aspects of her job. Sue has had a perfect attendance record and has always received excellent performance appraisals. The manager bases his failure to promote Sue on his assumptions about her supposed difficulty walking, breathing, and completing nonsedentary tasks, and these assumptions are simply not true. The manager regards Sue as being an individual with a substantially limiting impairment.

Individuals Not Covered by the ADA

The ADA provides protection against disability discrimination only for those who meet the criteria outlined earlier. This means that individuals with temporary impairments, such as a broken leg or a knee replacement that is likely or expected to heal normally, will not find that the ADA protects them. Individuals who have impairments that are not substantially limiting, such as a visual limitation correctable with eyeglasses, will not find benefits under the ADA.

Furthermore, the ADA enumerates specific exclusions in its definition of disability. It does not provide protection for individuals who fall into one of the following categories: transvestites, homosexuals, pedophiles, exhibitionists, voyeurs, gender disorders not caused by physical impairments, and other sexual behavior disorders.[63] The ADA further excludes from its protection illegal drug users, compulsive gamblers, kleptomaniacs, pyromaniacs, and alcoholics whose alcohol use prevents them from performing their jobs.[64] The ADA does provide protection against discrimination based on disability for recovering illegal drug users, as long as they participate in a rehabilitation program.

Qualified Individuals

Title I of the ADA does not protect all individuals with disabilities. It protects only those who are qualified individuals with a disability. The ADA specifies that “the term ‘qualified,’ with respect to an individual with a disability, means that the individual satisfies the requisite skill, experience, education and other job-related requirements of the employment position such individual holds or desires and, with or without reasonable accommodation, can perform the essential functions of such position.”[53] The first inquiry in deciding whether an individual with a disability meets the basic job requirements looks at the individual's amount of experience, level of education, and skills necessary to perform the job. Carlotta meets these requirements because the school hired her as a qualified teacher more than 18 years ago; therefore, she meets the basic education, skills, and experience requirement. The next inquiry is whether the individual can perform the essential functions of the job.

Essential Job Functions

The ADA defines **essential job functions** as job duties fundamental to the position that the individual holds or desires to hold, as opposed to functions that are marginal functions.[54] Essential functions are those that the individual who holds the position must be able to perform with or without the assistance of a reasonable accommodation. One may consider a function essential because the position exists to perform the particular function. These essential functions are usually obvious. For example, a typist must type, and a proofreader must proofread.

A function is essential because of the limited number of employees available who can share the particular function. For example, because there are only three Spanish teachers at Carlotta's school, Carlotta must collaborate with the other two Spanish teachers to write and direct the annual Spanish language pageant. If the school employed 20 Spanish teachers, it could divide responsibilities so that Carlotta did not have to participate in the annual Spanish language pageant.

An essential function is also one in which the function is so specialized that the employer hires the person in the position for his or her particular expertise or ability to perform that function. For example, the position of brain surgeon is a highly specialized one, and the person in this position is hired to perform highly technical surgery.

Whether a function is an essential function is determined on a case-by-case basis. Specific evidence will support whether a particular function is essential. The Equal Employment Opportunity Commission (EEOC), the federal agency that enforces Title I's provisions, and the courts look at seven factors[55] as evidence of whether a function is essential (Box 15.2).

Box 15.2

Seven Factors That Determine Essential Job Functions

- The employer's judgment of which functions are essential
- Written job descriptions prepared before the hiring process begins
- The amount of time spent performing the job function
- The consequences of not requiring the performance of a particular function
- The terms of the collective bargaining agreement
- The work experience of previous employees who held the job
- The current work experience of incumbents in similar positions

In some situations, essential functions are obvious. For example, the essential functions of a receptionist's position may include answering telephones, taking messages, and greeting and announcing visitors. Typing may be a marginal function for a receptionist in a very busy office where the receptionist has not had to type anything at all over the last 6 months. Essential job functions are determined on a case-by-case basis by looking at the facts of each situation. OTs can help determine essential job functions by looking at the job description, by conducting focus groups with employees, and by performing a job analysis as discussed in Chapter 14.

In determining essential job functions, the focus must be on the outcome or job tasks that employers expect employees to perform. The definition of essential job functions focuses on the concept of job duties or expected outcomes, not the physical demands required to perform a job duty. In other words, an essential function is a task that one must perform to perform the job, not a physical function. Essential functions are not bending, lifting, walking, climbing, or other physical demands. For example, being a mail clerk for a large corporation includes delivering mail as one of the essential functions. The essential function is not walking and carrying the mail, but rather the outcome of delivering the mail. A mail clerk who is not able to carry the mail could push the mail on a cart to accomplish the same result or outcome. Essential functions are what you do, not how you do it.

The job description, job analysis, and discussions with Carlotta about her job show that as a teacher, Carlotta must perform several essential functions, including grading papers and tests and recording their results, discussing student progress with parents, preparing lesson plans, motivating students, and maintaining order in the classroom. (Note that these essential functions are all specific job tasks and not physical functions, such as "hand manipulation skills for writing" or "walking around the classroom.") The OT evaluation shows that Carlotta is able to perform these functions for her position as a Spanish teacher. However, she may have difficulty maneuvering around the classroom to the desks of the individual students because of steps and multiple levels in the former band classroom in which she currently teaches Spanish. Carlotta will also have difficulty writing on the blackboard from a wheelchair. The key to facilitating Carlotta's continued participation in the workplace lies in making reasonable accommodations.

Reasonable Accommodations

The ADA defines **reasonable accommodations** as any change in the work environment or in the way that work is customarily performed that enables an individual with a disability to enjoy equal employment opportunity.[56] Not all employees are entitled to reasonable accommodation. Employers need to make reasonable accommodations only for employees with disabilities who are qualified (Box 15.3).

Box 15.3

Progression of Reasonable Accommodations Decision

Step 1: Is the Individual with a Disability Qualified (IWD)?

Does the individual meet one or more of the following criteria?

- A physical or mental impairment that substantially limits one or more major life activities
- A history of having had such an impairment
- Regarded as having such an impairment

If the worker is not an IWD, the employer does not have to accommodate.

Step 2: Is the Individual with a Disability Qualified?

Does the individual meet both of the following criteria?

- Individual satisfies the requisite skills, experience, education, and other job-related requirements of the job
- Individual can perform the essential functions of such position with or without reasonable accommodations

If the worker is not qualified, the employer does not have to accommodate.

Step 3: Is the Accommodation Reasonable?

- How much does the accommodation cost in relation to the size and budget of the business?
- Are there tax credits or deductions or outside funding sources to pay for the accommodation?
- Does the accommodation interfere with the operation of the business or the ability of other employees to perform their duties?

If it is not reasonable, the employer does not have to accommodate.

Courtesy Barbara L. Kornblau, ADA Consultants.

Reasonable accommodations include three subcategories. First, reasonable accommodations include modifications or adjustments in the job application process that enable consideration of a qualified applicant with a disability for employment in a position that the person wants.[57] This would include reading a job application to an individual with dyslexia or modifying the way a preplacement screening is performed to accommodate an individual with one hand. If Carlotta were to apply for another position, her potential employer would need to provide her with an accessible entrance to the human resources department so that she could obtain a job application.

The potential employer would also have to allow her to use a larger pen for filling out an application because she uses the larger pen to prevent joint changes in her hand. As an alternative, the potential employer can provide someone to assist her in filling out the application.

The modifications and adaptations that OTs most typically provide fall under the umbrella of the second category of reasonable accommodations. The second category includes modifications or adjustments to the work environment or to the manner or circumstances in which the position is customarily performed to enable an individual with a disability who is qualified to perform the essential functions of that position.[58] OTs have traditionally been involved in this area by modifying job sites, including raising or lowering work heights, making a jig, or having the individual with a disability use a piece of equipment (eg, a cart) to move objects rather than carrying them.

OT Practice Notes

OTs may help human resources personnel to understand how disabling conditions, and the limitations in performance skills and client factors that accompany them, can affect the hiring process. In addition, OTs can suggest appropriate, reasonable accommodations available for the application and interview process, which can prevent unintentional discrimination.

Carlotta's continued participation in her work environment will require reasonable accommodations in her intervention plan, in the form of changes in the way the work is performed. For example, Carlotta's employer could reasonably accommodate her by moving her to a different classroom, one that is on a single level and that does not have steps or risers; this would provide Carlotta physical access to the students at their desks. Carlotta could also benefit from a laptop computer with a projector that has a liquid crystal display (LCD), which will eliminate the need for her to write on the board—an impossible task from wheelchair level. (See Chapter 14 for a more detailed discussion of job modifications.)

OTs and OTAs working on the development of reasonable accommodations should note that employers must provide an effective reasonable accommodation—this means one that works, not the most expensive accommodation or the specific accommodation the employee wants. Although the employee suggests the specific type of accommodation, ultimately the employer gets to select the accommodation used. If a shoebox with some rubber bands wrapped around it works as well as the high-tech computerized gadget that the employee requests, the employer need only provide the shoebox with the strategically placed rubber bands.

The third category of reasonable accommodations includes modifications or adjustments that enable employees with a disability to enjoy equal benefits and privileges of employment as other similarly situated employees without disabilities enjoy.[59] For example, suppose the language department at Carlotta's school customarily holds an annual international fair for all the students and their families at the school. The teachers compete by class for the best food, costumes, and projects. The teacher of the winning class wins prizes supplied by the Parent-Teacher Association (PTA). Under the ADA, the school would be required to hold the fair at an accessible location so that Carlotta could participate. This would also apply to the school's annual holiday party and all other school functions for employees. OTs can improve awareness on the part of employers, assist them in making reasonable accommodations, and help sensitize them to the needs of individuals with disabilities in these situations.

According to the ADA, reasonable accommodations may include physical changes to make facilities accessible, in addition to other nonenvironmental changes. Depending on the individual circumstances, reasonable accommodations can include job restructuring; part-time or modified work schedules; reassignment to a vacant position; acquisition or modification of equipment or devices (eg, Carlotta's laptop computer and LCD projector); appropriate adjustment or modification of examinations, training materials, or policies; provision of qualified readers or interpreters; and other similar accommodations for individuals with disabilities.[57,58]

For example, an individual who needs to begin kidney dialysis may find that leaving work early 3 days a week reasonably accommodates his needs. Allowing a cashier with fatigue from multiple sclerosis to sit instead of stand while working may reasonably accommodate her needs. Because of their knowledge of the limitations of impairments and how to adapt the work environment to the individual, OTs can suggest and/or design many of these accommodations while working with the client. Carlotta has a good understanding of much of what she needs to reasonably accommodate her work needs, and her intervention plan should incorporate her insights and suggestions.

The most efficient way for employers to identify the reasonable accommodations that an individual employee may need is to initiate an informal, interactive process with the qualified individual with a disability in need of the accommodation.[86] Employers will find that individuals with a disability are often in the best position to determine which reasonable accommodations they may need to enable job performance. OTs may participate in this effort when the parties need additional expertise to make these accommodations. The EEOC recognizes the expertise of OTs in helping employers and individuals with disabilities make reasonable accommodations.[90]

The ADA provides an exception to the employer's requirement to provide reasonable accommodations for qualified individuals with disabilities. Employers need not provide reasonable accommodations when provision of the accommodation would cause an undue hardship to the employer. **Undue hardship** refers to any accommodation that would be unduly costly, extensive, substantial, or disruptive or that would fundamentally alter the nature or operation of the business.[60] For example, it would probably be an undue hardship for the school to fix Carlotta's classroom by ripping out the floor in the old band room to remove the risers and level the floor because this would eliminate the use of a very needed classroom for an extended period and might represent a significant expense. The alternative, to swap classrooms with another teacher, would be more cost-effective and less disruptive.

Determination of whether an accommodation presents an undue hardship to the employer involves looking at whether the proposed action requires significant difficulty or expense when the following factors are considered[61]:

- Nature and cost of the accommodation needed in light of tax credits and deductions and/or outside funding
- Overall financial resources of the facility, the number of people employed at the facility, and the effect on expenses and resources
- Overall financial resources, overall size of the business, and the number, type, and location of facilities
- Composition, structure, and functions of the workforce
- Impact of the accommodation on operation of the facility, including impact on the ability of other employees to perform their duties and impact on the facility's ability to conduct business

According to the Job Accommodations Network,[95] a federally funded program that has provided technical assistance in making accommodations for more than 25 years, data show that more than 50% of all accommodations cost nothing. The network's statistics also show that employers experience financial gains from the decreased costs of training new employees, a decrease in insurance costs, and an increase in worker productivity.

Discrimination Under the ADA

The ADA does not give one specific definition of discrimination. Instead, it specifies at least nine categories of activities considered discriminatory.

Limiting, classifying, or segregating.

The first prohibited activity includes limiting, classifying, or segregating the employee because of his or her disability.[65] For example, if Carlotta's school were to require all employees who use wheelchairs for mobility to work in one wing of the first floor, it would be segregating the employees with disabilities. This section also forbids employers from asking any questions about an applicant's worker's compensation history during the interview or on the employment application because employers can use this information to limit or classify individuals because of their disability.

Poor disability etiquette can lead to limiting, classifying, and segregating individuals with disabilities in the workplace. The way coworkers treat people with disabilities and the language they use to refer to individuals with disabilities can also make people feel bad or left out of the workplace culture. One method employers may use to avoid limiting, classifying, or segregating employees because of their disabilities is to sensitize supervisors and other employees to working with individuals with disabilities. Nondisabled individuals who lack familiarity in socializing with individuals with disabilities may not know how to shake hands with a person who does not have a right hand. They may shout at a person who is deaf, instead of speaking clearly and facing the person with the hearing impairment.

OT Practice Notes

OTs can assist employers in providing sensitivity training experiences similar to those used in some OT program classrooms to develop an understanding of the disability experience. Giving coworkers time in a wheelchair or with a blindfold during planned activities can help them experience functional limitations, if only for a brief time, that may encourage the development of some sensitivity to how it feels to have limitations in performance and participation. Using lay language free of confusing jargon during this kind of training makes it easier to get the message across to coworkers unfamiliar with OT lingo.

OTs can work with supervisors and coworkers on basic disability etiquette tips, such as using politically correct terminology in which, as mentioned earlier, the person comes before the disability. For example, using the phrase “a person who had a stroke” is better than calling someone a “stroke patient” or “stroke victim” because the word *victim* has negative connotations. Using the phrase “wheelchair user” is more appropriate than “wheelchair bound” because no one is physically bound to the wheelchair, as a book is bound to its binding. Box 15.4 gives more tips on disability etiquette, and Box 15.5 presents tips on conducting the interview process.

Box 15.4

Disability Etiquette Do's and Don'ts

- Do try to treat an individual with disabilities as you would treat any other person.
- Don't raise your voice at someone because he or she is in a wheelchair or has a visual or hearing impairment.
- Do address the person, not the wheelchair, interpreter, or guide.
- Don't trap yourself into thinking, “If I were disabled, how would I feel?”
- Do refer to an individual with a disability as “an individual with a disability.”
- Don't refer to an individual with a disability as “the quadriplegic” or “Mary is a diabetic or epileptic.”
- Do cleanse your vocabulary of offensive, outdated terms, such as wheelchair bound or stroke “victim” or as “afflicted with …” or “suffering from …”
- Don't refer to able-bodied persons as “normal.”
- Do avoid generalizations such as “People with epilepsy are unpredictable” or “People with learning disabilities are not very intelligent.”
- Don't apologize for comments such as “Let's take a walk” to an individual in a wheelchair or “Do you see my point?” to a person with a visual impairment.
- Do avoid statements such as “I admire your courage” or “You've done so much for a person in a wheelchair.”
- Don't use outdated terminology such as “handicapped,” “crippled,” “retarded,” “lame,” “the disabled,” or “the handicapped.”
- Do provide assistance only in the manner requested.
- Don't take hold of an individual's wheelchair or push his or her wheelchair unless asked to do so.
- Do put yourself on the same level as the individual in a wheelchair as soon as possible by sitting down during the conversation or interview.
- Don't turn away when conversing with an individual with a hearing impairment.
- Do speak directly to the person, not the interpreter.
- Don't complete the sentences of an individual with communication impairments.
- Do rid your thinking of stereotypes about disabilities.
- Don't perpetuate another person's insensitivity to an individual with a disability.

Courtesy Barbara L. Kornblau, ADA Consultants.

Box 15.5

Interview Do's and Don'ts

- Don't make notes about an individual's physical or mental condition.
- Do discuss reasonable accommodations when possible. The interviewee is an expert on accommodating his or her disability.
- Don't rely on body language as a measure during the interview process. Lack of eye contact or a mild grip handshake may be caused by an applicant's disability, not his or her lack of confidence.
- Do remember that individuals with disabilities may make poor interviewees if judged against many "traditional" interviewing standards.
- Don't try to put yourself in the applicant's place and ask yourself, "Could I do this job if I were disabled?"
- Do offer an applicant a job based on his or her abilities, not disabilities.
- Don't job stereotype.
- Do remember that communications skills are often an inaccurate measure of the intelligence, ability, or confidence of an individual with a speech or hearing problem.
- Don't patronize the applicant with a disability with your own body language.

Courtesy Barbara L. Kornblau, ADA Consultants.

Contractual relationships that discriminate.

The second prohibited activity includes participating in a contractual or other relationship that results in discrimination against qualified applicants or employees because of their disability.[66] This provision applies to collective bargaining agreements, contracts with employment agencies, and other contracts. For example, suppose Carlotta's employer contracted with an outside company to provide continuing education courses at her school. The continuing education company would have to comply with the ADA by offering reasonable accommodations when needed, such as allowing Carlotta to tape sessions or providing her with a note taker if she is unable to take notes during the classes. The OT could work with the continuing education provider to help develop other reasonable accommodations for Carlotta and other individuals with disabilities.

Using standards, criteria, and methods of administration that discriminate.

The third prohibited activity includes the use of standards, criteria, or methods of administration that are not job related and consistent with business necessity and that have the effect of discrimination based on the disability.[67] For example, an employer could not require that Carlotta have a driver's license for promotion to chair of the Spanish Department if driving is not an essential function of the position.

Employers may use a **direct threat** standard to exclude from employment individuals whose disabilities pose a direct threat to the health and safety of themselves or others in the workplace.[62] However, the direct threat must pose a significant risk for substantial harm to the health or safety of the individual or others that employers or others cannot eliminate or reduce to less than a significant risk by reasonable accommodation. Employers must consider the duration of the risk, the nature and severity of the potential harm, the likelihood that the potential harm will occur, and the imminence of the potential harm.[62]

For example, suppose Carlotta wanted to swap classrooms with a teacher whose classroom is on the second floor of the school, which has three stories and an elevator. The headmaster could not refuse to allow Carlotta to use this second-floor classroom because he fears that Carlotta, as a wheelchair user, would pose a direct threat in the event of a fire. The chance of a fire occurring is small; therefore, little likelihood exists that any harm will occur. Moreover, the school could develop an emergency plan in advance that would further lower the risk.

Employers must base the determination that an individual poses a direct threat on an individualized assessment of the person's present ability to safely perform the essential functions of the job. Employers must base the assessment on a reasonable medical judgment that relies on the most current medical knowledge and/or on the best available objective evidence.[62]

The regulations suggest that employers seek opinions from professionals who have expertise in the disability involved or direct knowledge of the individual with the disability. The EEOC recognizes that documentation of direct threat can come from OTs "who have expertise in the disability involved and/or direct knowledge of the individual with a disability."[90] Often a reasonable accommodation can reduce the risk. For example, say that a teenager with epilepsy has a seizure every time the buzzer goes off on the fryer while he is working at the local fast-food restaurant. The OT could suggest that the employer could reasonably accommodate him by changing the buzzer to a bell.

Discrimination based on association with an individual with a disability.

The fourth prohibited activity includes excluding or otherwise denying an equal job or benefits to a qualified individual because of a disability identified in an individual with whom the qualified individual is known to have a family, business, social, or other relationship or association.[68] For example, an employer could not refuse to hire Carlotta's husband because Carlotta has arthritis and is in a wheelchair, and the employer is worried that Carlotta's husband may have excessive absences because of Carlotta's condition. In fact, this principle prohibits the employer from asking any questions that may reveal information about his wife's disability.

Failing to make a reasonable accommodation.

The fifth prohibited activity includes failing to make a reasonable accommodation after a request for a particular accommodation for a known disability of a qualified individual or denying someone employment to avoid providing a reasonable accommodation, unless the employer can show that the accommodation would impose undue hardship on operation of the business.[69] As discussed previously, the OT can play a major role in assisting employers to determine reasonable accommodations. Carlotta's intervention plan includes her need for the following reasonable accommodations: a laptop computer with an LCD projector and a one-level classroom. Carlotta must request the specific accommodations that she wants. As part of the intervention plan, the OT may prepare a report for the school as documentation, explaining Carlotta's need for the particular accommodations, for submission with Carlotta's accommodation request. The OT may meet with the school's staff members to help them understand the needed accommodations. Should Carlotta's school fail to make the reasonable accommodations she requests, it would violate this provision of the ADA.

The employer must know that a prospective or actual employee is an individual with a disability before its obligation to make accommodations arises. Courts have found that an employer cannot discriminate based on disability if it does not know about the disability *(Morisky v. Broward County).*[100] Vague statements about one's limitations or past are not sufficient to put the employer on notice of a disability.[100] Disabilities such as multiple sclerosis, arthritis, learning disabilities, and mental health disorders may not be as obvious to an employer as the disability of a person in a wheelchair. To obtain reasonable accommodations for these hidden disabilities, employees or potential employees must disclose their disability to the employer. OTs can work with clients as employees or potential employees in determining whether to disclose the disability, when to disclose it, and how to disclose it.

Employment tests that screen out individuals with disabilities.

The sixth prohibited activity involves using employment tests that tend to screen out individuals with disabilities on the basis of their disability, unless the test is shown to be job related for the position in question and is consistent with business necessity.[70] The EEOC considers a test job related if it measures a legitimate qualification for the specific job in question.[90] A test is not consistent with business necessity if it excludes an individual with a disability because of the disability and is not related to the essential functions of the job.[90] For example, under this section of Title I, the private school where Carlotta works could not give a written, 12th grade–level reading test to an individual with a known learning disability who applies for a janitorial position. The janitorial position requires reading labels, which are on a fourth-grade reading level. The 12th grade–level test would screen out the applicant based on her disability and is neither job related nor consistent with business necessity.

Administering tests to measure physical attributes, not skills or aptitudes.

The seventh prohibited activity involves failing to administer tests in a manner to ensure that when administered to a job applicant or employee with a disability that impairs sensory, manual, or speaking skills, the test results accurately reflect the skill, aptitude, or whatever other factor of the applicant or employee that the test purports to measure rather than the sensory, manual, or speaking skills, except when such skills are the factors that the test purports to measure.[71] For example, in *Stutts v. Freeman*,[107] an individual with dyslexia was denied a heavy equipment job because he could not pass the written test required to enter a training program. The standard that he pass a written test had the effect of discriminating against the plaintiff as a result of his disability because the test was not meant to test the applicant's ability to read and write but rather his knowledge of heavy equipment operation. Had the employer administered the test orally, the potential employer would have focused on evaluation of the applicant's qualifications for the job, not his ability to read the material.

Retaliating against individuals who file discrimination claims.

The eighth prohibited activity prevents employers from retaliating against individuals who file claims for discrimination under Title I.[72] Before an applicant can file a lawsuit in court under Title I, he or she must file a complaint with the EEOC. This section prohibits an employer from firing, demoting, or otherwise retaliating against an employee who files a charge of discrimination with the EEOC or otherwise pursues his or her rights under this law.

Conducting preemployment medical exams or inquiries.

The ninth and final prohibited activity prevents employers from conducting preemployment medical examinations of an applicant or employee, or inquiring into whether the applicant is an individual with a disability or the nature and extent of the person's disability, before the employer extends an offer of employment to the applicant.[73] Under the ADA, a medical examination means a "procedure or test that seeks information about an individual's physical or mental impairments or health."[91] The EEOC considers a variety of factors in deciding whether a test is a medical exam. These factors include, among others, whether the test is administered or the results interpreted by a healthcare professional or someone trained by a healthcare professional; whether the test is designed to reveal an impairment; and whether the test measures the applicant's performance of a task or his or her physiological responses to performing the task.[91]

Preplacement Screenings and Functional Capacity Assessments

The preplacement screenings and functional capacity assessments provision of Title I affects the way OTs do business. OTs are often involved in preplacement screenings and functional capacity evaluations, which are sometimes considered under the category of fitness-for-duty exams. Employers often hire OTs to perform these tests (see Chapter 14). The ADA regulations outline the types of testing that employers (or those acting on their behalf) may perform and the stages at which they may perform them.

The hiring process involves two relevant stages. The first stage, the preoffer, occurs during the interview process, before an employer extends an offer of employment to an applicant or candidate. The second stage, the postoffer, occurs after the employer has made a hiring decision and extends an offer of employment to the applicant or candidate. We often speak of this offer of employment as a conditional offer of employment because it is subject to withdrawal under certain circumstances, which this chapter addresses later.

During the preoffer stage, an employer may conduct only a simple agility test. Employers and OTs acting on their behalf may not conduct medical examinations or inquiries, preemployment physical examinations, preplacement screening, or functional capacity assessments during the preoffer stage. An agility test is a simple test that looks at a person's physical agility. It is not a medical test. Agility tests do not involve medical examinations, physicians, or medical diagnoses. Employers may request clearance from the applicant's physician before administering an agility test.[90] The classic agility test for police recruits shows them running through tires, scaling a wall, and climbing ropes. Another example of a permissible agility test would include an employer asking an applicant to carry a piece of wallboard from one end of the construction site to the other.

Although employers may conduct these agility tests, the ADA rules govern their use. If an employer chooses to use an agility test, he or she must give the test to all similarly situated applicants or employees. If the agility test screens out individuals with disabilities, the employer must show that the test is job related, consistent with business necessity, and that the applicant could not perform the job with a reasonable accommodation.

During the postoffer stage, employers or those acting on their behalf may conduct agility tests, medical exams and inquiries, preemployment physicals, preplacement screenings, and functional capacity assessments. If the employer chooses to give medical exams, once a conditional offer of employment has been made, he or she must give the exam to all employees entering the same job category. The ADA does not require that a medical exam satisfy the job-related and consistent-with-business-necessity standards. However, if the employer withdraws a conditional offer of employment because of the results of the medical exam, he or she must be able to show (1) the reasons for the exclusion are job related and consistent with necessity, or the person is being excluded to avoid a direct threat to health or safety, and (2) no reasonable accommodation was available that would enable this person to perform the essential functions without a significant risk to health or safety, or the accommodation would cause an undue hardship.

As mentioned earlier, during the postoffer stage, employers and OTs acting on their behalf may perform preplacement screenings and functional capacity assessments. Both are subject to the same requirements as medical exams. In other words, although the tests need not comply with the job-related and business-necessity requirements, should the tests screen out individuals with disabilities, job related and business necessity become the required standard to meet. Reality dictates then that to comply with the ADA, the preplacement screening must be job related and test only the essential functions of the job. For example, assessing Carlotta's hand strength as part of the interview process for hiring her as a Spanish teacher would violate this provision of the ADA because hand strength is not job related and not related to an essential job function.

Employers and those acting on their behalf must keep the results of all medical exams and inquiries confidential, with some limited exceptions. These exceptions include work restrictions information, insurance purposes, government investigations of ADA complaints, and state worker's compensation and second injury funds, which are funds set up by some states to encourage employers to hire individuals with previous workers' compensation–related or other injuries.

This prohibition against inquiries into medical and disability-related information also extends to job applications and interviews. Employers cannot ask questions about a person's disability, or questions that will lead to information about a person's disability, during the job interview process. Box 15.6 shows examples of questions employers may not ask during the interview process.

Box 15.6

Questions Not Permitted Under the ADA

- How did you become disabled?
- Are you in good health?
- Have you recovered from your prior disability?
- How much can you lift?
- How far can you walk?
- Have you been in a wheelchair your whole life?
- Do you have a driver's license? (if the job does not require driving or if a reasonable accommodation cannot eliminate the driving)
- Does your wife, husband, child, or roommate have a disability?

- Who takes care of your disabled husband (or wife or child)?
- Have you ever been injured in an accident?
- Have you ever filed a claim for worker's compensation?
- How were you burned?
- Do you have any physical conditions that would prevent you from doing your job?
- Do you have a good back?
- Have you ever been hospitalized?

OTs can assist human resources professionals in the proper way to inquire into an individual's ability to perform the essential functions of a position without asking prohibited questions. Employers must base their interview questions on specific job functions, information that OTs gather from the job analysis (described in more detail in Chapter 14). Ideally, the interviewer should have a job description prepared from the OT's job analysis and ask interviewees questions about the match between their skills and abilities and the job's essential functions.

Role of the Occupational Therapist

OTs can work with individuals with disabilities, as part of their intervention plan, to identify needed accommodations that will enable participation in the workplace; they also can help the individual plan a strategy to obtain those accommodations from the employer. OTs can help their clients understand their right to reasonable accommodations under Title I of the ADA. This includes the requirement to request the specific accommodations needed and to furnish documentation of the need, which the OT can prepare for the client to provide to the employer. OTs may find themselves advocating for the accommodations to their client's employer.

For example, as described earlier, Carlotta's OT can play a major role in her employer's provision of the accommodations she needs. Carlotta and her OT identified the accommodations she needs as part of her occupational profile and intervention plan. If the employer refuses to provide the accommodations after Carlotta provides the OT's documentation and if Carlotta eventually files a lawsuit, the OT may find himself or herself testifying in court about Carlotta's need for the accommodations.

OTs can also provide consultation services for employers who want to avoid litigation and who seek advice on making reasonable accommodations for their employees with disabilities. If Carlotta's employer were proactive, he or she may have contacted an OT for advice on how to accommodate Carlotta.

This kind of consultation, in which the client is the employer, not the individual with a disability, usually begins with a job analysis (see Chapter 14) to see what the job requires. The therapist compares this information with the individual's limitations and tries to develop accommodations to enable performance. This accommodation development stage cannot proceed without input from the person with the disability.

For example, the author was hired by a hospital to look at whether a nurse affected by some post-polio weakness and arthritis could use a scooter (wheelchair substitute–type scooter) as her requested accommodation to cut down on the number of steps she took during the day. The nurse had filed a charge of discrimination with the EEOC, and the hospital's attorney suggested hiring an OT to see whether the requested accommodations were reasonable, so that a full-blown lawsuit could be avoided if possible. The head nurse could not imagine a nurse using a scooter. The author performed a job analysis and determined that the scooter was a reasonable accommodation. Convincing the head nurse that the scooter was reasonable took more work in the form of sensitivity training (an area in which OTs also make major contributions).

Suppose Carlotta decided she did not want to return to her teaching position because she wanted a career change from classroom teaching. An OT might suggest that Carlotta look for jobs with potential employers who are federal government contractors. Federal government contractors must develop affirmative action plans to recruit, hire, promote, and retain people with disabilities, with a workplace goal of 7%.[114] This recent workplace mandate also requires employers to evaluate their hiring practices and adjust them to achieve this goal.[115] In theory, this means that as a person with a disability, Carlotta would have preference in hiring if she applied for a job with a company that contracts with the federal government, as long as she is qualified for the position.

If Carlotta were out of work for a period of time and needed to transition from disability benefits to employment, many work incentive programs exist to help ease her transition. OTs can learn more about the return-to-work incentive programs designed for people with disabilities from the Social Security Administration's "Red Book."[106]

Title II: State and Local Government Services

Title II of the ADA prohibits state and local government entities, and those with whom they contract, from denying a qualified individual with a disability participation in or the benefits of services, programs, or activities provided to individuals without disabilities.[23] Title II's antidiscrimination protection in the employment of individuals with disabilities by state governments has been limited by cases decided by the U.S. Supreme Court. Individual state employees can no longer bring lawsuits for monetary damage in federal court when a state discriminates in its employment practices based on the disability.[88]

Title II's other requirements look similar to those of Title III, described in detail later for nongovernment entities. However, Title II goes farther in its requirement for state and local government services than for privately owned entities in one particular concept:

Title II requires that government agencies give qualified individuals with disabilities equal opportunity to participate in or benefit from the state or local government aid, benefits, or services.[24] This requires providing more access than in Title III's requirements to provide what is readily achievable, as described later in this chapter. Providing equal opportunity to state and local government services requires taking specific measures that allow access to equal services. These may include making facilities physically accessible, making policy changes, providing reasonable accommodations in the form of auxiliary aids and services, providing accessibility in public transportation, and supplying communication aids, such as 911 services for people with hearing impairments. It may include other accommodations described more fully under Title III later in this chapter. OTs can help state and local governments make some of the needed changes, as will be discussed further in this chapter.

Title II and Title III were amended through the rule-making process, and new regulations took effect March 15, 2011.[110-112] Most of the changes apply to both Title II and Title III. Several are specific to Title II. In particular, residential housing programs and detention and correctional facilities run by state and local governments must now comply with the applicable design requirements listed in the new 2010 Standards for Accessible Design, commonly called the 2010 Standards.[111,113]

Title III: Public Accommodations

Title III of the ADA prohibits discrimination against individuals with disabilities in **places of public accommodation (PPAs)**. This description may seem slightly misleading because despite its name, this section of the ADA covers privately owned entities that own or lease to others, places that affect commerce. In other words, PPAs are privately owned entities where business of some kind is transacted or affected. The term PPA covers 12 broad categories enumerated in the ADA (Table 15.1).[25] The U.S. Department of Justice, the federal government agency charged with overseeing and enforcing Title III, reports that more than 5 million PPAs exist in the United States.[109]

TABLE 15.1

Places of Public Accommodation Under Title III

Category	Examples
Places of lodging	Hotels, motels
Establishments serving food or drink	Restaurants, bars
Places of exhibition or entertainment	Movie theaters, stadiums
Places of public gathering	Convention centers
Sales or rental establishments	Bakeries, shopping malls
Service establishments	Laundromats, funeral homes, physician's offices
Public transportation terminals	Train stations
Places of public display or collection	Museums, libraries
Places of recreation	Parks, zoos, amusement parks
Places of education	Preschools, private schools, colleges
Social service establishments	Day care centers, senior centers
Places of exercise or recreation	Health clubs, bowling alleys, golf courses

The “super rule,” which forms the basis for Title III, prohibits discrimination as follows:

No individual shall be discriminated against on the basis of disability in the full and equal enjoyment of the goods, services, facilities, privileges, advantages, or accommodations of any place of public accommodation by any private entity who owns, leases (or leases to), or operates a place of public accommodation.[26]

Under Title III, PPAs must remove barriers to access, and if the PPA cannot remove the barriers, it must provide an alternative or reasonable accommodation to enable access to the goods and services it provides. Many think of the barriers that Title III addresses as architectural barriers or barriers in the physical environment, such as steps and curbs, that limit physical access to a place a person desires to go. However, although many view the requirements of Title III as a quasi–building code, removing barriers to access as described in the ADA refers to more than mere access through removal of physical barriers. It also refers to access caused by attitudinal barriers and rules and to policies based on myths, misperceptions, and fears about individuals with disabilities that act as barriers to their access to PPAs.

For example, before the ADA became law, some banks refused to allow individuals who are blind to have safe deposit boxes. The rationale behind this policy was that because individuals who are blind cannot see what is in their safe deposit boxes, how can they remove things that they need from the box? Only the safe deposit box holder can go into the viewing booth. Based on misperceptions, banks believed themselves at risk for accusations of theft from the boxes, and consequently, they disallowed individuals who were blind from benefiting from the services they provided to individuals who were not blind. This practice discriminated against individuals with visual impairments. The ADA prohibits these practices and seeks to break down these kinds of barriers.

To further its mission of breaking down physical and attitudinal barriers, Title III specifies three broad principles that provide the foundation for its philosophy of inclusion of individuals with disabilities in society. First, PPAs must provide individuals with disabilities an equal opportunity to participate in or benefit from the goods and services offered.[27] Furthermore, PPAs must give individuals with disabilities an equal opportunity to benefit from the goods and services that they offer.[27] Finally, PPAs must provide the benefits in the most integrated setting possible.[27,28]

PPAs can violate Title III's mandates against discrimination by doing the following, among other things.

- Refusing to admit an individual with a disability merely because he or she has a disability.[27] For example, a restaurant cannot refuse to admit and/or serve an individual with cerebral palsy because he or she drools.
- Failing to provide goods and services to individuals with disabilities in the most integrated setting appropriate to the individual's needs.[28] For example, a professional or college football team cannot segregate all wheelchair users in a “handicapped” section in the end zone. It must allow wheelchair users to sit with family members and disperse wheelchair seating throughout the stadium.
- Using eligibility criteria that screen out or tend to screen out individuals with disabilities from full and equal enjoyment of goods and services.[30] For example, retail stores located in a busy tourist area require that individuals using credit cards show a driver's license as proof of identification as a way of cutting down on the use of stolen credit cards. However, this practice screens out individuals with visual impairments or other disabilities who do not qualify for driver's licenses. The retail stores would have to accept state identification cards in place of a driver's license from individuals with disabilities who do not qualify for driver's licenses.
- Failing to make reasonable modifications in policies, practices, or procedures when the modifications are necessary to offer goods, services, or facilities to individuals with disabilities.[31] The example given earlier about bank policies for safe deposit boxes and individuals who are blind is a good illustration of a policy that discriminates on the basis of disability. As another example, Great Grocery Store has a policy whereby cashiers must place all checks in a specific column in the cash drawer. Carlotta's OT recommended that she use large-print checks because she can write more legibly with larger print. She attempts to give the cashier a large-print check. The cashier refuses to take the check because it does not fit in the cash drawer column for checks. She also tells Carlotta that their policy is to accept large-print checks only from blind people. Great

Grocery Store must modify its policies and accept Carlotta's check.

- Failing to take steps to ensure that individuals with disabilities are not excluded or denied services, segregated, or otherwise treated differently from individuals without disabilities because of the absence of auxiliary aids and services.[33] Auxiliary aids as used in the ADA include devices that OTs usually refer to as adaptive equipment or assistive technology. According to the regulations, auxiliary aids and services include, among other things, qualified interpreters on site or through video remote interpreting (VRI) real-time computer-aided transcription services, assistive listening devices, closed captioned decoders on televisions, Braille materials, taped texts, and "acquisition or modification of equipment or devices."[33]

For example, suppose Carlotta stays at a restored historic hotel in her quest for the perfect bed and breakfast. She finds that she can use the bathing facilities in her room only if she has a tub bench. The hotel would have to provide her with a bathtub bench as an auxiliary aid so that it will not exclude or deny her bathing services.

Two exceptions exist to the auxiliary aid provision requirement. The PPA need not provide an auxiliary aid that fundamentally alters the nature of the goods and services offered, or one that causes an undue burden.[33] An undue burden means that provision of the auxiliary aid would cause significant difficulty or expense. The impact on the PPA varies, depending on such elements as the size of the business and its budget. A major corporation should expect to spend more money on auxiliary aids and services than a neighborhood "mom and pop" operation. A fundamental alteration in the nature of the goods and services offered would occur, for example, if an individual with a visual impairment requested management to raise the lights in a bar in which the lights are customarily turned down low to create a particular ambiance or atmosphere.

The PPA need not provide personal devices and services such as individually prescribed devices (eg, eyeglasses) or services of a personal nature (eg, eating, toileting, or dressing).[37] However, it would probably be a reasonable auxiliary service should Carlotta request that the restaurant cut her meat in the kitchen before serving her steak if weakness in her hands prevents her from performing this task.

- Failing to furnish auxiliary aids and services when necessary to ensure effective communication, unless an undue burden or fundamental alteration would result.[33] For example, Bob is deaf and needs a sign language interpreter to converse with others. When seeking counseling services at a private mental health clinic, he requests a sign language interpreter to enable him to communicate with the mental health therapist. The mental health clinic must provide the sign language interpreter unless it is an undue burden.
- Refusing to remove architectural and structural communication barriers in existing facilities when

this is readily achievable.[34] Readily achievable means removal of barriers that can easily be accomplished and carried out without much difficulty or expense.[34] The ADA regulations provide 21 examples of steps PPAs can take to remove barriers (Box 15.7).

The ADA regulations recognize that not all changes are immediately readily achievable. In concert with input from members of the disability community, the Justice Department set forth four priorities in the ADA regulations that PPAs should follow to comply with the barrier removal requirements (Box 15.8).[33]

Box 15.7

Examples of Ways to Remove Barriers

- Installing ramps
- Making curb cuts in sidewalks and entrances
- Repositioning shelves
- Rearranging tables, chairs, vending machines, display racks, and other furniture
- Repositioning telephones
- Adding raised markings on elevator control buttons
- Installing flashing alarm lights
- Widening doors
- Installing offset hinges to widen doorways
- Eliminating a turnstile or providing an alternative accessible path
- Installing accessible door hardware
- Installing grab bars in toilet stalls
- Rearranging toilet partitions to increase maneuvering space
- Insulating lavatory pipes under sinks to prevent burns
- Installing a raised toilet seat
- Installing a full-length bathroom mirror
- Repositioning the paper towel dispenser in a bathroom
- Creating designated accessible parking spaces
- Installing an accessible paper cup dispenser at an existing inaccessible water fountain
- Removing high-pile, low-density carpeting
- Installing vehicle hand controls

Box 15.8

Four Priorities in Complying With Barrier Removal Requirements

Priority 1: Access Into a Place of Public Accommodation

First, the place of public accommodation (PPA) should try to provide access to and into the PPA from public sidewalks, parking, or public transportation. In other words, provide a way for individuals with disabilities to get into the building. For example, this includes, among other things as may prove necessary in individual circumstances, installing a ramp to the entrance, widening entrances, and providing accessible parking spaces.[34] Under this provision, the PPA is responsible for making sure that Carlotta can get from her parking space into the lobby of the movie theater.

Priority 2: Access to Areas Where Goods and Services Are Made Available

The second priority the PPA should focus on is providing access to areas of public accommodation where it makes goods and services available to the public. This step answers the following question: Now that individuals with disabilities can enter through our door, how do we get them to the actual part of the PPA where we provide the goods and services? This can include changes such as adjusting the layout of display racks, providing Braille and raised-character signage, widening doorways, providing visual alarms, and installing ramps.[33] The movie theater, under this section, would want to make sure Carlotta could get to the snack bar to purchase her popcorn and into the theater to watch the movie.

Priority 3: Access to Restrooms

The third priority for access is access to the restroom facilities. This may include modifications such as removing obstructing furniture or vending machines, widening doorways, installing ramps, providing accessible signage, widening toilet stalls, lowering paper towel dispensers and mirrors, and installing grab bars, usable faucet handles, and soap dispensers, to name a few. The movie theater would provide Carlotta access to the restrooms under this provision.[33]

Priority 4: Access to Goods and Services

The fourth and final priority for access is access to the goods, services, facilities, privileges, advantages, or accommodations offered at the PPA. This includes access to the actual goods or services that the PPA provides.[34] For Carlotta, the PPA needs to consider whether a place exists for her to sit in the movie theater so that she can watch the movie she wants to see. Can they remove seats to provide her a place to sit where she can sit with her family? Can they disperse the seats in the theater so that they do not have to segregate all of the wheelchair users in the back or front of the theater?

- Refusing to provide access to goods and services through alternative, readily achievable measures when removal of barriers is not readily achievable.[36] The ADA regulations give three examples of alternatives to removal of barriers, including, for instance, providing curb service or home delivery for an inaccessible restaurant, retrieving merchandise from inaccessible shelves or racks in the grocery store, and relocating activities to accessible locations.[36] For example, in pursuit of her movie hobby, Carlotta wants to see the latest popular art film. A multiscreen cinema is showing the film, but the particular theater the film is being shown in requires climbing a flight of steps. The theater must rotate the films to provide Carlotta access to the film that she wants to see.[36]
- Failing to provide equivalent transportation services and to purchase accessible vehicles in certain circumstances.[38] For example, Robby Rat's Fantasy Garden, a large amusement park, provides trams to take people to their cars in its enormous parking lots. On one of her trips, Carlotta takes her grandchildren to the Fantasy Garden. The Fantasy Garden must provide accessible transportation from the parking lot to the entry gates for Carlotta.
- Failing to maintain the accessible features of facilities and equipment.[29] For example, Streams Department Store must maintain its accessible ramped entrance into the store. This means shoveling snow in the winter and raking leaves in the fall so that Carlotta has access into the store on her trips to the city.
- Failing to design and construct new facilities and, when undertaking alterations, alter existing facilities in accordance with the ADA Accessibility Guidelines issued by the Architectural and

Transportation Barriers Compliance Board and incorporated in the final Department of Justice Title III regulations or the 2010 Standards, depending on the date of completion of the new or altered facilities.[35,39,40,113] This is where the "building code" flavor of the ADA comes in. Specific requirements dictate how builders should design and decorate buildings to provide access. The 2010 ADA Standards for Accessible Design (2010 Standards) requirements are available online (*http://www.ada.gov/2010adastandards_index.htm*).

Government agencies periodically update the accessibility guidelines and related standards. For example, the 2010 Standards allow PPAs to ask individuals to remove their service animal if it is out of control and the handler is not able to get it under control, or if it is not housebroken.[32] The 2010 Standards also adopt a two-tiered approach to mobility devices by distinguishing wheelchairs and "other power-driven mobility devices," to include mobility devices used by individuals with disabilities, but not necessarily developed for that purpose, such as a Segway PT.[112] Wounded soldiers returning from war often use adapted Segway PTs for mobility. The new rules allow access for these alternative mobility devices. Another change in the 2010 Standards provides that places of lodgings must allow individuals to make reservations for accessible guest rooms during the same hours and in the same manner as people without disabilities.[112]

Keep in mind that some state regulations differ from the 2010 Standards requirements. For example, Florida requires accessible parking spaces to have a 12-foot width (144 inches) and a 5-foot access aisle,[102] whereas the 2010 Standards require a width of 8 feet (96 inches) with a 5-foot access aisle.[76] The ADA regulations advise PPAs to follow the rule that provides the most access to individuals with disabilities.

Sometimes standards developed by government agencies exist only as recommended guidelines. For example, Carlotta may find it difficult to transfer from her wheelchair to an examination table for her annual Pap smear or to access mammography equipment from her wheelchair. Other wheelchair users may not have access to weight scales or other diagnostic equipment in their healthcare providers' offices. To address these needs, Section 4203 of the Affordable Care Act established Section 510 of the Rehabilitation Act.[77] This new section required the Architectural and Transportation Barriers Compliance Board (also known as the U.S. Access Board), in consultation with the Food and Drug Administration (FDA), to develop accessibility standards for medical diagnostic equipment.

The Architectural and Transportation Barriers Compliance Board (Access Board), published a "Notice of Proposed Rulemaking" in 2012 as a first step in developing accessibility standards for medical diagnostic equipment that would "allow independent entry to, use of, and exit from the equipment by individuals with disabilities to the maximum extent possible."[103] An advisory committee that included medical device manufacturers, healthcare providers, standards-setting organizations, organizations representing individuals with disabilities, federal agencies, and other stakeholders released recommended standards at the end of 2013.[98,99] At this point, these standards are recommendations only and are not required. However, OTs should consider these standards when advising clients with disabilities about access needs in medical settings. These standards are also important for OTs advising clients who seek OT consultation services for assistance in meeting their Title II and Title III access obligations in connection with the provision of medical services.

Role of the Occupational Therapist

Even though Congress passed the ADA more than 25 years ago, many examples point to a pervasive lack of compliance with access requirements.[85,96] OTs are in a unique position to promote Title III's access and inclusion mandates. With our knowledge of performance in occupations, performance skills, performance patterns, activity analysis, and client factors, we have the skills to look at how the physical environment can affect performance.[80] We know how to make adaptations in the environment, the task, or the person to enable performance despite the limitations an individual may have in performance skills. This knowledge base equips OTs to act as consultants, helping PPAs comply with Title III's access requirement, by looking at limitations to accessibility and making recommendations to PPAs to improve access, both physical and nonphysical (including attitudes, policies, and procedures).

OTs may find themselves working from two angles in providing access intervention. Their clients may include individuals with disabilities, such as Carlotta, who seek to increase their participation in the community by increasing their access and inclusion. Alternatively, OTs may find that their clients include proactive PPAs seeking to make their goods and services accessible to individuals with disabilities to avoid lawsuits and/or do the right thing.

When the individual with a disability is the client, the OT should perform an occupational profile that delves into the client's interests in the community, as was done with Carlotta.[80] The OT works with the client to determine what the barriers are to the client's participation in the community activities of his or her choice. In Carlotta's case, we know that movies and going to the mall are important to her. Part of our intervention plan will include problem-solving the changes that Carlotta needs to be able to participate in these occupations, explaining her right to accommodations under Title III, and suggesting ways to advocate to the PPA for the needed changes. If the PPA fails to make changes to provide access for Carlotta, she can file an administrative complaint with the Department of Justice in Washington (*http://www.usdoj.gov/crt/ada/enforce.htm#anchor218282*) or immediately file a lawsuit. The OT may serve as a witness in Title III litigation, should it come to that.

When the PPA is the client, the OT should look at the goods and services the PPA offers, the policies and procedures it uses (especially customer service–related policies), and the physical access offered, in the ADA-delineated priority order. Just as an employment-related ADA consultation with an employer usually begins with a job analysis, an access consultation with a PPA begins with an accessibility audit. An **accessibility audit** is a review of the access and inclusion practices of a PPA from a physical and policy perspective. The accessibility audit looks at the 2010 Standards requirements, the types of modifications the PPA can make to increase access, and the readily achievable changes the PPA can make according to the priorities set in Title III. Fig. 15.1 presents an accessibility audit that includes examination of physical and nonphysical barriers to access according to the 2010 Standards and follows the priorities specified in Title III. OTs can also provide consultation services for employers.

OT Practice Notes

Advocating for Employees With Disabilities

- Analyze physical functions to determine, for the employee, whether he or she can perform the essential functions of a given job with or without reasonable accommodations.
- Suggest specific reasonable accommodations, such as adaptive equipment, auxiliary aids, or modifications to the worksite, to enable the prospective or returning employee to perform the essential functions of his or her job.
- Obtain adaptive devices or auxiliary aids to facilitate performance in the workplace and in the community.
- Develop strategies to prepare the prospective employee to suggest reasonable accommodations to human resources personnel during the interview and hiring process.
- Teach adolescents with disabilities entering the job market for the first time how to manage the application, hiring, and interview processes.
- Expand access to public accommodations in the mainstream of independent living, such as theaters, conference centers, hotels, and restaurants, through focusing on mobility in the community; identification of equipment, aids, and services; and advocacy to obtain them.
- Provide information to clients so they can develop a basic understanding of their rights under the ADA.

OT Practice Notes

Consulting With Places of Public Accommodation

- Advise businesses that offer public accommodations, such as restaurants, movie theaters, hospitals, medical clinics, and hotels, how to make their facilities accessible to individuals with disabilities.

- Ensure that places of public accommodation are accessible to individuals with disabilities and make recommendations to remove architectural and other barriers.
- Assist in the acquisition of auxiliary aids to allow individuals with disabilities to have an equal opportunity to participate in or benefit from programs offered.
- Prevent lawsuits by performing accessibility audits and making recommendations for increased access and barrier removal on a proactive basis.
- Locate and/or acquire auxiliary aids and services for places of public accommodation.
- Train employees in how to make people with disabilities feel welcome in their facilities, how to use the auxiliary aids, and how to provide auxiliary services to individuals with disabilities.

OT Practice Notes

Consulting With Employers

- Analyze jobs to determine essential job functions and possible accommodations that one can easily make for a specific job.
- Develop or rewrite job descriptions based on job analysis that include specific descriptions of essential job functions.
- Modify job sites to make reasonable accommodations for individual employees with disabilities.
- Suggest specific devices and adaptive equipment that allow the employer to hire an individual with a disability who, with the assistance of the device, can now perform the essential functions of a given job.
- Sensitize coworkers and supervisors to interacting, supervising, and working effectively with individuals with disabilities.
- Train supervisors to develop reasonable accommodations for injured workers returning to the job, including worker's compensation claimants.
- Ensure that job sites are accessible to individuals with disabilities and make recommendations to remove architectural barriers when inaccessible features are found.
- Propose post-offer, job-related employee screenings and/or evaluations for positions associated with high risk for injury.
- Perform an individualized assessment of a worker's present ability to safely perform the essential functions of the job to determine whether the worker with a disability poses a direct threat to the health and safety of himself, herself, or others.
- Save businesses money by promoting cost-effective reasonable accommodations during the complaint or mediation process to avoid costly litigation.

How to Do an Accessibility Audit Under the ADA

A. Remember, Title III, Public Accommodations, is not limited to the physical accessibility of a building. Title III includes meaningful access and equal participation in all programs and services offered by the public accommodation.

1. Making something accessible is worthless if you do not identify its location. For example, public accommodations must include accessible signage to assist individuals in locating accessible bathrooms and building entrances.

B. Title III sets forth the following priorities for accessibility:

1. **Access to and into the place of public accommodation** from public sidewalks, parking, or public transportation. This includes installing a ramp to the entrance, widening entrances, and providing accessible parking spaces.

2. **Access to those areas of public accommodation where goods and services are made available to the public.** This includes adjusting the layout of display racks, providing Brailled and raised character signage, widening doorways, providing visual alarms, and installing ramps.

3. **Access to restroom facilities.** This includes removing obstructing furniture or vending machines, widening doorways, installing ramps, providing accessible signage, widening toilet stalls, lowering paper towel dispensers and mirrors, and installing grab bars.

4. **Access to the goods, services, facilities, privileges, advantages, or accommodations offered at the place of public accommodation.** This includes access to the actual goods or services themselves.

C. **The Accessibility Audit should follow the priorities set forth in Title III.**

STEP ONE: According to the first priority, look at the access to and into the place of public accommodation from public sidewalks, parking, or public transportation:

		YES	NO
1.	Are parking spaces 96 inches wide with an adjacent access aisle of 60 inches?	________	________
2.	Is one in every eight parking spaces served by a 96-inch access aisle marked "van accessible"?	________	________
3.	How many parking spaces are designated for individuals with disabilities? ________ (________% of spaces) (compare with chart at ADAAG § 4.1.2(5)(a); 10% of total number provided for outpatient units or facilities should be accessible.)	________	________
4.	If covered parking is provided, is the ceiling at least 114 inches high to allow access to high-top vans?	________	________
5.	Are all curb ramps (curb cuts) from the parking spaces at a gradient of 1:20 with a textured, non-slip surface?	________	________

6. Are parking area and building separated by a street? ________ ________

7. Are the accessible parking spaces located on the shortest accessible route of travel from the parking area to the accessible building entrance? ________ ________

8. Is the surface of the accessible route smooth (no sand, gravel, or utility hole covers)? ________ ________

9. Are all ramps along the accessible route at a gradient of at least 1:12 (1:16 - 1:20 preferred)? ________ ________

10. Do ramps have 5-foot level landings at the bottom and top that are as wide as the ramp itself? ________ ________

11. Do all ramps have handrails with top handrail, non-slip, gripping surfaces mounted between 34 inches and 38 inches above the ramp surface? ________ ________

12. Is the accessible route walkway at least 48 inches wide? ________ ________

13. Is the accessible route marked with appropriate signage? ________ ________

14. Is there a passenger loading and unloading zone? ________ ________

15. The accessible entrance is located ________________ ________________________________ ________ ________

16. Is the accessible door marked with appropriate signage? ________ ________

17. Is the entrance door a minimum of 32 inches wide? ________ ________

18. Is the door automatic? ________ ________

19. Is the door-opening mechanism set to less than ________ pounds of pressure (as measured by a push then pull scale, although no specific requirements are set for exterior doors at this time)? ________ ________

20. If there are two doors in series at the entrance, do the doors open in the same direction or away from the space between the two doors and is the space at least 48 inches plus the width of any door opening into the space? ________ ________

21. Is there an alternative to a revolving door? ________ ________

22. Is door hardware shaped so as to require one hand to open and not to require tight grasping, tight pinching, or twisting of the wrist to operate? ________ ________

23. Are thresholds less than ½ inch high? ________ ________

24. If the primary entrance has steps, is there a proper sign directing patrons to the accessible entrance? ________ ________

STEP TWO: Look at access to those areas of public accommodation where goods and services are made available to the public. This includes adjusting the layout of display racks, providing Brailed and raised character signage, widening doorways, providing visual alarms, and installing ramps.

A. List all areas in the facility where goods, services, and programs are provided to the public. (Remember, this includes areas in places that are not normally considered places of public accommodations, but parts of those facilities where members of the public would go, i.e., the showroom of a factory not open to the general public but where outside buyers and salespersons might go.)

B. Are all areas where goods, services, and programs are located accessible?
(This section should be repeated for all goods, services, and programs offered at the location.)

Goods/Service/Program and Location

		YES	NO
1.	Is the width of the pathway to the area, including corridors and aisles, at least 32 inches of usable space?	______	______
2.	Is the pathway free of protruding telephones, water fountains, or other items?	______	______
3.	Is the pathway flooring covered with high-density, low-pile (½ inch) carpeting, non-slip tile, or vinyl?	______	______
4.	Are doorways at least 32 inches wide?	______	______
5.	If there are steps along the pathway, is the area also served by an elevator?	______	______
6.	Are steps covered with non-slip surfaces, provided with adequate lighting, and designed with curved nosers and sloped risers?	______	______
7.	Do all stairways have handrails positioned at both sides of the stairs with top handrail, non-slip, gripping surfaces mounted between 34 inches and 38 inches above the stair nosing?	______	______
8.	Do the handrails extend 12 inches beyond the top riser and 12 inches plus the width of one thread beyond the bottom riser?	______	______
9.	Are thresholds at ½ inch high or less for interior doors?	______	______
10.	Is the door-opening mechanism set to 5 pounds of pressure or less?	______	______
11.	Is door hardware shaped so as to require one hand to open and not to require tight grasping, tight pinching, or twisting of the wrist to operate?	______	______
12.	If doorways have two independently operated door leaves, is one leaf at least 32 inches wide?	______	______
13.	If there are two doors in series along the pathway, do the doors open in the same direction or away from the space between the two doors and is the space at least 48 inches plus the width of any door opening into the space?	______	______
14.	Are elevator call buttons centered at 42 inches above the floor and at least ¾ inch in diameter?	______	______
15.	Do objects mounted below the elevator call button protrude more than 4 inches into the elevator lobby?	______	______
16.	Are visible and audible signals provided at each elevator entrance to indicate which car is answering the call and the direction the car is going (once for up and twice for down)?	______	______

17. Are raised and Braille characters at least 2 inches high, provided on both jambs of the elevators, and centered 60 inches above the floor? ________ ________

18. Are elevators provided with an automatic reopening device? ________ ________

19. Is the minimum amount of time the elevators remain open in response to a call at least 3 seconds? ________ ________

20. Are control buttons inside the elevator designated by Braille and raised letters? ________ ________

21. Are floor buttons 54 inches or less above the floor for a side wheelchair approach and 48 inches or less for a front approach? ________ ________

22. If public telephones are provided, are they on an accessible floor at an accessible location? ________ ________

23. Is at least one telephone mounted so that its operable parts are no more than 54 inches or less above the floor for a side wheelchair approach and 48 inches or less for a front approach? ________ ________

24. Is there a clear floor or ground space of at least 30 inches by 48 inches under the telephone absent bases, enclosures, fixed seats, and protruding objects of more than 4 inches? ________ ________

25. Is at least one telephone equipped with an amplifier for individuals with hearing impairments and located near an electrical outlet for portable TTDs? ________ ________

26. Is the telephone cord at least 29 inches long? ________ ________

27. Is at least one text telephone provided? ________ ________

28. Where are the accessible telephones located? ________ ________

29. Are accessible telephones marked with appropriate signage? ________ ________

30. Are water fountains mounted so that spouts are no higher than 36 inches from the floor? ________ ________

31. Are fire alarms and other warning signals provided in both a visual and audible manner? ________ ________

32. Are room numbers, directional signs, emergency directions, and other signs and markings indicated in large, block letters and numerals, using contrasting colors so they can be read by individuals with visual impairments? ________ ________

33. Are signs provided in raised and Braille letters and numbers? ________ ________

If the answer to any of the above questions is no, what reasonable accommodations may be made to allow access to the area where the goods, services, and programs are provided?

____

____

STEP THREE: Look at access to restroom facilities.

		YES	NO
1.	Where are the accessible restrooms located? ____________ ______________________________	______	______
2.	Is the accessible restroom designated with appropriate signage?	______	______
3.	Is the restroom on an accessible pathway?	______	______
4.	Can one use the restroom without going up or down steps?	______	______
5.	Is the width of the pathway to the restrooms, including corridors, and aisles, at least 32 inches of usable space?	______	______
6.	Is the pathway to the restrooms free of protruding telephones, water fountains, or other items?	______	______
7.	Is the pathway flooring to the restrooms covered with high-density, low-pile (½ inch) carpeting, non-slip tile, or vinyl?	______	______
8.	Are the doorways to the restrooms at least 32 inches wide?	______	______
9.	Do doorways to the restrooms require 5 pounds or less of pressure to open?	______	______
10.	Is the entrance to the toilet stall at least 32 inches wide?	______	______
11.	Is the top of the seat of the accessible toilet between 17 inches and 19 inches from the floor?	______	______
12.	Does the toilet paper dispenser allow for the continuous flow of toilet paper without delivery control?	______	______
13.	Does the toilet stall have a minimum depth of 56 inches where toilets are wall mounted and 59 inches where toilets are floor mounted?	______	______
14.	Is at least one stall a minimum of 36 inches wide with an outwardly opening, self-closing door?	______	______

15. Are there a minimum of two grab bars at least 36 inches long in the accessible toilet stall with one grab bar mounted behind the toilet? ________ ________

16. Are grab bars between 33 inches and 36 inches from the floor? ________ ________

17. Are urinal rims at a maximum of 17 inches from the floor? ________ ________

18. Is there a clear space in front of the urinal of 30 inches by 48 inches to allow a front approach? ________ ________

19. Are soap dispensers, paper towel dispensers, hand dryer, and feminine product dispensers within 48 inches of the floor? ________ ________

20. Are mirrors mounted so that the bottom edge is within 40 inches of the floor? ________ ________

21. Are sinks mounted so that the rim or counter surface is within 34 inches of the floor and a 29-inch clearance space is provided from the floor to the bottom of the apron? ________ ________

22. Is there a clear space in front of the sink of 30 inches by 48 inches to allow a front approach? ________ ________

23. Are hot water pipes insulated or configured to avoid contact? ________ ________

24. Are sink faucets lever-operated, push-type, electronically controlled, or otherwise operable with one hand without requiring tight grasping, pinching, or twisting of the wrist? ________ ________

25. Do self-closing faucets remain open for at least 10 seconds? ________ ________

STEP FOUR: Look at access to the goods, services, facilities, privileges, advantages, or accommodations offered at the place of public accommodation.

This step answers the question, "Can people use or take advantage of the goods, services, facilities, or programs provided at the place of public accommodation?"

Look back at the goods, services, facilities, or programs identified in **STEP TWO** and determine whether they are usable. **For example:**

	YES	NO
1. Are printed materials provided in alternative formats where needed?	________	________
2. Are items in racks or on walls within reach?	________	________
3. Are special listening devices provided for individuals with hearing impairments in theaters, conference centers, and concert halls?	________	________

4. Can individuals in wheelchairs reach the microfilm machines at the library? ____________ ____________

5. Is there an integrated location for individuals in wheelchairs to sit at the football stadium without having to transfer out of one's chair? ____________ ____________

6. Can individuals with disabilities reach the items on the grocery store shelves? ____________ ____________

STEP FIVE: If STEPS ONE through FOUR identify goods, services, facilities, or programs that are not usable by individuals with disabilities, can an accommodation be made to enable the individual to take advantage of the goods, services, facilities, or programs?

Are there policies that need to be changed to enable participation by individuals with disabilities?

FIG 15.1 How to do an accessibility audit to check for compliance with ADA requirements.[113] (Courtesy Barbara L. Kornblau, ADA Consultants, 1992, 2002, 2011.)

Air Carrier Access Act

Carlotta's occupational profile shows that travel is a meaningful occupation for her. To pursue that occupation now that she uses a wheelchair for mobility, she will need to know what to expect while traveling and how she can advocate for herself. The key is the Air Carrier Access Act of 1986 (ACAA). The ACAA, as amended,[78] prohibits discrimination against qualified individuals with physical or mental impairments in air transportation by foreign and domestic air carriers. The ACAA applies only to air carriers that provide regularly scheduled services for hire to the public. As with the ADA and Fair Housing Act, the ACAA lists specific actions that it considers discriminatory.

Discrimination Prohibited Under the ACAA

Airline carriers may not refuse to transport qualified individuals with disabilities on the basis of their disability.[3] The definitions of disability are similar to the definitions found in the ADA. A qualified individual with a disability in the airline travel context means that he or she seeks to purchase or has a ticket to fly. The ACAA would protect Carlotta because she has arthritis and an airline ticket. By federal statute, carriers may exclude anyone from a flight if carrying the person would pose a direct threat to the health and safety of others.[4] This parallels the direct threat criteria under the ADA. If the airline carrier excludes persons with disabilities on safety grounds, the carrier must provide a written explanation of the decision within 10 days of the refusal, including the specific basis for the refusal.[6]

Airline carriers may not deny transportation to a qualified individual with a disability "because the person's disability results in appearance or involuntary behavior that may offend, annoy, or inconvenience crewmembers or other passengers."[5] Airline carriers cannot limit the number of people with disabilities they will allow on flights as a means of refusing transportation based on disability.[2] The ACAA prohibits airlines from requiring a person with a disability to accept special services, such as preboarding, if the passenger does not request them.[1] Similarly, air carriers cannot segregate passengers with disabilities, even if separate or different services are available to them.[8]

Under the ACAA, airline carriers cannot require qualified individuals with a disability to provide advance notice of their intention to travel or of their disability as a condition of receiving transportation or of receiving services or required accommodations.[7] Carlotta would not have to notify the airline in advance that she planned to fly. A limited exception to this rule exists, however. An airline carrier may require up to 48 hours' notice for certain specific accommodations that require advance preparation. These include, for example, medical oxygen use, transportation of an electric wheelchair in a plane with fewer than 60 seats, travel with a service animal on a flight longer than 8 hours or an emotional support or psychiatric service animal, and provision of an onboard wheelchair in an aircraft that lacks an accessible lavatory.[8]

Airlines cannot exclude a passenger with disabilities from a particular seat, or require him or her to sit in a certain seat, except to comply with safety regulations established by the Federal Aviation Administration (FAA), such as exit row seating, which requires that passengers have specific abilities to open the exit door in case of an emergency.[15] Airlines must accommodate passenger seat assignments if they are required, based on the person's disability, and requested 24 hours in advance. For example, if Carlotta traveled with a service animal that assisted her in tasks such as pulling her wheelchair and picking up items from the floor, the carrier would have to assign them to a bulkhead seat or another seat that could accommodate the service animal.[14]

Airline carriers may not require a person with a disability to travel with an attendant except in certain limited circumstances.[9] Such limited circumstances include, among others, those in which a person with an impairment in mobility is unable to assist in his or her own evacuation and in which a person with a mental disability cannot understand or respond to the crew's safety instructions.[9] If the person with a disability and the carrier disagree about whether the individual's circumstances meet the ACAA's criteria, the carrier may require the attendant but may not charge for the attendant's transportation cost.[9]

Airline Carriers' Obligations

Airline carriers must provide assistance in boarding and deplaning by providing personnel, ground wheelchairs, boarding wheelchairs, and ramps or mechanical lifts.[16] If entry-level boarding is unavailable, airlines must provide boarding assistance through lifts or ramps.[17] Exceptions exist for certain small airplanes and low-volume airports. OTs should review with Carlotta how to explain to airline personnel the safest way to transfer her. Carlotta should also know that the carrier cannot leave her unattended in a ground or boarding wheelchair for more than 30 minutes if she cannot independently operate that wheelchair.[18] The carrier must also accept her wheelchair as carry-on baggage if a place exists to store it on the plane or as gate-checked baggage, which the airline returns to her as soon as possible and as close to the airplane door as possible if she wishes.[20] She can also choose to have it delivered to her in the baggage claim area.[20]

The ACAA requires airlines to provide other assistance to individuals with disabilities as outlined in Box 15.9.[19] Carriers cannot charge for providing these services.[10]

Box 15.9

Services Airlines Must Provide if Requested

- Assistance moving to and from seats during boarding and deplaning
- Assistance in preparation for eating, such as opening cartons (but not assistance in eating)
- Assistance to and from the lavatory if the aircraft has an onboard wheelchair (but no assistance in the lavatory)
- Assistance moving to and from the lavatory for a semiambulatory person, not involving lifting or carrying
- Assistance loading and retrieving carry-on items, including mobility aids stored on board

Wide-bodied aircraft must have accessible lavatories, and those with 100 seats or more must have priority space for storing wheelchairs in the cabins.[12,13] This information may help Carlotta select her flights based on the services that the plane provides. In addition to services and access on the airplanes themselves, airlines must make sure that their terminals are accessible.[11]

The ACAA requires airline carriers to train their employees in awareness and appropriate response to persons with a disability, "including persons with physical, sensory, mental, and emotional disabilities, including how to distinguish among the differing abilities of individuals with a disability."[21] This could provide opportunities for advocating for a particular client such as Carlotta or for consulting with the airline to provide sensitivity training and disability awareness.

Each airline must designate a complaint resolution official at each airport that it serves to receive and make efforts to resolve complaints. If it cannot resolve the complaint, it must give the passenger a written summary of the problem and outline the steps that the carrier will take to solve it. It must also notify the passenger of his or her right to pursue the complaint with the U.S. Department of Transportation (DOT).[22] Information about filing a complaint with the DOT is available online at *http://airconsumer.ost.dot.gov/ACAAcomplaint.htm*.

The DOT takes the ACAA very seriously. In February, 2011, one airline agreed to a $2 million settlement with the DOT for failing to provide adequate and prompt enplaning and deplaning wheelchair assistance to passengers with disabilities, failing to provide dispositive responses to written complaints alleging ACAA violations, and failing to properly categorize and accurately report its disability-related complaints.[75]

Role of the Occupational Therapist

OTs can work with their clients to help them understand what their needs will be for air travel and also to help them develop a strategy to follow for meeting their needs. They can also play a key role in informing clients of the rights to which they are entitled in air travel and how to advocate for those rights for themselves.

Ethical Considerations

As OTs we are in a unique position to facilitate an understanding of disabilities and the impact they have on everyday activities and functions. OTs can use this knowledge to work directly with airlines as consultants and conduct the training mandated by law to promote a culture of sensitivity and awareness.

Fair Housing Act

Congress passed the Fair Housing Amendments Act of 1988 to add "handicaps" (hereafter referred to as individuals with disabilities, a more politically correct term with the same legal meaning[89]) to the list of those protected against discrimination in housing. Before passage of the Fair Housing Act Amendments, the Fair Housing Act (FHA) prohibited discrimination based only on race, color, religion, sex, familial status, or national origin.[94]

Generally, the FHA prohibits discrimination in the sale, rental, or advertising of housing dwellings, in the provision of brokerage services, or in other residential real estate–related transactions, such as the provision of mortgage loans. The FHA covers private housing, housing that receives federal government assistance, and state and local government housing. Some exceptions exist to the FHA. For example, the FHA does not apply to owner-occupied apartment buildings with four or fewer units, or to private homes when the owner owns fewer than three single-family homes and is not in the business of selling or renting dwellings.

The FHA uses the same definition of individuals with disabilities as the ADA. Discrimination means denying or making a sale or rental unavailable because of the disability of a buyer or renter, the disability of an intended resident, or the disability of any person associated with a person with a disability. Landlords may not inquire whether a person applying to buy or rent housing is an individual with a disability, and they cannot charge a higher price or provide different services because a renter or purchaser of a dwelling unit is an individual with a disability.

Passage of the Fair Housing Act Amendments gave individuals with disabilities certain additional rights to use and enjoy their dwellings. These additional rights play a significant role in promoting independent living and participation for individuals with disabilities. Under the FHA, it is illegal to refuse to permit reasonable modification of existing premises occupied or to be occupied by individuals with disabilities if the proposed modification is necessary to allow the person with the disability full use and enjoyment of the dwelling. However, unlike the ADA, which requires businesses to pay for modifications that provide access, the FHA does not require landlords to pay for modifications; it requires only that the landlord allow the tenant to make modifications, at the expense of the person with a disability who needs them.

The landlord may condition permission for modification on the renter's agreeing to restore the interior to its condition before the modification, if this is reasonable. If the renter plans to make a modification in the dwelling, the landlord may not increase a security deposit. The landlord may, however, condition permission for modification on provision of a reasonable description of the proposed modification and assurances that the work will be properly performed by licensed professionals with permits, in addition to other stipulations.

The FHA also makes it illegal for any person to refuse to make reasonable accommodations in rules, policies, practices, or services, when needed, to afford a person with a disability equal opportunity to use and enjoy a dwelling unit, including public and common use areas. For example, an apartment building management company would have to make an exception to a "no pets" policy so that an individual with a spinal cord injury could keep a service dog. Another often-disputed example involves parking. A person with a disability may need an assigned parking space close to his or her apartment in a development that prides itself on unassigned parking. It would be a reasonable accommodation to modify the parking policy to allow assignment of a parking space to the person with the disability.

Research shows that interventions based on home assessments, such as providing bath benches and recommending grab bars, help prevent falls in the home and encourage safe and independent participation in everyday home life.[87,105] Carlotta's intervention plan would include a home assessment. Applying the provisions of the FHA to Carlotta's case affords her some assistance in her quest for independent participation. First, the landlord would have to allow Carlotta to install the grab bars that her OT recommended for her bathtub, as long as this was done in a workmanlike manner with permits and all necessary requirements. The landlord would probably have to allow Carlotta to widen her bathroom door, as the OT recommended, so that Carlotta could wheel her wheelchair into the bathroom. With these modifications and others developed by the OT in collaboration with Carlotta, Carlotta can independently participate in her ADLs.

The second issue for Carlotta involves her need for assistance to carry out her aquatics home program. To do this, she must be able to use the pool, an amenity to which she is entitled, as are all residents of the apartment complex. Carlotta has no access to the pool unless her friend can help her get into and out of the pool each day. The landlord would probably have to modify the “no guests in the pool on weekends” policy to allow Carlotta access to and use of the pool on weekends.

What if the landlord does not want to allow Carlotta to make these accommodations? Even the most wonderful suggestions for accommodation made by the OT and/or OTA are worthless if the client cannot use them. Because the success of the OT intervention plan may rest on provision of these accommodations, the OT and/or OTA should steer Carlotta to the website for the U.S. Department of Housing and Urban Development (HUD) —*http://www.hud.gov/complaints/housediscrim.cfm*—where Carlotta can file an administrative complaint to encourage the landlord to allow her to make the needed accommodations. Remember, under the FHA the landlord is not responsible for making the accommodations, but must allow the tenant to make needed reasonable accommodations. HUD staff members will contact the landlord and/or property management company, mediate the situation by encouraging them to follow the law, and try to resolve the issues without the need for filing a lawsuit.

OTs and OTAs will also find the FHA helpful in other, very commonly encountered situations. For example, OTs who make home visits to patients' and clients' homes before hospital discharge will appreciate the support of the FHA. During these home visits, OTs customarily evaluate the individual's ability to function in the home as independently as possible. This assessment includes making recommendations about adaptive equipment and other modifications to the home to promote independent participation. The FHA gives the therapist's recommendations clout should the landlord refuse to allow the modifications to the dwelling unit. Clients in need of grab bars and other accommodations in their homes have an alternative route to take should the landlord say “no” to the accommodations needed.

Advocacy as Intervention

OTs promote participation in work, leisure, and ADLs. As shown earlier, sometimes barriers to participation exist despite the efforts of OTs and their clients. For example, the client may successfully transfer from the wheelchair to the toilet and bath bench in the clinic, but cannot get into the bathroom at home if the landlord will not allow modifications to the apartment. Carlotta can do her job from a wheelchair, but the headmaster will not transfer her to an accessible classroom.

To promote participation in these instances, the OT may have to include advocacy as an intervention strategy. The OT may need to act as an advocate, or he or she may have to guide the client through a self-advocacy process.

Ethical Considerations

Eight Rules of Advocacy

- Know the laws.
- Read the regulations.
- Believe that you or your client has a right to what you seek.
- Organize yourself, document your efforts, get everything in writing, and keep copies of all correspondence.
- Start with the source of the problem.
- Be specific; tell them exactly what you want.
- File a complaint with the administrative agency that oversees the matter.
- Follow through.

Summary

The ADA, ACAA, and FHA exist to provide individuals with disabilities certain rights. These laws, in concert with OT intervention, have the potential to open many avenues to participation for individuals with disabilities. By familiarizing themselves with these laws and sharing that information with clients, OTs can play a major role in ensuring that those whom they serve have more opportunities to participate in work, leisure, and ADLs.

With the assistance of the ADA, ACAA, and FHA, Carlotta should be able to continue in her job as a teacher with the reasonable accommodations provided by her employer under Title I of the ADA. Carlotta can continue traveling by airplane to find the perfect bed and breakfast with accommodations provided to her under the ACAA. She can continue shopping and going to movies with the protection afforded her under Title III of the ADA. The FHA will provide the legal tools Carlotta needs to stay in her current apartment and care for herself independently, with cooperation from her landlord for the accommodations she needs.

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16

Leisure Occupations[a]

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CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Discuss the benefits of leisure for adults.
2. Describe the key areas in which humor can be used.
3. Understand the different leisure needs of people in different stages of life.
4. Identify specific strategies to promote leisure activity for people with disabilities.

KEY TERMS

Humor
Leisure
Leisure exploration
Leisure participation
Modeling
Play

Threaded Case Study

Jeri, Part 1

Before she was involved in a traffic accident, Jeri, a 29-year-old newly married woman, lived a full and happy life. She was employed as an interior designer; spent time with her husband, friends, and family; and participated in leisure occupations. She particularly enjoyed scrapbooking, going to a nearby lake to boat and fish, playing with and caring for her dogs, and shopping. As Jeri was driving home from running errands one evening, a drunk driver hit her car. It rolled over, and she was trapped inside. She was taken by paramedics to the local hospital, where she was found to have a traumatic brain injury, a broken wrist, and a broken leg. Jeri was transported to the regional brain trauma center for rehabilitation. She recovered over a period of months and returned home.

Jeri continues rehabilitation as an outpatient for residual problems from her brain injury and for continuing problems using her dominant hand because of the wrist fracture. Jeri receives occupational therapy twice weekly and is demonstrating significant improvement; she has progressed from needing maximum assistance for activities of daily living (ADLs) to minimum assistance. Jeri has no apparent cognitive deficits; she uses a walker to ambulate; and she still needs a family member or aide at home on a full-time basis because she has poor balance, which impairs her safety when moving around in her environment. The occupational therapist (OT) is ready to discharge Jeri because her ADL goals have been met. However, during the intervention review before discharge, Jeri tells her OT that she spends most of her days hanging out at home, watching TV, that she feels lonely and disengaged from her friends, and that she will miss occupational therapy because it is her only activity outside the home.

Critical Thinking Questions

1. Is Jeri ready to be discharged from occupational therapy?

2. Why is Jeri dissatisfied with her current lifestyle?

3. What intervention could the OT provide to improve Jeri's quality of life?

Participating in meaningful leisure occupations is vital to a healthy, balanced lifestyle.[6,52,62] As one of eight categories of occupation in the domain of occupational therapy, **leisure** is defined in the current version of the occupational therapy Framework (the “Occupational Therapy Practice Framework,” third edition [OTPF-3]) as “a nonobligatory activity that is intrinsically motivated and engaged in during discretionary time, that is, time not committed to obligatory occupations such as work, self-care, or sleep”[4] (OTPF-3, p. S21). Key phrases in the definition are that these activities are intrinsically motivated and that they are not obligatory. In other words, people participate in leisure occupations that they choose and enjoy. For instance, for some people cooking may be a chore, whereas for others it is a pleasure.

Leisure time may be spent in a variety of ways indicative of an individual's unique interests. Examples of leisure occupations are reading, playing games, participating in sports, doing arts and crafts, engaging in outdoor activities (biking, hiking, fishing), cooking, taking a yoga class, exercising at the gym, going to concerts, watching movies, and so on. Because of the uniqueness of individuals, this list is as long as there are people who participate in leisure occupations.

Leisure and Life Satisfaction for People With Physical Disabilities

When adults sustain injuries (eg, traumatic brain injury, stroke, spinal cord injury, carpal tunnel syndrome), have health conditions (eg, multiple sclerosis, Parkinson's disease, arthritis, Alzheimer's disease), or experience life transitions (eg, empty nest syndrome, menopause, retirement) that disrupt normal habits and routines, they face devastating losses. Loss of work, social activities, and meaningful leisure activities may contribute to depression, and the self must be redefined.[47,78]

Occupational therapists are skilled in collaborating with people with physical disabilities to assist them in resuming a full life.[76] It has been suggested that one method of measuring whether a person is fully engaged in life is to consider the individual's participation in leisure activities.[10,63] This is especially important because research indicates that the perception of leisure satisfaction by adults with physical disabilities is the most significant predictor of life satisfaction.[39,42] Depressive symptoms have also been shown to diminish when the number and variety of pleasant activities increase.[24,33,68] Engaging in familiar or novel leisure activities provides a receptive environment for opportunities for socializing and making friends, in which people with physical disabilities have a chance to demonstrate their occupational skills to others who might not otherwise view those with a disability as capable or as a candidate for friendship.[65] Subsequent studies of people with multiple sclerosis and those with Parkinson's disease have demonstrated similar findings about social participation.[18,31]

OT Practice Notes

Benefits of Leisure Activities

Participation in leisure activities can offer many psychosocial and physical benefits.

Psychosocial Benefits

- Increased sense of self-worth
- Release of hostility and aggression
- Shared control of self and environment
- Experience of choice
- Increased socialization
- Development of leadership
- Practice in adaptive behavior and coping skills
- Increased attention span
- Improved emotional well-being
- Adjustment to living arrangements
- Increased tolerance of groups and other people
- Experience of intellectual stimulation

Physical Benefits

- Increased circulation
- Promotion of gross, fine, bilateral, and eye-hand coordination

- Provision of vestibular stimulation
- Provision of sensory stimulation
- Promotion of motor planning
- Improvement or maintenance of perceptual abilities
- Maintenance or improvement of adaptive and coping skills
- Increased strength, range of motion, and physical tolerance
- Improved balance
- Provision of opportunity to grade activities

OT Practice Notes

The Therapist's Role in Encouraging Leisure Activities

If therapists provide interventions aimed only at physical rehabilitation (eg, strengthening, range-of-motion exercises) and improving performance in activities of daily living and instrumental activities of daily living, the recovering individual may never experience the opportunity of resuming old leisure interests or developing new ones. Leisure skills are integral to redefining one's identity, self-worth, and self-efficacy.

Leisure also has been shown to contribute to individual development and well-being and to provide a significant mechanism of coping.[4] Unfortunately, studies indicate that most leisure activities are abandoned after the onset of a physical disorder such as rheumatoid arthritis or stroke.[63,88] Adults with physical disabilities seem to relinquish activities that are purely for enjoyment, especially community-based social activities, and focus their effort and time on ADLs and work.[63,67]

The emphasis on the physical model of recovery is most likely due to healthcare professionals who deliver treatment with a focus on mobility and independence in ADLs and also the fact that rehabilitation outcome measures are commonly based on these factors.[63] Occupational therapists need to recognize that people often experience difficulty adapting their interests and activities by themselves after a physical or neurological disorder.

Drummond and Walker[24] conducted a randomized, controlled study of stroke survivors, and the findings of that study affirmed the need for occupational therapists to address the leisure area of occupation to encourage clients to engage in leisure interests and activities after therapy is discontinued. In the study, 65 clients were randomly assigned to three groups—leisure rehabilitation, conventional OT treatment, and control. The baseline number and frequency of leisure activities in the three groups demonstrated no significant difference between the groups on admission to the hospital.

After discharge from the hospital, the leisure rehabilitation group and the conventional OT treatment group were treated by the same occupational therapist for 30 minutes one time per week for 3 months, and then for one 30-minute session every 2 weeks for 3 months. Each person in the leisure rehabilitation group was given an individualized program that included "advice and help … in the following broad categories: treatment (eg, practice of transfers needed for leisure pursuits); positioning; provision of equipment; adaptations; advice on obtaining financial assistance and transportation; liaison with specialist organizations, and providing physical assistance (eg, referral to voluntary agencies)."[24]

The conventional OT treatment group received individualized treatment by the same therapist for the same amount of time. Interventions included "transfers, washing and dressing practice, and, where appropriate, perceptual treatments …. No reference was made to the importance of continuing previous interests, and no help or advice was offered to encourage participation in leisure pursuits."[24]

At 3 and 6 months after discharge, an independent assessor readministered the leisure questionnaire, which showed that the leisure rehabilitation group had significantly higher leisure scores than did the conventional OT treatment group and the control group.[24]

Thus, adults with physical disabilities may give up leisure activities because they are not aware of ways to adapt valued activities so they can participate in them again, or they may not know about new hobbies or crafts that they might enjoy. Occupational therapists have an important role in helping people both explore and plan engagement in leisure occupations so that they can participate in activities that bring joy to life.[11,55,70,76,78] Engagement in "serious leisure" (a term used in the literature to indicate fulfilling leisure activities that engage the individual's special skills, knowledge, and experience) has been associated with positive effects on affect,[39,51] quality of life, and mood.[23] Additionally, it can serve as a mechanism for upholding identity and for helping the individual remain engaged in a fulfilling life with the disability.[31,34,40]

Benefits of Play and Laughter in Leisure Occupations

When talking about participating in leisure occupations, people often use the word *play:* play golf, play the piano, play sports, play cards, play board games, and so on. Other types of leisure occupations involve being creative, such as dressing uniquely, preparing original recipes, writing poetry, and such. **Play** allows adults to escape the reality of everyday life and immerse themselves in a world of carefree spontaneity that provides meaning to their existence and sometimes an avenue for self-expression.[12] Play suggests fun, and fun is often accompanied by laughter.

Many physical health benefits of laughter have been demonstrated through numerous research studies. For example, immune cells increase and stress hormones decrease, thereby possibly preventing illness or aiding recovery.[9,66,77] Some people experience relief from pain and a sense of well-being after hearty laughter.[1,22,46] Laughter also benefits people psychologically and psychosocially.[26,69,73,85] Laughing together facilitates bonding, reduces anxiety, and improves coping[35,48]—all important factors in a therapeutic alliance between the occupational therapist and the client (Box 16.1).

Box 16.1

Health Benefits of Laughter

Physical Health Benefits of Laughter[26,69]

- Stress hormones decrease (eg, cortisol and noradrenaline).[9]
- Immune functions increase (eg, immunoglobulin A and natural killer cells).[9,77]
- Muscle tension relaxes.
- Blood pressure drops, and cardiovascular functions improve; blood flow increases to aid healing.
- Respiratory airways are cleared (through laughing and coughing).
- Pain relief may be attained after hearty laughter and may last for several hours as a result of release of opioids and endorphins.[66]
- “Feel good” hormones (eg, beta-endorphins and serotonin) are released.

Psychological and Psychosocial Health Benefits of Laughter[46,69,73]

- Facilitates bonding—laughter occurs more often with others than when alone
- Improves ability to cope with problems[1]
- Increases well-being and promotes hope and optimism[48]
- Diverts negative thoughts—it is hard to maintain destructive thoughts when laughing[22]
- “Saves face” in embarrassing situations
- Facilitates mental clarity, creativity, and brainstorming because the two brain hemispheres communicate better during humor, and the limbic system is aroused[48]
- Adds vibrancy to facial tone and sparkle to the eyes

Facilitating psychosocial and physical adaptations is integral to occupational therapy, and given the current healthcare climate of high productivity and short hospital and rehabilitation stays, it is imperative that occupational therapists be able to quickly form a therapeutic alliance with their clients. **Humor** and laughter are natural ways that therapists and clients connect. Recent studies have found that all of the occupational therapists who were interviewed or surveyed agreed that humor has a place in occupational therapy.[44,50,73]

In a national, cross-sectional, randomized survey of 283 occupational therapists that examined their attitudes and use of humor in interacting with adult clients with physical disabilities, humor was classified into four key areas: building relationships, helping clients cope with adversity, promoting clients' physical health, and facilitating compliance with treatment.[73] Although therapists reported positive attitudes about humor in all four of these areas, most were actually using humor only to build relationships and to help clients cope. The majority of therapists felt comfortable using spontaneous humor with clients as part of the therapeutic use of self rather than using planned humor as a therapeutic intervention.

People who are disabled may need to learn ways to adapt to their new circumstances. Humor is a skill that can be learned and may provide the client with the ability to manage concerns related to his or her health and life situations. Within a larger relational context, humor may be modeled by occupational therapists to teach coping skills. Bandura[7] described four essential factors for **modeling** to be an effective intervention: (1) the client must have an adequate attention span that allows him or her to focus on the modeled behavior; (2) the client must be able to cognitively form and retain a mental image of the behavior; (3) the client must be able to recall the image and then produce the behavior; and (4) and perhaps most important, the client must have the motivation to engage in the behavior.

Ethical Considerations

Establishment of trust through the bond of a therapeutic relationship may provide the encouragement clients need to try new behavior, such as humor and laughter.[38]

The intimacy that humor presumes may provide the client with a sense of connection with the therapist. This connection, which occurs on conscious and unconscious levels, has many benefits for clients. When the therapist is able to demonstrate professionalism and empathy with a touch of humor, a client may feel less alone and more cared for as an individual.[73] An improved sense of equality with the healthcare provider may occur that could increase the client's active involvement in her or his treatment.[2,26]

Although laughter has been shown to be beneficial, there are times when humor may not be a good choice and must be used with caution or avoided altogether. Seizures and cataleptic or narcoleptic attacks may follow a laughter episode in a small number of people.[32] In addition, because laughing increases abdominal and thoracic pressure, people with recent abdominal surgery, upper body fractures, acute asthma, or “preexisting arterial hypertension and cerebral vascular fragility”[32] should not be encouraged to laugh.

Ethical Considerations

Occupational therapists also need to be aware that humor can have destructive elements and may be used intentionally or unintentionally to hurt a person. Following the “AT&T principle”[71] (**a**ppropriate, **t**imely, and **t**asteful) can help OTs determine the proper use of humor. As Klein[44] pointed out, this principle means that the therapist must be attuned to the patient's humor style, culture, and current status (physical, emotional, and cognitive) before introducing humor and facilitating laughter.

Leisure exploration is defined in the OTPF-3 as “identifying interests, skills, opportunities, and appropriate leisure activities,” and **leisure participation** is “planning and participating in appropriate leisure activities; maintaining a balance of leisure activities with other areas of occupation; and obtaining, using, and maintaining equipment and supplies as appropriate”[4] (OTPF-3, p. S21). In exploring leisure options with the client, the occupational therapist must evaluate the appropriateness of an occupation with respect to the client's age and gender, the cultural fit, and the meaning of the occupation to the specific individual. These concerns are addressed in the next section.

Meaningful Leisure Occupations: Age, Cultural Issues, and Gender

Clients choose the leisure occupations they want to pursue.[4,76] Choices may be based on past experiences or on a desire to explore something new. As people move through the developmental stages of adulthood, the occupation of leisure may vary in intensity and time allotted. The continuity theory of aging suggests that personality plays a major role in adjustment to aging. Because personality does not radically change throughout life, preferences, lifestyle, and activities remain relatively the same in individuals who age successfully.[5,14,56,80,81]

Age and Leisure

It is crucial that occupational therapists have a knowledge of the typical progression through adulthood, the common life-stage choices of leisure activities, and the ways physical disabilities can disrupt participation in leisure activities. Armed with this information, OTs are able to discover gaps in developmental stages and to assist clients in the mastery of valued and meaningful occupations.[27]

Young Adulthood (20 to 40 Years)

Young adults are typically healthy, active, working, and engaged in relationships. Erikson's sixth stage of psychosocial development, intimacy versus isolation, describes young adulthood as a time in life when people know who they are and are ready to form intimate relationships with others.[61] Inability to make commitments on an intimate level may lead to isolation. Levinson views this age period as a time of becoming independent from parents, choosing and beginning a career, and imagining one's dream future.[61] Young adults typically settle down and choose interests that encompass family, work, and leisure activities.

Examples of leisure activities in which young adults engage may include social and family group activities, sports (eg, basketball, off-road biking), exercise (eg, zumba and yoga), travel, computer games, social networking on the Internet, hobbies and crafts (eg, scrapbooking), outdoor activities, dancing, dating, and sex. In addition, the popularity of outdoor adventure sports continues to grow at a rapid pace. Many outdoor adventure sports are fully accessible, even if the individual has limited arm movement. These include paragliding, flying a sailplane, hang gliding, sky diving, surfing, white water rafting, and zip lining (Fig. 16.1).[83]

FIG 16.1 Wheelchair user zip lining in Costa Rica. (From Vogel B: Outdoor recreation: you can do it, New Mobility 26(263):32–42, 2015.)

Accidents or physical disorders that affect an individual's areas of occupation, performance skills, and body functions can severely impede progress through the normal activities of young adulthood and may delay the development of age-related roles such as spouse, parent, employer/employee, social participant, participator in leisure occupations, and sexual being. Individuals at the beginning stage of adulthood who sustain an irreversible injury may need to redefine themselves to successfully navigate the aging process. Leisure problems may include social isolation and changes in relationships, lack of ability to perform favorite sports, difficulty traveling, and decreased knowledge of how to creatively express the self.[36,42,78] A sense of incompetence may ensue that could lead to depression.

Middle Adulthood (40 to 65 Years)

People in this age group are typically immersed in work and family life. They have usually developed expertise in their chosen field of employment and may have risen to supervisory levels. Financial independence is attained as people purchase homes and cars and build a nest egg. Some adults in this age group experience a midlife review of self and career and may change careers or retire. This is the stage of generativity versus stagnation (Erikson's seventh stage of psychosocial development) in which the person enjoys developing the skills and talents of younger people (eg, serving as a sports coach or work mentor).[61] Lack of generativity may lead to stagnation in life, disappointment, and burnout.[27]

Examples of leisure activities typical of this age group are friend and family activities, sports (eg, golf, bowling, coaching [Fig. 16.2]), card games, Internet surfing, socializing and shopping, travel, pet care, gardening, movies, attending plays and concerts, boating, fishing, reading, television, bike riding, dating, and sexual activity with a spouse or partner.

FIG 16.2 Middle-aged man coaching a baseball player at third base. (Courtesy iStock.com)

Disruption caused by a physical disability can impair the individual's ability to engage in cherished leisure occupations. Spouses or significant others are called on to be caregivers, and the relationship may undergo changes. Leisure occupations such as travel and fishing may be put aside for the more immediate concerns of learning to cope with self-care, rehabilitation exercises, and therapeutic equipment.[74,88] Friend relationships often change as well. For example, if two men had a friendship based on golfing every Saturday and one of them experiences a stroke and needs to use a wheelchair, either they will have to be proactive and figure out a way to enjoy each other's company in a new way (eg, playing golf with adapted equipment or trying out a new activity that they both enjoy), or they may drift apart. Finally, changes caused by life transitions such as menopause and empty nest syndrome are ameliorated many times by engagement in leisure occupations. For example, a qualitative study of women experiencing menopause indicated that leisure activities not only gave the women a sense of familiarity, security, and continuity, but also provided them opportunities to develop new interests and to focus on themselves.[64]

Late Adulthood (65 Years or Older)

Occupational roles typically go through transformations during this age span. Some changes seen in older adults include a shift of emphasis from parent to grandparent and from worker to retiree or volunteer. As time spent in work/career diminishes, free time increases, and leisure occupations come into full bloom. The interests and activities that were put aside during career attainment can now be given full rein.[27] Erikson's last stage of psychosocial development (stage 8, ego integrity versus despair) is described as the time when people review their lives and hopefully accept the life cycle as being complete and satisfying.[61] The "use it or lose it" principle is particularly important as people age. If activity levels are not maintained, strength, coordination, and skills may deteriorate rapidly.[61] Some aspects of aging considered fairly normal include diminishing hearing and eyesight, arthritis, and decreased sensory abilities, in addition to general aches and pains.

Examples of leisure activities in which older adults engage are dining with or cooking for friends and family, social activities, card games, bingo (Fig. 16.3), travel, sports (eg, golf, or attending games or watching them on TV), walking, exercise at the gym, swimming, boating, sexual activity with a spouse or partner, reading, television, pet care, gardening, and hobbies (eg, crafts, genealogy, collecting, scrapbooking).[13,47]

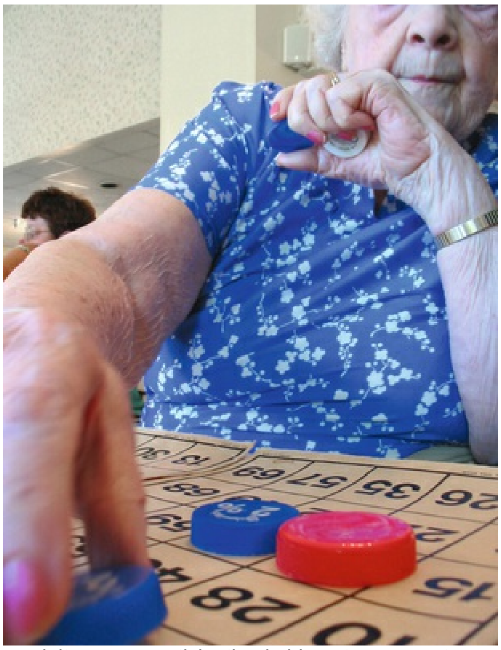

FIG 16.3 Older adult woman participating in bingo tournament. (Courtesy iStock.com)

If a physically disabling event or disease progression occurs, spouses or significant others may be called on to assist their partners in performing ADLs, including leisure. This can be problematic because the caregiver may also be advanced in age and may not be well suited to provide the care needed.[53] Consequently, leisure activities may be forgotten except for sedentary activities, such as watching television.[88]

For some in late adulthood, isolation and depression could set in and diminish the person's quality of life. A quantitative study of 383 retirees indicated that leisure plays a significant role in achieving a high level of life satisfaction, which the authors propose is equivalent to successful adaptation to retirement.[56] In a study of 324 older Swedes living in the community, Silverstein and Parker[71] discovered that people who increased participation in leisure activities reported being more satisfied with life. The researchers stated, "The results suggest that maximizing activity participation is an adaptive strategy taken by older adults to compensate for social and physical deficits in later life."[71] Mental acuity may also be strengthened or preserved by engaging in novel activities. Engagement with life is vital to successful aging.[47,72]

Culture and Leisure

Because of the increasing diversity of the U.S. populace, occupational therapists must know how culture affects the choices and performance of leisure activities for clients. The U.S. Census Bureau (*www.census.gov*) reports that although the white population is still the majority (63%), by the year 2050, whites and minority groups overall will be roughly equal in size. Ethnic groups are currently concentrated in various areas of the country (Table 16.1). Thus, depending on where occupational therapy is delivered, therapists should make themselves familiar with leisure activities related to the culture of their clients.

TABLE 16.1

Population Estimates for Ethnic Groups in the United States (2013)

Ethnic Group	Percentage of the Population	Population Centers
White	62.6	Midwest and Northeast
Hispanic or Latino	17.1	Southwest and California
Black or African American	13.2	Southeast and Mid-Atlantic
Asian American	5.3	West and Northeast
American Indian and Alaskan Native	1.2	Northwest, West, Southwest, and Midwest
Native Hawaiian and other Pacific Islanders	0.2	Hawaii and West
Two or more races reported	2.4	

Data from US Bureau of the Census: 2013 population estimates. http://www.census.gov.

Leisure Occupations Related to Culture

Games and leisure occupations instruct, inspire, and reflect the values and beliefs of the parent cultures. For people who immigrate to a new country (eg, Hispanics to the United States), leisure activities can be used to maintain connections with their heritage. Other possible uses of leisure that aid community integration are to gain pleasure from the new environment and people and learn their language and customs.[43] Watching television and reading are two ways newcomers use leisure to improve their conversational skills and to understand cultural features.[3] Depending on the interest of the client involved, occupational therapists may offer leisure occupations that reflect the client's traditional background, thus fostering security in a new country, or provide leisure experiences of the new country to increase learning, comfort, and integration. Keeping the leisure interventions client centered is the critical element for a successful outcome. Table 16.2 presents ideas for leisure resources.

TABLE 16.2

Resources on Leisure Occupations for Individuals with Disabilities

Media	Titles
Books	J.A. Decker: *Making the Moments Count: Leisure Activities for Caregiving Relationships*[20] C. Kenney: *Have Crutch, Will Travel*[41] J.L. Klinger: *Meal Preparation and Training: The Healthcare Professional's Guide*[45] L.H. Meyer: *Lifelong Leisure Skills and Lifestyles for Persons With Developmental Disabilities*[54] R. Steadward, et al: *Adapted Physical Activity*[75]
Journals	*Adapted Physical Activity Quarterly* *Leisure Sciences* *Journal of Leisure Research* *Leisure Studies*
Magazines specifically for individuals with disabilities	*New Mobility Magazine* (*www.newmobility.com*): Serves people with disabilities by providing information, humor, and inspiration to unite the disabled community. *Sports 'n Spokes* (*http://pvamag.com/sns/*): A monthly magazine from the Paralyzed Veterans Association for wheelchair athletes and other people who use a wheelchair who pursue an active lifestyle. The annual survey of lightweight wheelchairs is available in the Online Article Library. *Ability Magazine* (*www.abilitymagazine.com*): Provides information on new technologies, travel and leisure, and employment opportunities. *Audacity Magazine* (*http://www.audacitymagazine.com/*): A lifestyle magazine that examines issues of the able-minded individual with a disability, ranging from fashion, sports and dating to cooking, money, hobbies, and advice.

Leisure-Time Physical Activity by Gender, Age, and Racial/Ethnic Groups

Physical inactivity has been associated with various health risks, such as obesity; cardiovascular disease, including stroke; diabetes; some cancers; and premature mortality.[19] Occupational therapists can help clients live a healthy lifestyle by encouraging them to participate in some type of leisure-time occupation that involves physical exercise at least several times a week. Some examples of leisure occupations that provide physical exercise but that could be more attractive alternatives to some people are dancing, swimming, boating, bowling, golfing, gardening, and yoga.

To discover trends in physical activity levels, researchers at the Centers for Disease Control and Prevention conducted a randomized telephone survey of 170,423 people from 35 states and the District of Columbia. They asked, "During the past month, other than your regular job, did you participate in any physical activities or exercise such as running, calisthenics, golf, gardening, or walking for exercise?" Analysis of the data revealed that women, older adults, and the majority of racial/ethnic groups participated the least in leisure-time physical activities.[37] African Americans, Hispanics, Native Americans, and Alaskan Natives more often reported fair or poor health, obesity, diabetes, and lack of leisure-time physical activity than did whites, Asians, or Pacific Islanders. Women in all cultures surveyed engaged in the least amount of physical activity.[28,60]

Some barriers to leisure-time physical activity have been identified. Although many people of different cultures and ages believe that movement (eg, exercise, gardening, walking) yields positive benefits, such as improved health and appearance, they do not engage in physical activities because of "self-consciousness and lack of discipline, interest, company, enjoyment and knowledge."[21] Additional barriers to activity were identified, such as lack of transportation, prohibitive cost, and perceived lack of safety.[47] Social issues, such as gender roles for activity and poor support from the family, were identified by minority women. As barriers to activity, these women additionally reported problems with language, isolation in the community, and lack of childcare because of lack of relatives in the area. In planning interventions, occupational therapists can collaborate with clients to address these problems, find community resources, and develop strategies to improve participation in leisure-time physical activities.

OT Practice Notes

Barriers to Leisure Participation

Incurring any type of disability or health condition may result in barriers to leisure engagement, such as the following.[10,29]

- Perception of constraint
- Loss of interest, motivation
- Lack of facilities/support, lack of physical access
- Reduced ability/limited tolerance of activity
- Lack of time
- Attitude of others (caregivers may not value leisure)
- Attitudes of fellow participants (awkwardness displayed by able bodied)
- Challenging behaviors (eg, in those with neurologic disability)
- Communication issues (eg, in those with cognitive deficits)
- Increased expense (as a result of adaptations, career support, equipment)

Leisure Occupations: Evaluation and Intervention

The OTPF-3 focuses on a client-centered approach, and as the first step in the therapy process, the OTPF-3 requires the OT to work collaboratively with the client and family/caregivers to develop an occupational profile.[4] The profile includes the client's occupational history, past and current interests, performance, and values. A knowledge of the problems and goals the client and family/caregivers consider important gives the therapist a basis for a meaningful intervention plan. Evaluation includes formal and informal assessments, conducted initially and over the course of the therapy process, to guide the therapist in providing an individualized intervention program that meets the client's expressed needs and desires. Examples of possible assessments that address the leisure area of occupation and a description of each are presented in Table 16.3.

OT Practice Notes

Evaluation and Intervention for Leisure Activities

To ensure successful performance of leisure activity, the OT practitioner needs a comprehensive approach to evaluation. Important components are:

- Demographic material
- Social information, including family context
- Educational history
- Occupational history
- Military involvement
- Community and church involvement
- Typical daily routine
- Interests and hobbies
- Meanings assigned to occupations, including leisure occupations
- Mealtime interests
- Abilities
- Sensorimotor components
- Cognitive components
- Psychosocial components

TABLE 16.3

Standardized and Nonstandardized Leisure Assessments and Descriptions Used by OTs

Assessment	Descriptions
Activity Card Sort (second edition)[8]	Picture cards of adults performing instrumental, social-cultural, and leisure activities. Client sorts them into piles, depending on his or her interest level. Provides a “retained activity level” score indicating engagement levels of performance of past and current activities. Standardized.
Canadian Occupational Performance Measure (fifth edition)[49]	Interview conducted before and after interventions to describe problems, level of satisfaction in performing activities, and level of perceived performance abilities in areas of self-care, productivity, and leisure. Available in multiple languages. Standardized with Web-based scoring.
Leisure Attitude Scale—Short Version for adolescents and young adults (LAS-SV)[79]	Measures leisure attitudes using 18 self-report items, comprising three subscales, that address cognitive, affective, and behavioral components of attitude. Rated on a 5-point Likert scale from 1 (strongly disagree; very unfavorable or negative attitude) to 5 (strongly agree; favorable or positive attitude). Standardized.
Leisure Satisfaction Scale (LSS—Short Form)[82]	Measures whether personal needs are met through leisure activities. Scale of 24 items scored on a 5-point Likert scale from 1 (almost never true for me) to 5 (almost always true for me). Higher scores indicate greater satisfaction. Standardized.
Nottingham Leisure Questionnaire (shortened version)[25,84]	Measures declination of leisure participation in clients with stroke. Questionnaire of 30 items scored on a 3-point Likert scale (regularly, occasionally, never). Standardized.

Ohio Functional Assessment Battery: Standardized Tests for Leisure and Living Skills[59]	Designed for use in cognitively impaired individuals. Structured interview/questionnaire assessing interests, resources, participation, motivation, and barriers to therapy. Three test options: Functional Living Skills Assessment, Quick Functional Screening Test, and Recreation and Leisure Profile. Standardized.
Physical Activity Scale for the Elderly (PASE)[86]	Ten-item self-report assessment measures physical activity, including leisure, household, and physical activities over the preceding 7 days. Standardized.
Physical Activity Scale for Individuals with Physical Disabilities (PASIPD)[87]	Modification of the PASE specifically for individuals with physical disabilities; 13 items consist of leisure, household, and occupational activity components. Standardized.
Quality of Life Scale[15,16,30,88]	Perceived quality of life on a scale of 16 items (eg, material comforts, expressing oneself creatively, socializing, participating in active recreation). Rated on a Likert scale from "very dissatisfied" to "very satisfied." Standardized.
Occupational Profile[48]	Interview with the client (and family/caregivers if appropriate), along with observations to gather information about demographics, language, health status, and social and medical history. Questions address why the client needs OT services, what his or her concerns are, the client's occupational history (eg, values, meanings associated with life experiences), and the client's priorities. Nonstandardized.
Modified Interest Checklist (*http://www.cade.uic.edu/moho/*)	Checklist of 68 activity items that assesses the client's level of interest (casual, strong, or no interest). Includes many leisure-time activities. Available in multiple languages. Nonstandardized.
Role Checklist[57] (*http://www.cade.uic.edu/moho/*)	Interview to discover past, present, and future occupational roles (including leisure roles) and their value to the client. Available in multiple languages. Nonstandardized.

Intervention: Where There's a Will, There's a Way

Based on information gathered during the evaluation process, an intervention plan incorporating leisure occupations is developed; this plan must be one that the client and family/caregivers view as important to improving quality of life. Clients (including family members or caregivers, as necessary) and therapists develop goals and plan interventions together, thus ensuring that the client is motivated to engage in therapy sessions to the best of his or her ability.[4] In occupational therapy, leisure occupations can be a means and an end. As a means of intervention, the client is provided with the therapeutic use of leisure that is motivating because it is chosen and fun. Leisure as an end is seen when the client voluntarily engages in leisure occupations after therapy intervention stops.[4] As stated by Taylor and McGruder,[78] when developing discharge plans that include leisure, the therapist should consider "attributes of novelty and challenge, meaningful use of time, and identity construction," which are imperative to the continued growth, adaptation, and quality of life of clients. Occupational therapists may offer a variety of leisure activities that are delivered to individuals or groups, depending on the relevance to the client's interests, abilities, and activity demands. In the case of Kris (see the following case study), individual activities need to be mastered before group activity can be considered.

Case Study

Kris

Kris, a 22-year-old man with a spinal cord injury (paraplegia), has an avid interest in playing wheelchair basketball. To prepare him for this sport, the occupational therapist works with him individually to order the correct wheelchair, strengthen his upper extremities, develop skill in dribbling, catching and throwing the ball, making baskets from the wheelchair, finding appropriate sports apparel (eg, to hide his leg bag; shirts that can stay down in back when he is reaching for the basket; push cuffs or golf gloves to protect his hands), and learning how to get back into the wheelchair when he falls out on the court. Referral is then made to a recreational therapist, who helps Kris incorporate these basic skills into an existing team of players. By developing his individual skills before entering the group activity, his potential to successfully participate in his leisure activity of choice is increased.

Balloon volleyball is a fun and social activity. For example, in a long-term care facility, residents with appropriate cognitive and motor skills can be organized into two teams, seated and facing each other. A real or simulated volleyball net is erected between the two teams, and a balloon is hit back and forth. Music adds to the enjoyable atmosphere. This game can meet several OT goals, such as improving eye pursuit, upper extremity range of motion, socialization, and cognition (keeping track of the score). In addition, because joking and laughing often occur, physical, social, and psychological benefits may be gained (see Box 16.1). The therapist must ensure that clients are interested in participating and that each person is safe, with wheelchairs locked and, if necessary, seat belts attached. Cardiac patients may not be appropriate to include because of the upper extremity workout and increased respiration, heart rate, and blood pressure that could occur.

Adapting the Activity for Success

Occupational therapists are uniquely qualified to adapt the activity, including the equipment, the environment, or the nature of the activity, to make leisure occupations accessible to clients. By participating in leisure occupations that are meaningful, clients are able to continue to make positive adaptations that lead to greater life satisfaction. Table 16.4 describes some leisure occupations and possible adaptations.

TABLE 16.4

Examples of Adapted Leisure Occupations

Leisure Occupation	Possible Adaptations	
Gardening	Raised beds for flower or vegetable gardens that are accessible from a chair or wheelchair. Nonskid surface under pots to prevent sliding during potting.	 (Courtesy iStock.com.)
Bowling	Wheelchair specially designed for bowling, on which the wheels are set under the chair for ease of bowling action. Bowling ball can be made with handles for people with arthritis or hand dexterity problems.	 (Courtesy Innovative Bowling Products, Jacobus, PA.)
Golf	Adapted golf clubs (eg, constructed to be used from a seated or wheelchair position or to be used one handed), lower extremity prosthetics specially made for golf.	 (Courtesy David B Windsor, PGA, Georgia State Golf Association Adaptive Golf; Adaptive Golf Academy and Adaptive Golf Association.)
Playing cards	Card shuffler, card holder, large-print or Braille cards	

		 (Courtesy iStock.com.)
Computer activities or Internet surfing	Large monitor screen, large-print font, voice-activated controls or software (eg, Dragon NaturallySpeaking).	 (Courtesy iStock.com.)
Cooking	Energy conservation techniques, sliding instead of lifting heavy pots, nonskid surface to prevent slippage, rocker knife, perching stool.	 (Courtesy iStock.com.)
Pets	Canine companions to manage daily tasks (eg, open drawers and doors, acknowledge phone ringing, obtain objects) and to provide love and licks. Therapy dogs to visit clients in hospitals, skilled nursing facilities, and homes to bring joy and opportunities for touch. Pets such as fish, cats, dogs, and others provide companionship and may promote motivation for engagement in caring activities.	 (Courtesy iStock.com.)
Bike riding	Handcycles for those with lower extremity weakness or paralysis. These bikes are propelled and controlled by arm strength and coordination.	

		

Level of Functioning

Occupational therapists view the client as a whole person with myriad dimensions (eg, physical, cognitive, spiritual, psychological). Leisure occupations are self-enhancers that add joy and pleasure to life. For effective implementation, activities must be analyzed according to the individual's level of functioning (eg, performance skills, performance patterns, client factors, activity demands, and context). Examples of clients by level of function, along with leisure occupations that are meaningful to the individual, are presented in the case studies of Tina, John, and Miguel.

Case Studies

Tina, John, and Miguel

Tina

Level of Function: Maximum Assistance Needed

Tina, a 41-year-old mother of two, had a severe stroke that left her unable to smoothly coordinate movement. She enjoys listening to tapes of her son playing the guitar.

Leisure Occupation

OT assessment revealed that when Tina was positioned correctly, her left hand could be guided to hit a large-button switch (Fig. 16.4). Stephanie, the OT, connected the button switch to a tape player, which held a tape of her son's recent musical accomplishments. Her family members were instructed in how to assist Tina so that they could all participate in a valued leisure activity together.

FIG 16.4 Tina, with her husband, Scott, using a large-button device to turn on a tape player so she can listen to her son playing the guitar.

John

Level of Function: Moderate Assistance Needed

John, a 50-year-old man, suffered a traumatic brain injury 3 years earlier. He demonstrates poor dynamic balance, short-term memory deficits, and weakness on his right side. He uses a three-wheeled walker for ambulation. John lives with his wife and is independent in the majority of activities of daily living. His passion is bowling.

Leisure Occupation

After assessing his satisfaction and perceived bowling performance using the Canadian Occupational Performance Measure (COPM), DeShawn, John's occupational therapist, accompanied John, his wife, and their adult son to the bowling alley. DeShawn called ahead to make sure the bowling alley was accessible and had accommodations for people with disabilities. The lanes were set up with gutter bumpers and a bowling ball ramp. Using a gait belt and moderate assistance, John was able to place a lightweight ball on the ramp, set up his shot, release the ball, and knock down some of the pins. When he, his wife, and his son saw that bowling was possible again, they set up a family night once a week to resume a cherished fun activity.

Miguel

Level of Function: Independent

Miguel, a 25-year-old single man, was in a skiing accident 5 years earlier and incurred a spinal cord injury that resulted in paraplegia. He progressed through rehabilitation and is independent in ADLs and instrumental activities of daily living (IADLs). He uses a power wheelchair, drives, and has a job as a police dispatcher. Miguel has come to occupational therapy to upgrade his wheelchair and discuss leisure occupations. He reports that his free time is boring and he wants to return to a sport.

Leisure Occupation

Wheelchair sports abound in variety. Miguel's occupational therapist, Eric, began by helping Miguel explore the many options for people who want to participate as a wheelchair athlete, including basketball, mountaineering, hunting, rugby (the fastest-growing wheelchair sport), weightlifting, racing (including handcycle racing), tennis, javelin throwing, and snow skiing. When Miguel indicated that he might be interested in resuming his previously loved leisure occupation of camping, Eric showed him how to locate helpful resources, such as magazines, journals, websites, catalogs, and other related publications. For example, an article in the *British Journal of Occupational Therapy*[17] reviewed sports wheelchairs, and that article might also provide information on the chairs' suitability for use on camping trails.

Miguel was further directed to *New Mobility*, a magazine written for and by people with physical disabilities, which had an excellent article on accessible campgrounds and suggestions for making a trip successful. Eric also recommended other magazines, such as *Adapted Physical Activity Quarterly* and *Sports'n Spokes*, so that Miguel could read about others' experiences and stories and broaden his ideas of equipment and gadgets for wheelchair users. Eric was thrilled to hear from Miguel a few months later that he had indeed gone camping (Fig. 16.5) and that it was a "super experience!"

FIG 16.5 Miguel, in his power wheelchair, is able to enjoy the experience of forests and camping. (Courtesy iStock.com)

Threaded Case Study

Jeri, Part 2

Reconsider the questions posed about Jeri, a 29-year-old newly married woman whose case study opened the chapter.

1. Is Jeri really ready to be discharged from occupational therapy?

Probably not. Although the occupational therapist has done a thorough job of teaching Jeri how to be competent in ADLs, we now know that there is more to life for occupational therapists to consider than just instructing clients in personal care techniques. OT assessments of Jeri's leisure attitudes, interests, skills, and abilities need to be undertaken and a further intervention plan developed that addresses her quality of life issues.

2. Why is Jeri dissatisfied with her current lifestyle?

Jeri is leading a restricted life, compared with her life before the accident. She has lost many of the activities that brought joy to her life. She is unable to do scrapbooking because she still lacks the fine motor coordination in her dominant hand to manipulate scissors and small decorative paper pieces. She wants to drive again and misses working as an interior designer, shopping, meeting friends for lunch, and running errands. Her husband treats her as though she will break and is unsure whether she is capable of boating and fishing again. Jeri is no longer engaging in leisure activities that reaffirm her age-related competencies.

3. What interventions could the OT provide to improve Jeri's quality of life?

To improve Jeri's ability to resume her cherished hobby of scrapbooking, the occupational therapist could provide fine motor activities that incorporate scrapbooking materials. Manipulation of materials can be improved by gluing small pieces of paper onto sturdy cards to make them easier to hold and using adapted scissors for cutting. A predriving assessment and perhaps driver training may help Jeri resume her outside activities, or the assessment may determine that driving is not advisable at this time. If Jeri is unable to drive, the occupational therapist may determine that an intervention aimed at accessing and using public transportation may be the first step in increasing community independence.

A collaborative session with Jeri's husband can be set up to talk through his concerns and to instruct him in the use of adaptive equipment, transfers, and other means of assisting her in resuming former life roles, such as fishing. Jeri, her husband, and the occupational therapist could discuss Jeri's missed social roles and need for emotional expression. They may set mutual goals that encourage Jeri and her husband to invite friends and family over for a few hours for socializing. She may also be interested in joining a brain injury support group that the OT department runs to provide her with needed peer interaction; her husband may also wish to be included in a support group for families. Sexual and sensual expression may be brought up in this meeting, and the occupational therapist could offer suggestions regarding communication of perceived changes, use of touch, and positions to enhance intimacy. The occupational therapist may also indicate referrals, as necessary. All of these leisure-related accomplishments will help reestablish 29-year-old Jeri's perception of herself as a whole human being.

Summary

Occupational therapists assist clients in attaining life satisfaction through a variety of occupations that are meaningful to the individual. Engaging and reengaging in leisure occupations, which may include social interactions, movement, playfulness, and pleasure, are important aspects of a balanced lifestyle. Realizing that lack of leisure activities may lead to isolation and depression and detrimentally affect an individual's recovery and joy in life, occupational therapists need to include leisure evaluation, intervention planning, and implementation for people with physical disabilities. Consideration of the client's age, gender, culture, interests, and environment is paramount when investigating or implementing leisure so that the intervention is client centered. A skilled occupational therapist can facilitate participation in meaningful leisure occupations that may lead to improved psychological and physical well-being, social relationships, and quality of life.

Review Questions

1. What can the absence of a meaningful leisure occupation lead to for people with a physical disability?
2. List five psychosocial benefits and five physical benefits of leisure activities.
3. Why is the client's cultural background important when considering leisure occupations?
4. When should humor and laughter be used with caution?
5. What four factors are essential for modeling behavior to be an effective intervention?
6. Why is it important for the client to be involved in setting his or her own goals?

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17

Assistive Technology

Denis Anson

CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Describe the range of assistive technology options currently available for people with physical disabilities.
2. Explain the human interface assessment (HIA) model.
3. Identify common solutions for enabling control of daily living devices through technology.
4. Discuss options for augmentative and alternative communications.
5. Analyze input and output options for assistive technologies and match them to the needs of clients.

KEY TERMS

Assistive technologies
Augmentative and alternative communications (AAC)
Electronic aids to daily living (EADLs)

Graphic communications
Human interface assessment (HIA) model
Message composition system
Message transmission system
Modifier keys
Pointing systems
Power switching
Rehabilitation technology
Universal design
User control system

Threaded Case Study

Gianna, Part 1

Gianna, who is 26 years old, has completed her undergraduate degree and wants to apply to law school. Her path to the legal profession is challenged by a complete spinal cord injury at the C4 level, which she sustained 12 years previously in an automobile accident that killed her parents. Gianna is bright, articulate, and exceptionally popular in her rural community. She recently received a new wheelchair with sip-and-puff controls, which allows her mobility in her home and community, and she would now like to attend law school. Ultimately, Gianna would like to specialize in disability rights to support the civil rights of others with profound disabilities. She believes that her insider perspective on the issues might make her arguments more compelling when disabled workers are seeking reasonable accommodations.

The admissions office at the nearby university, where Gianna wants to apply for law school, suggested that Gianna may have a difficult time completing the required work. As a law student, she will have to research legal precedence in case law and write briefs. She can get into the library, which meets many of the requirements of the Americans with Disabilities Act (ADA), but will need to be able to navigate the legal records, take notes on her findings, and write formal responses to legal challenges. The admissions counselor believes that Gianna, who has no movement below her neck, may find that the challenge of the legal profession exceeds her capabilities.

Gianna does have full-time attendant care, and the attendant would be allowed to sit with Gianna in the classroom and act as a note taker for her. (The school also provides lecture notes to disabled students within 3 days of a class session, if requested.)

However, because Gianna's attendant must constantly monitor Gianna's physical needs, the ability of the attendant to focus on the lecture may be impaired. In addition, because the attendant does not have the interest or background to study law, her ability to identify and record what is important in the lecture is limited. Finally, because of the required hours and hourly wage, Gianna is often faced with attendants quitting after 6 months or so. The new attendant would not have a complete background to help in interpreting the material Gianna is studying.

In her home life Gianna would like to be able to adjust the lights in the room, the room temperature, and the music playing (she prefers to study with music in the background) without interrupting her attendant. She knows that she will always be dependent on others for bathing, dressing, meal preparation, and many other aspects of her activities of daily living. However, she thinks that if she were able to make fewer demands on her attendants, they might be able to remain in her employ longer.

Gianna is seeking an assistive technology consultation to explore technological aids that could help her reach her life goals.

Critical Thinking Questions

1. Which of Gianna's areas of occupation might be improved through the application of assistive technology?

2. What types of assistive technologies might assist Gianna in pursuing her activities and

occupations?

3. What control strategies might be appropriate for Gianna?

4. Would Gianna benefit from output enhancement technologies?

What Is Assistive Technology?

A discussion of assistive technology should begin with a description of the general limits of this modality. This is made difficult because the legal definitions of assistive technology are not uniform. Assistive technologies are sometimes included in the category of rehabilitation technology.[12] In other cases, rehabilitation technology is considered an aspect of assistive technologies.[8] A third type, universal design technologies, does not seem to fit into either category.[11] For the purposes of this discussion, the author presents a set of definitions that are within the current definitions, but not necessarily congruent with any particular statute.

Rehabilitative, Assistive, and Universal Technologies

The category into which an enabling technology falls depends largely on its application, not on the specific device. What is for some people a convenience may be an assistive technology for another.

Rehabilitation Technology

To *rehabilitate* is to restore to a previous level of function. To be consistent with general usage, therefore, the term **rehabilitation technology** should be used to describe technologies that are intended to restore an individual to a previous level of function after the onset of pathology. When an occupational therapist (OT) uses a technological device to establish, restore, or modify function in a client, he or she is using a rehabilitative technology. Physical agent modalities, such as ultrasound, diathermy, paraffin, and functional electric stimulation, are examples of rehabilitative technology. Broadly, whenever an OT uses a technology, be it diathermy or a traditional OT activity (eg, leather working) with the primary goal of restoring strength, mobility, or function, the technology is rehabilitative. When these technologies have done their job, the client will have improved intrinsic function, and the technology will be removed.

Assistive Technology

Central to occupational therapy is the belief that active engagement in meaningful activity supports the health and well-being of the individual. When an individual has functional limitations secondary to some pathology, he or she may not have the cognitive, motor, or psychological skills necessary to engage in a meaningful activity and may require assistance to participate in the desired task.

Ethical Considerations

Rehabilitative technologies are generally intended to be used in a therapy setting by trained professionals and for a short period. Because these technologies are intended to be used by trained professionals, they can have fairly complex or cryptic controls. The expectation is that the professional will have had significant training before using the technology. The professional guiding the use of such technologies is expected to ensure correct application of the technology and to protect the safety of the individual using the device.

To *assist* is to help, aid, or support. There is no implication of restoration in the concept of assistance. **Assistive technologies**, therefore, are technologies that assist a person with a disability to perform tasks. More specifically, assistive technologies are technologies, whether designed for a person with a disability or designed for mass market and used by a person with a disability, that allow that person to perform tasks that an able-bodied person can do without technological assistance. It may be that an able-bodied person prefers to use a technology to perform a task (eg, a television remote control), but the device does not rise to the level of assistive technology as long as it is possible for the individual to perform the task without the technology.

Assistive technologies replace or support an impaired function of the user without being expected to change the native functioning of the individual. A wheelchair, for example, replaces the function of walking but is not expected to teach the user to walk. Similarly, forearm crutches support independent standing but do not, of themselves, improve strength or bony integrity and thus will not change the ability of the user to stand without them.

Because they are not expected to change the native ability of the user, assistive technologies have different design considerations. These devices are expected to be used over prolonged periods by individuals with limited training and possibly with limited cognitive skills. The technology, therefore, must be designed so that it will not inflict harm on the user through casual misuse. The controls of the device must be readily understood, such that although some training may be required to use the device, constant retraining will not be. The device should not require deep understanding of its principles and functions to be useful.

A significant difference between rehabilitation technology and assistive technology can be seen at the end of the rehabilitation process. At this point the client no longer uses rehabilitation technologies but may have just completed training in the use of assistive technologies. The assistive technologies go home with the client; the rehabilitation technologies generally remain in the clinic. Some technologies do not fit neatly into these categories because they may be used differently with different clients. For some clients, the practitioner may use assisted communication as a tool to train unassisted speech. For other clients, assisted communication may be used to support or replace speech. In the first case, the technology is rehabilitative; in the second, the same technology may be assistive.

Universal Design

Universal design is a new category of technology. The principles of universal design were published by the Center for Universal Design at North Carolina State University in 1997,[11] and their application is still very limited. The concept of **universal design** is very simple: if devices are designed with the needs of people with a wide range of abilities in mind, they will be more usable for all users, with and without disabilities.

In some cases this design philosophy could make assistive technology unnecessary. A can opener that has been designed for one-handed use by a busy housewife will also be usable by a cook who has suffered a cerebrovascular accident (CVA) and now has the use of just one hand. Because the two individuals are using the same product for the same purpose, it is just technology, not assistive technology. Electronic books on dedicated e-readers (eg, Kindle, iPad) include features to allow them to be used as talking books. The goal here is to provide a hands-free, eyes-free interface so that the books can be used by commuters while driving. However, the same interface will meet the needs of an individual who is blind and cannot see the screen or who has limitations in mobility and cannot operate the manual controls. No adaptation is necessary because the special needs of the person with a disability have already been designed into the product.

Role of Assistive Technology in Occupational Participation

The Occupational Therapy Practice Framework[7] defined the appropriate domain of occupational therapy as including analysis of the performance skills and patterns of the individual and the activity demands of the occupation that the individual wants to perform.

Human Interface Assessment

The **human interface assessment (HIA)** model, developed by Anson et al.,[5] provides a detailed look at (1) the skills and abilities of humans in the areas of motor output, cognitive processing, and communication/interaction and (2) the demands of an activity (Fig. 17.1A). The HIA model suggests that when the demands of a task do not exceed the skills and abilities of an individual, no assistive technology is required, even when a functional limitation exists (Fig. 17.1B). Conversely, when a task makes demands that exceed the native abilities of the individual, the individual will not be able to perform the task in the prescribed manner (Fig. 17.1C). In these cases an assistive technology device may be used to bridge the gap between demands and abilities (Fig. 17.1D).

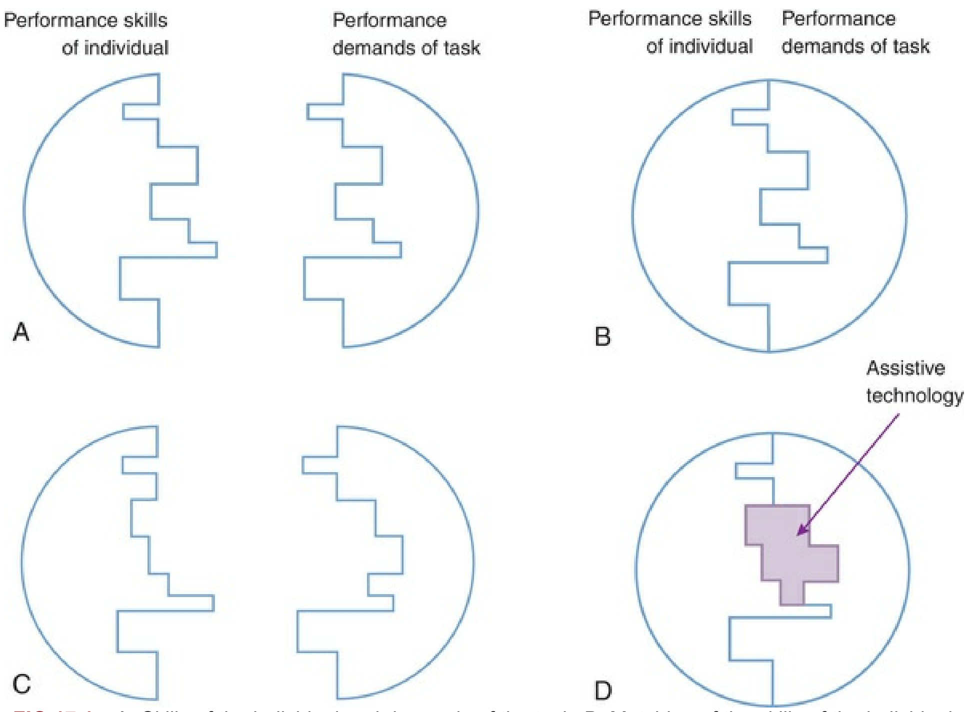

FIG 17.1 A, Skills of the individual and demands of the task. B, Matching of the skills of the individual with the demands of the task. C, Mismatching of the skills of the individual and demands of the task. D, Assistive technology used to bridge the gap between the skills of the individual and the demands of the task.

Although an assistive technology must be able to assist the individual in performing the desired task, it also presents an interface to the individual that must match his or her needs. A careful match between the abilities of the human in sensory perception, cognitive processing, and motor output and the input and output capabilities of assistive technologies is necessary for assistive technologies to provide effective interventions.

Types of Electronic Enabling Technologies

Even though modern technology can blur some of the distinctions presented in this section, it is useful to consider assistive technologies in categories defined by the application for which the technologies are used. This chapter deals only with electronic assistive technologies, which in terms of their primary application may be considered to fall into three categories: electronic aids to daily living, augmentative and alternative communications, and general computer applications.

Electronic Aids to Daily Living

Electronic aids to daily living (EADLs) are devices that can be used to control electrical devices in the client's environment. Before 1998 a device in this category was generally known as an environmental control unit,[31] although technically this terminology should be reserved for furnace thermostats and similar controls. The more generic EADL applies to control of lighting and temperature, in addition to control of radios, televisions, telephones, and other electrical and electronic devices in the environment of the client (Fig. 17.2).[9,10,13]

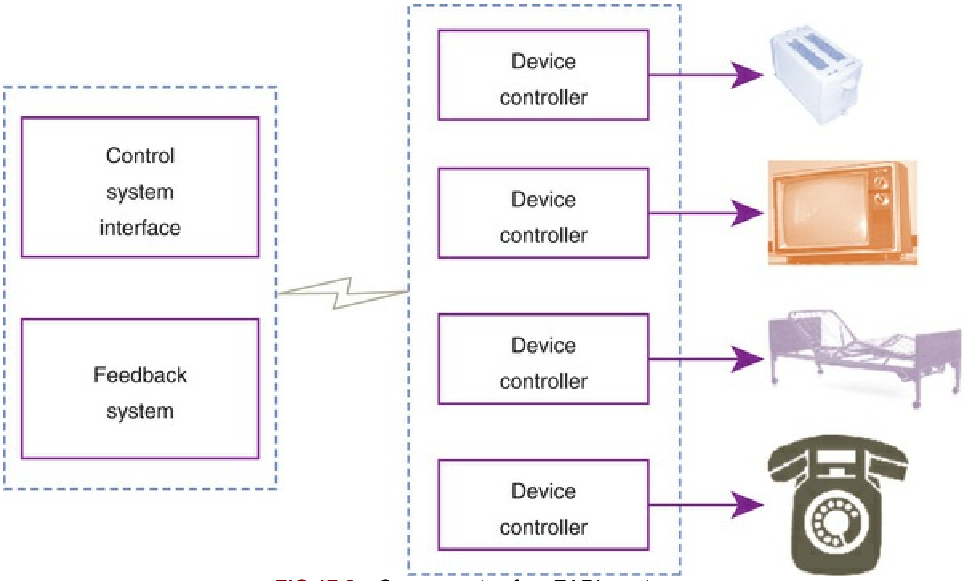

FIG 17.2 Components of an EADL system.

As described by the HIA model, EADLs bridge the gap between the skills and abilities of the user and the demands of the device to be controlled. Within this context, EADL systems may be thought of in terms of the degree and types of control over the environment that they provide to the user. These levels of control are simple **power switching**, control of device features, and subsumed devices (Fig. 17.3).

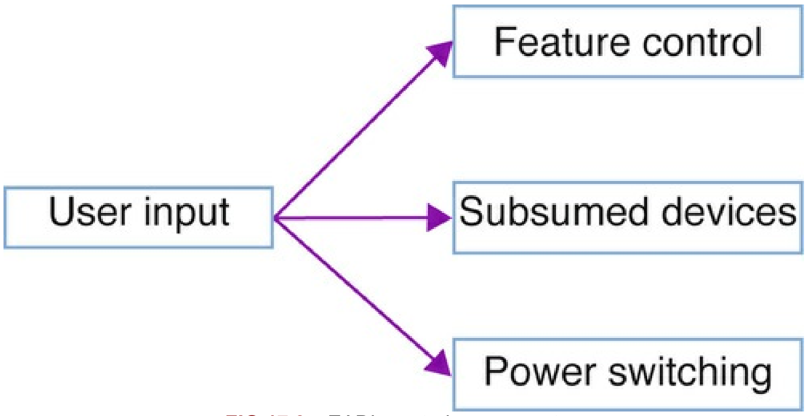

FIG 17.3 EADL control components.

Power Switching

The simplest EADLs provide simple switching of the electrical supply for devices in a room. Though not typically considered EADLs, the switch adaptations for switch-adapted toys provided to severely disabled children would formally be included in this category. Primitive EADL systems consisted of little more than a set of electrical switches and outlets in a box that were connected to devices in a room by extension cords (eg, Ablenet PowerLink 3). These devices are limited in their utility and safety because extension cords pose safety hazards to people in the environment through the risks of both falls (tripping over the extension cords) and fires (overheated or worn cords). The limitations of extension cords drove EADL technology to use remote switching technologies.

Second-generation EADL systems used various remote control technologies to remotely switch power to electrical devices in the environment. These strategies included the use of ultrasonic pulses (eg, TASH Ultra 4), infrared light (eg, infrared remote control), and electrical signals propagated through the electrical circuitry of the home (eg, X-10). All these switching technologies remain in use, and some are used for much more elaborate control systems. However, we will be considering only power switching.

The most prevalent power-switching EADL control system is produced by the X-10 Corporation. The X-10 system uses electrical signals sent over the wiring of a home to control power modules plugged into wall sockets in series with the device to be controlled. (In a series connection, the power module is plugged into the wall, and the remotely controlled device is plugged into the power module.) X-10 supports up to 16 channels of control, with as many as 16 modules on each, for a total of up to 256 devices controlled by a single system.

The signals used to control X-10 modules will not travel through a home's power transformer, so in single-family dwellings, there is no risk the devices will interfere with systems in a neighbor's home. However, this is not necessarily true in an apartment setting, where two X-10 users may inadvertently control each other's devices. The general setup for early X-10 devices was to control up to 16 devices on an available channel so that such interference would not occur.

In some apartments or homes, the power in a single unit may be on different phases of the power supplied to the building. (These phases are required to provide 220-volt power for some appliances.) If this is the case, the X-10 signals from a controller plugged into one phase will not cross to the second phase of the installation. A special “phase crossover” is available from X-10 to correct this problem. In addition to switching power on and off, X-10 modules can be used with special lighting modules to dim and brighten room lighting. These modules work only with incandescent lighting, but they add a degree of control beyond simple switching. Models are being developed for halogen bulbs. For permanent installations, the wall switches and receptacles of the home may be replaced with X-10–controlled units. Because X-10 modules do not prevent local control, these receptacles and switches work like standard units, with the added advantage of remote control.

When they were introduced in the late 1970s, X-10 modules revolutionized the field of EADLs. Before X-10, remote switching was a difficult and expensive endeavor, restricted largely to industry and to applications for people with disabilities. However, the X-10 system was intended as a convenience for able-bodied people who did not want to walk across a room to turn on a light. Because the target audience was able to perform the task without remote switching, the technology had to be inexpensive enough to make it more attractive to pay the cost of the device than to get out of a chair. X-10 made it possible for an able-bodied person to remotely control electrical devices for under $100, whereas most disability-related devices cost several thousand dollars. Interestingly, the almost universal adoption of X-10 protocols by disability-related EADLs did not result in sudden price drops in the disability field; consequently, many practitioners continue to adapt mass-market devices for individuals with disabilities.

The currently developing Internet of Things (IoT) will likely bring new power control options. Just as smart televisions are not "off" when switched off, so that they can "listen" for control signals, IoT devices in the near future will not be truly off when not in use. Rather, they will be in a sleep mode, listening for signals to turn themselves on arriving over the Internet. Such devices can be controlled from any Internet-connected device. For example, Philips' Hue light bulbs can be switched on and off, and can change the color of light being provided, through the user's smart phone or tablet. Similarly, television set-top boxes, streaming radio services, and other entertainment services can be controlled either by a dedicated remote control, a personal computer, or a cell phone.

Feature Control

As electronic systems became more widely used in the home, simple switching of lights and coffee pots failed to meet the needs of individuals with disabilities who wanted to control the immediate environment. With wall current control, a person with a disability might be able to turn radios and televisions on and off, but would have no control beyond that. Yet, a person with a disability would want to be able to surf cable channels as much as an able-bodied person with a television remote control. When advertisements are blaring from the speakers, a person with a disability might want to be able to turn down the sound or change to another radio station. Nearly all home electronic devices are now delivered with a remote control, which generally uses infrared signals. However, most of these remote controls are not usable by a person with a disability because the devices require fine motor control and good sensory discrimination.

EADL systems designed to provide access to the home environment of a person with a disability should provide more than on/off control of home electronics; they should also provide control of the features of home electronic devices. For this reason, EADL systems frequently have hybrid capabilities. They incorporate a means of directly switching power to remote devices, often using X-10 technology. This allows control of devices such as lights, fans, and coffee pots, in addition to electrical door openers and other specialty devices.[37] They also typically incorporate some form of infrared remote control, which allows them to mimic the signals of standard remote control devices. This control is provided either by programming in the standard sequences for all commercially available DVD players, televisions, and satellite decoders (as is done for cable or satellite television remote controls to also control the connected television) or by "teaching systems," in which the EADL learns the codes beamed at it by the conventional remote.

The advantage of teaching systems is that they can learn any codes, even, subsequently, those not yet invented. The disadvantage of these systems is that the controls must be taught, which requires more setup and configuration time for the user and caregivers. Because the infrared codes have been standardized, it is entirely possible for an EADL to include the codes for the vast majority of home electronics. As with "universal remote controls" for able-bodied users, the setup process then requires only that the individual enter simple codes for each device to be controlled.

Infrared remote control, as adopted by most entertainment systems controllers, is limited to approximate line-of-sight control. Unless the controller is aimed in the general direction of the device to be controlled (most have wide dispersion patterns), the signals will not be received. This means that an EADL cannot directly control, via infrared, any device not located in the same room. However, infrared repeaters (eg, the X-10 Powermid) can overcome this limitation by using radio signals to send the control signals received in one room to a transmitter in the room with the target device. With a collection of repeaters, a person would be able to control any infrared device in the home from anywhere else in the home.

One problem shared by EADL and able-bodied consumers is the proliferation of remote control devices. Many homes are now plagued with a remote control for the television, the cable/satellite receiver, the DVD player, the home stereo/multimedia center, and other devices, all in the same room. Universal remote controls can be switched from controlling one device to another but are often cumbersome to control.

Some hope is on the horizon for improved control of home audiovisual devices with less difficulty. In November, 1999, a consortium of eight home electronics manufacturers released a set of guidelines for home electronics called Home Audio Video Interoperability (HAVi). The HAVi specification would allow compliant home electronics to communicate so that any HAVi device can control the operation of all of the HAVi devices sharing the standard. A single remote control could control all of the audiovisual devices in the home through a single interface. (As of summer 2016, eight major manufacturers were identified: http://documents.mx/documents/home-audio-video-interoperability.html#)

The Infrared Data Association (IrDA) is performing similar specifications work focusing purely on infrared controls. The IrDA standard will allow an infrared remote control to control features of computers, home audiovisual equipment, and appliances with a single standard protocol. In addition to allowing a single remote control to operate a wide range of devices, the IrDA standard will allow other IrDA devices (eg, personal digital assistants [PDAs], personal computers, and augmentative communications systems) to control home electronics. Having a single standard for home electronics will allow much easier design of EADL systems for people with disabilities.

A more recent standard, V2,[23] offers a much higher level of control. If fully implemented, V2 will allow a single EADL device to control all the features of all electronic devices in its vicinity, such as the volume of the radio, the setting of the thermostat in the hall, or the "push to walk" button on the crosswalk.

One of the issues preventing adoption of these universal remote standards comes from marketing departments. General Electric does not want its devices to be controlled by a device labeled Samsung. We may see product lines that all use the same remote controls (Samsung television remotes, for example, can also control Samsung's DVD players and stereo systems), but standardization across manufacturers does not appear likely in the near future.

An interesting aspect of feature control by EADLs is the relationship between EADLs and computers. Some EADL systems, such as the Quartet Simplicity, include features to allow the user to control a personal computer through the EADL. In general, this is little more than a pass-through of the control system of the EADL to a computer access system. Other EADLs, such as the PROXi, were designed to accept control input from a personal computer. The goal in both cases is to use the same input method to control both a personal computer and the EADL. In general, the control demands for an EADL system are much less stringent than those for a computer. An input method that is adequate for EADL control may be very tedious for general computer controls. On the other hand, a system that allows fluid control of a computer will not be strained by the need to also control an EADL. The "proper" source of control will probably have to be decided on a case-by-case basis (this issue appears again in the discussion of augmentative communication systems, later in the chapter).

Subsumed Devices

Modern EADLs frequently incorporate some common devices that are more easily replicated than controlled remotely. Some devices, such as telephones, are so widely used that an EADL system can assume that a telephone will be required. Incorporating telephone electronics into the EADL is actually less expensive, because of the standardization of telephone electronics, than inventing special systems to control a conventional telephone. Other systems designed for individuals with disabilities are so difficult to control remotely that the EADL must generate an entire control system. Hospital bed controls, for example, have no provisions for remote control, but they should be usable by a person with a disability.

Many EADL systems include a speakerphone, which allows the user to originate and answer telephone calls by using the electronics of the EADL as the telephone. Because of the existing standards, these systems are generally analog, single-line telephones, electronically similar to those found in the typical home. Many business settings use multiline sets, which are not compatible with home telephones. Some businesses are converting to digital interchanges, or "Voice Over IP" (VOIP), which are also not compatible with conventional telephones. As a result, the telephone built into a standard EADL may not meet the needs of an individual with a disability in an office setting. Before recommending an EADL as an access solution for a client's office, therapists should check that the system is compatible with the telecommunications systems in place in that office.

Many homes no longer are connected to a hard-wired telephone line and depend exclusively on cell phones for communication. In the United States, there are two competing standards for cell communications, each of which is used in different frequency ranges for different carriers. As a result, providing telephone communication in EADL systems may require matching the local carrier, further complicating the choice.

Because the target consumer for an EADL often has severe restrictions in mobility, the manufacturers of many of these systems believe that a significant portion of the customer's day will be spent in bed; therefore, they include some sort of control system for standard hospital beds. These systems commonly allow the user to adjust the bed's head and foot height independently, thereby extending the time the individual can be independent of assistance for positioning. As with telephone systems, different brands of hospital beds use different styles of control. It is essential that the practitioner match the controls provided by the EADL with the input required by the bed to be controlled.

Controlling Electronic Aids to Daily Living

EADL systems are designed to allow individuals with limited physical capability to control devices in the immediate environment. Consequently, the method used to control the EADL must be within the capability of the client. Because these controls have many features in common with other forms of electronic enablers, control strategies are discussed next.

Augmentative and Alternative Communications

The term **augmentative and alternative communications (AAC)** is used to describe systems that supplement (augment) or replace (alternative) communication by voice or gestures between people.[30] Formally, AAC incorporates all assisted communication, including tools such as pencils and word processors or computers, as used to communicate either over time (as in leaving a message for someone who will arrive at a location after you leave) or over distance (sending a letter to Aunt May). However, as used in assistive technology, AAC is considered the use of technology to allow communication in ways that an able-bodied individual would be able to accomplish without assistance. Thus, using a pencil to write a letter to Aunt May would not be an example of an AAC for a person who is unable to speak because an able-bodied correspondent would be using the same technology (pencil and paper) for the same purpose (social communication). However, when a person who is nonvocal uses the same pencil to explain to the physician that she has sharp pains in her right leg, the pencil becomes an AAC device because an able-bodied person would communicate this by voice.

The causes of a communication disorder fall into two very different categories: language disorders and speech disorders. After a brain injury that affects Wernicke's area on the left cerebral hemisphere, an individual may exhibit a language disorder; that is, the person may have difficulty understanding language (sometimes referred to as receptive aphasia). An individual who sustains damage to the frontal cortex region involved with speech production (Broca's area) would have problems speaking (referred to as expressive aphasia, although no aphasia is purely receptive or expressive), regardless of the means of production.

Although there are degrees of aphasia, ranging from mild to severe/profound, in most cases a person with a language disorder will not benefit from AAC. In contrast, with a brain injury (from birth, trauma, or disease) that affects the speech motor cortex (Broca's area), an individual may be perfectly able to understand and formulate messages but unable to speak intelligibly because of difficulty controlling the oral musculature. Such a person has no difficulty with language composition, only with language transmission. (In cases of apraxia, the motor control of writing can be as impaired as that of speaking without affecting language.) In other cases the physical structures used for speech generation (eg, jaw, tongue, larynx) may be damaged by disease or trauma. Although the person has intact neural control, the muscles to be controlled may not function properly. This person may well benefit from an AAC device. In recent years it was discovered that, for many individuals with autism, the sound of their own voice interferes with the process of composing a message. For these individuals, the separation between composition of a message and voicing of a message provided by an AAC device can be an effective aid to communication.

AAC devices range from extremely low technology to extremely high technology. In hospital intensive care units (ICUs), low-tech communication boards can allow a person maintained on a respirator to communicate basic needs (Fig. 17.4). A low-tech communication board can allow a client to deliver basic messages or spell out more involved messages in a fashion that can be learned quickly. For a person with only a yes/no response, the communication partner can indicate the rows of the aid one at a time and ask whether the desired letter or word is in the row. When the correct row has been selected, the partner can move across a row until the communicator indicates the correct letter. This type of communication is inexpensive and quick to teach but very slow to use. In settings in which there are limited communication needs, it is adequate but will not serve for long-term or fluent communication needs.

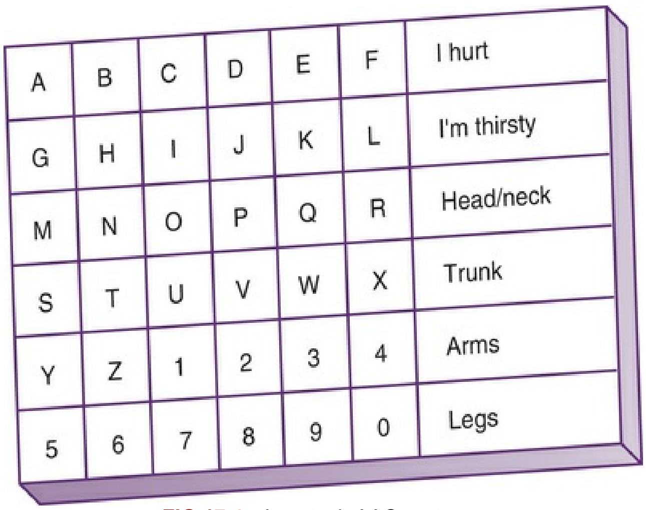

FIG 17.4 Low-tech AAC system.

To meet the communication needs of a person who will be nonvocal over a longer period, practitioners frequently recommend electronic AAC devices (Fig. 17.5).

OT Practice Notes

In selecting a communication device, the practitioner must consider the type of communication the individual will use, in addition to the settings in which the communication will take place.

FIG 17.5 High-tech AAC system (Accent). (Courtesy Prentke Romich, Wooster, OH.)

Light[29] described four types of communication that humans use: (1) expression of needs and wants, (2) transfer of information, (3) social closeness, and (4) social etiquette. In the ICU setting noted earlier, most communication occurs at the first two levels. The communicator wants to express the basic needs of hunger, thirst, and relief of pain. He or she wants to communicate with the physician providing care, convey information about where it hurts, and determine whether treatment seems to be working. In work or school settings, communication is often intended to convey information.

When participating in a classroom discussion, a student may want to be able to describe the troop movements in the battle of Gettysburg, for example. In math class, the student may need to present a proof involving oblique angles and parallel lines. Such exchanges of information may be spontaneous (as when a student is called on in class) or planned (as in a formal presentation).

In a social or an interpersonal setting, communication has a markedly different flavor. Teenagers may spend hours texting, exchanging very little "information" but communicating shared feelings and concerns. At a faculty tea, much of the communication is very formulaic, such as "How do you do?" Such queries are not intended as questions about medical status, but simply a recognition of the other person's presence and an indication that the speaker wishes him or her well. (Historically, this query was originally expressed as, "I hope I see you well today." This phrasing more accurately expresses the sentiment but is somewhat longer. The proper response to "How do you do?" was not "Fine, thank you," but a reciprocal "How do you do?").

The planning and fluency of communication in each domain are substantially different, and the demands on AAC systems in each type of communication are likewise very different. An AAC system used solely for expression of needs and wants can be fairly basic. The vocabulary used in this type of communication is limited, and because the expressions tend to be fairly short, the communication rate is not of paramount importance. In some cases the entire communication system may be an alerting buzzer to summon a caregiver because the individual is in need. Low-tech communication systems such as those just described can meet basic communication needs for individuals whose physical skills are limited to eye blinks or directed eye movement.

Low-tech devices also may enable expression of more complex ideas. For example, a therapist became aware that his client with aphasia wished to communicate something. Because no AAC was available to this client, the therapist began attempting to guess what the client wanted to communicate. After exhausting basic needs ("Do you need a drink?" "Do you need to use the bathroom?"), the therapist was floundering. Over the next 20 minutes, the client, in response to a conversation between another therapist and client in the same treatment room, was able to communicate that his ears were the same shape as Cary Grant's! Even a basic communication aid, such as the ICU aid described earlier, would have allowed much faster transfer of this information.

Most development in AAC seems to be focused on the level of communicating basic needs and transfer of information. Information transfer presents some of the most difficult technological problems because the content of information to be communicated cannot be predicted. The designer of an AAC device would probably not be able to anticipate the need to discuss the shape of Cary Grant's ears during the selection of vocabulary. To meet such needs, AAC devices must have the ability to generate any concept possible in the language being used. This is referred to by AAC practitioners as spontaneous novel utterance generation (SNUG). Making these concepts available for fluent communication is the ongoing challenge of AAC development.

Social communication and social etiquette present significant challenges for users of AAC devices. Although the information content of these messages tends to be low, because the communication is based on convention, the dialog should be both varied and spontaneous. AAC systems, such as the Dynavox, have provisions for preprogrammed messages that can be retrieved for social conversation, but providing both fluency and variability in social discourse through AAC remains a challenge.

One aspect of social communication that has recently been addressed is "phatic communication." When participating in a conversation, the listener sends messages that indicate continued attention and interest. These may include smiles, head nods, or short expressions of agreement (eg, "Yes!"). Such phatic content has not generally been available to AAC users. Recently, the Fat Cat Chat products have provided an enjoyable means of phatic communication. Although not intended as full communication solutions, products such as Fat Cat Pirate Chat (Point and Read, Inc. *http://www.piratechat.us*) allow a person with severe communication limitations to indicate his or her participation in a conversation.

Current devices allow somewhat effective communication of wants. They are not nearly as effective in discussing dreams.

Parts of AAC Systems

In general, electronic AAC systems have three components (Fig. 17.6): a **user control system**, which allows the user to generate messages and control the device; a **message composition system**, which allows the user to construct messages to be communicated to others; and a **message transmission system**, which allows the communication partner to receive the message from the user. The issues of user control of AAC devices are essentially the same as those for other electronic assistive technologies and are discussed with access systems in general.

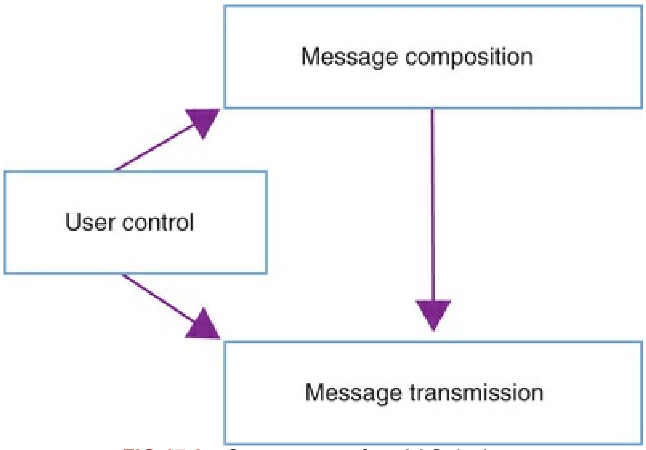

FIG 17.6 Components of an AAC device.

Message composition.

Most of the time both individuals with disabilities and able-bodied people plan their messages before speaking. (Many of us can remember the "taste of foot" when we have neglected this process.) An AAC device should allow the user to construct, preview, and edit communication utterances before they become apparent to the communication partner. This gives the AAC user the ability to think before speaking. It also allows compensation for the difference in rate between message composition via AAC and communication between able-bodied individuals.

Able-bodied individuals typically speak at a rate of 150 to 175 words per minute.[35] Augmentative communication rates are more typically on the order of 10 to 15 words per minute, resulting in a severe disparity between the rate of communication construction and the expected rate of reception. Although input techniques (discussed later) offer some improvement in message construction rates, the rate of message assembly achieved with AAC is such that many listeners lose interest before an utterance can be delivered. If words are spaced too far apart, an able-bodied listener may not even be able to assemble them into a coherent message!

The message construction area of an AAC device allows the individual to assemble a complete thought and then transmit it as a unit. A typical AAC device includes a display in which messages can be viewed before transmission. This area allows the communicator to review and edit the message being composed prior to transmitting it to the communication partner. This has two beneficial effects: the communicator can select words with care before communicating them, and the communication partner is relieved of the need for constant vigilance in conversation. The Atkinson-Shiffrin model of human memory suggests that human sensory memory retains spoken information for only 4 or 5 seconds before it fades.[1] Communication between able-bodied people generally takes place quickly enough for a complete sentence to be held in sensory memory at once. When an able-bodied person is communicating with a person using an AAC device, the time between utterances may be too long to allow the communication to remain in memory. The able-bodied person loses focus and may not be able to maintain attention to the conversation. If messages come as units, the communication partner can respond to a query and then busy himself or herself with another activity while the communicator composes the next message. This is not unlike having a conversation via e-mail or chat.

Message transmission.

When the communicator has finished composing a message, it can be transmitted to the communication partner. The means of transmission varies with the device and the setting. Some AAC devices use exclusively printed transmission. One of the first true AAC devices, the Canon

Communicator, was a small box that included an alphanumeric keyboard. The box was strapped to the user's wrist, and the user tapped out messages that were printed on paper tape (message composition). When the message was completed, it was removed from the communicator and passed to the communication partner (message transmission).[20] With devices such as the Zygo LightWRITER, the message may be shown on an electronic display that is made visible to the communication partner. Other systems use auditory communication in which the message is spoken out loud via speech synthesis. There is a tendency to think of voice output as more appropriate than text since able-bodied people generally communicate by voice.[20] In activities such as classroom discussion, voice communication may be the most appropriate method of communication. In other settings, such as a busy sidewalk or a noisy shop, voice output may be drowned out or unintelligible, and printed output may result in more effective communication. In a setting where verbalization may disturb others, printed output may, again, be the transmission method of choice.

In settings in which voicing is the preferred method of communication, voice quality must be considered. Early AAC devices used voices that to novice listeners were only slightly more understandable than the communicator's unassisted voice. As speech synthesis technology has improved, AAC voices have generally become more intelligible. The high-quality voices of modern speech synthesizers have vastly improved intelligibility but continue to provide only a narrow range of variation and vocal expression. It is a mark of the improved state of speech synthesis that AAC users can now discuss *who* they would like to sound like rather than *what* they would like to sound like.

Communication Structure

Communications to be augmented may be categorized in terms of their intent, in addition to their content, as proposed by Light.[29] At the top level, with the conditions discussed earlier, communication may be divided into primarily verbal and primarily written. In these cases the categorization would be based on the mode of communication that would typically be used by an able-bodied person, not on the form being used by the augmented communicator.

Verbal communications.

One category of verbal communication is conversation. Conversation implies a two-way exchange of information. This includes face-to-face communication with a friend, oral presentation when question and answer sessions are included, small group discussions, and a conversation on a telephone. In all these cases, rapid communication is required and the user is expected to compose and respond immediately. If the composition rate is too slow, communication breaks down and the conversation stops. The augmented communicator may use “telegraphic” speech styles, but this results in a primitive style of language (“want food”) that may be taken to indicate poor cognition.

Another form of verbal communication is an oral presentation in which no question and answer component is included or cases in which such a component is considered separately. In these cases the augmented communicator has ample preparation time to generate communications before delivery, and an entire presentation may be stored in a communication device before the time of delivery. In such cases, even though the time taken to prepare the message may be long, delivery of the message is not inhibited as long as the device has adequate storage for the entire presentation. Stephen Hawking, through the use of an AAC device, is able to orally present formal papers at conferences just as well as his colleagues. His ability to respond to questions, however, is severely constrained. Nonetheless, because he is Stephen Hawking, colleagues wait as long as necessary for his answers to questions. Less eminent augmentative communicators may find this more constraining.

Graphic communications.

The category of **graphic communications** includes all forms of communication mediated by graphic symbols. This includes writing using paper and pencil, typewriter, computer/word processor, calculator, or a drawing program. In this form of communication, the expectation is that there is a difference between the time to create the message and the time to receive it. In the realm of graphic communications, there is a wide range of conditions and intents of communication that may influence the devices selected for the user.

Historically, graphic communication did not allow conversation in the traditional sense, other than the note passing that friends sometimes engage in when not attending to a presentation. Today, however, technologies such as instant messaging and texting allow real-time conversations via written (typed) communication. The same need for fluency and immediacy of communication applies as for verbal conversations.

One specialized type of graphic communication is note taking. Note taking is a method of recording information as it is being transmitted from a speaker so that the listener can recall it later. The intended recipient of this form of communication is the person who is recording the notes. Because it is a violation of social convention to ask the speaker to speak more slowly to accommodate the note taker, a note-taking system must allow rapid recording of information. Note taking differs from merely recording a presentation in that it is a cognitively active process. Because spoken language is typically highly redundant, the note taker must attend to the speaker and listen for ideas that should be recalled later. Only key points need to be recorded. However, because the listener is also the intended recipient, notes can be very cryptic and may be meaningless to anyone other than the note taker. The special case in which notes are taken for a student with a disability changes the process to one of recording a transcript rather than simply taking notes, which is a different type of communication.

Modern assistive technologies and mainstream applications offer aids to help the student with limited note-taking ability keep up. Products such as Microsoft's One-Note (*http://www.microsoft.com*) and Ginger Labs' Notability (*http://gingerlabs.com*) are able to make an audio recording of a lecture as the individual makes notes. When a note is selected, the portion of the audio that was recorded at the time the note was written can be played back. With this system, notes can be particularly cryptic ("Interesting" or "Test!") because they are keyed to the information being referenced.

Messaging is a form of graphic communication that shares many characteristics with note taking. Although the intended recipient is another person, shared abbreviations and nongrammatical language are common in messaging. The language that is common in adolescent e-mail is very cryptic and only barely recognizable as English (Fig. 17.7), but it is a form of graphic messaging that communicates to its intended audience. In general, messaging does not demand the speed of input of note taking because encoding and receiving are not linked in time. However, instant messaging, which has become nearly ubiquitous, blurs the lines between messaging and conversation. The expectation generally is an immediate response, as in conversation. Social networking tools such as Twitter apply a different set of constraints. Because a Twitter feed may be followed by many people, obscure abbreviations cannot be used. However, because a single tweet can have no more than 140 characters, messages must balance between being cryptic and informative.

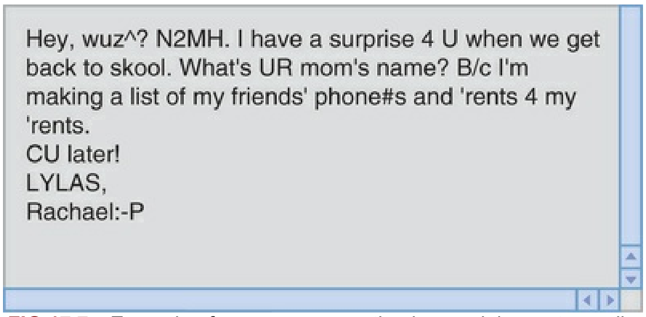

FIG 17.7 Example of message encryption in an adolescent e-mail.

The most language-intensive form of graphic communication is formal writing. This includes writing essays for school, writing for publication, and writing a book chapter, such as this one. Formal writing differs from the previously discussed forms of graphic communication in that it must follow the rules of written grammar. It is expected that the communicator will spend significant time and effort in preparing a formal written document, and the abbreviations used in note taking and messaging are not allowed.

The most difficult form of formal communication may be mathematical notation. The early target of AAC devices was narrative text as used in messaging and written prose. Such language is commonly linear and can be composed in the same order that it is to be read. Mathematical expressions, on the other hand, may be two dimensional and nonlinear. Simple arithmetic, such as 2 + 2 = 4, is not excessively difficult. However, algebraic expressions, such as:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

can be much more difficult for an AAC device to create. A relatively basic calculus equation such as:

$$\sum_{n=1}^{+\infty} \frac{(-1)^{n+1} \cdot 1 \cdot 3 \cdot 5 \mathrm{L}\, (2n-1)}{2 \cdot 4 \cdot 6 \mathrm{L}\, 2n} x^n$$

can be impossible to write, much less solve, for the user of an AAC device. Although current technology allows prose construction with some facility, an AAC user will have marked difficulty with higher mathematics. Because similar issues are experienced on the World Wide Web, new communication protocols (eg, MathML[17]) have been developed, and if these are incorporated into augmentative communication devices, they may provide improved access to higher mathematics for AAC users. Unfortunately, MathML is a visually descriptive language and is not intended to be read or written by people. The user selects options from menus or drags elements into position, and a MathML interpreter generates the language that allows the result to be printed. Thus, MathML allows access to higher math but requires a great deal of motor control to produce.

General Computer Access

Computers play an interesting double role in the field of assistive technology. In some cases using the computer is the intended activity. Browsing on the Web, for example, does not imply looking for specific information; it is a process of following links of immediate interest to see what is out there. The “Stumble-Upon” extension for the Firefox browser, for example, takes the browser to a random page that fits the interests declared by the user. Hobby computer programmers may use the computer simply to find out what they can make it do. Using a computer can provide an individual with a disability a degree of control that is missing in much of the rest of life. In other cases, the computer is a means of accessing activities that would not be possible without it, so the computer can be considered in the same category as any other assistive technology. A student with a high-level spinal cord injury may need a computer to take notes in class. A businessperson with mild cognitive limitations may use computer technologies to organize and record information. A person with severe limitation in mobility may use social networks to remain in contact with friends and family. In these cases and many others, the computer is the path, not the destination.

As with the television remote control, the status of the computer in assistive technology depends on the status of the user, not on the type of computer. If a person with a disability is using a computer in the same way and for the same purposes as an able-bodied person would, it is not assistive technology. When a person with paraplegia accesses an online database of movies being shown at local theaters, this is not an assistive technology application because the same information is available without the computer. However, when a blind individual accesses the same database using the installed screen reader, it is an assistive technology because the printed schedule is not accessible. For a person with a print impairment, the computer can provide access to printed information either through electronic documents or through optical character recognition (OCR) of printed documents, which can convert the printed page into an electronic document. Once a document has been stored electronically, it can be presented as large text for a person with limited visual acuity, or it can be read aloud for a person who is blind or profoundly learning disabled. Computers can allow the manipulation of “virtual objects” to teach mathematical concepts and constancy of form and to develop spatial relationship skills that are commonly learned by manipulation of physical objects.[22] Smart phones and PDAs may be useful for a busy executive, but they may be the only means available for a person with attention deficit/hyperactivity disorder (ADHD) to get to meetings on time.[39] For the executive, they are conveniences, but for the person with ADHD, they can be assistive technologies.

Individuals using computers can locate, organize, and present information at levels of complexity that are not possible without electronic aids. Through the emerging area of cognitive prosthetics, computers can be used to augment attention and thinking skills in people with cognitive limitations. For example, ThoughtQ from Quillsoft (*http://www.thoughtq.com/*), can assist a person with cognitive limitations in researching a topic by suggesting related search terms. By narrowing the suggestions or casting a wider net, the suggestions can assist in identifying topics for inclusion in a report. These ideas and concepts can be organized using a mind-mapping tool, such as SimpleMind (*http://www.simpleapps.eu/simplemind/desktop*), which can assist the individual in arranging the individual concepts into an organized report. Computer-based biofeedback can monitor and enhance attention to task. Research involving individuals with temporal processing deficits has led to the development of computer-modified speech programs that can be used to enhance language learning and temporal processing skills.[33,38]

Beyond such rehabilitative applications, the performance-enhancing characteristics of the conventional computer can allow a person with physical or performance limitations to participate in activities that would be too demanding without the assistance of the computer. An able-bodied person would find having to retype a document to accommodate editing changes frustrating and annoying. A person with a disability may lack the physical stamina to complete the task without the cut-and-paste abilities of the computer. For the able-bodied person, the computer is a convenience. For the person with a disability, it is an assistive technology because the task is impossible without it. The applications of the computer for a person with a disability include all of the applications of the computer for an able-bodied person.

Over time, applications that started as assistive technologies can become mainstream and thus no longer considered assistive technology. Curb cuts on sidewalks, for example, were originally mandated to allow wheelchair users to move in the community. As they became more common, they were used primarily by delivery persons or able-bodied people with rolling luggage or strollers. Electronic reminders were originally developed for people who, because of brain injury, needed constant reminders to manage their time. They became mainstream as Personal Data Assistants and now are in virtually all cell phones; so, for funding purposes, they are now arguably not assistive technologies.

Control Technologies

All these electronic enabling technologies depend on the ability of the individual to control them. Although the functions of the various devices differ, the control strategies for all of them share characteristics. Because the majority of electronic devices were designed for use by able-bodied people, the controls of assistive technologies may be categorized in ways that are adapted from the standard controls. Electronic control may be divided into four broad categories: input adaptations, performance enhancements, output adaptations, and cognitive aids.

Input to Assistive Technologies

Although there is a wide range of input strategies available to control electronic enablers, they can be more easily understood by considering them in subcategories. Different authors have created different taxonomies for the categorization of input strategies, and some techniques are classified differently in these taxonomies. The categorization presented here should not be considered uniquely correct, but merely as a convenience. Input strategies may be classified as those using physical keyboards, those using virtual keyboards, and those using scanning techniques.

Physical Keyboards

Physical keyboards generally supply an array of switches, with each switch having a unique function. On more complex keyboards, **modifier keys** may change the base function of a key, usually to a related function.[2] Physical keyboards are found in a wide range of electronic technologies, including typewriters/computers, calculators, telephones, and microwave ovens. In these applications, sequences of keys are used to generate meaningful units, such as words, checkbook balances, telephone numbers, or the cooking time for a baked potato. Other keyboards may produce immediate action when a key is pressed. For example, the television remote control has keys that switch power or raise volume when pressed. Other keys on the remote control may, like other keyboards, be used in combinations. Switching to channel 152 requires sequential activation of the "1," "5," and "2" keys.

Physical keyboards can be adapted to the needs of an individual with a disability in a number of ways (Fig. 17.8). Most alphanumeric keyboards, for example, are arranged in the pattern of the conventional typewriter. This pattern was intentionally designed, for reasons related to mechanical limitations, to slow the user down. Most individuals with disabilities do not require artificial restraints to slow them down, so this pattern of keys is seldom optimal for assistive technologies. Alternative keyboard patterns include the Dvorak Two Handed, Dvorak One Handed, and Chubon (Fig. 17.9).[2] These patterns offer improvement in the efficiency of typing that may allow a person with a disability to perform for functional periods of time.[4]

FIG 17.8 Physical keyboard with adaptive features. (Courtesy Kinesis Corp., Bothall, WA.)

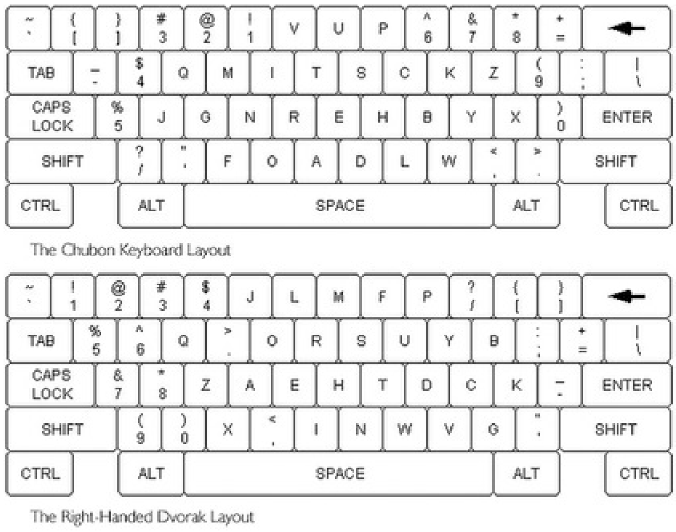

FIG 17.9 Alternative keyboard patterns.

The standard keyboard is designed to respond immediately when a key is pressed and, in the case of computer keyboards, to repeat when held depressed. This behavior benefits individuals with rapid fine motor control but penalizes individuals with delayed motor response. Fortunately, on many devices the response of the keyboard can be modified. Delayed acceptance provides a pause between the instant that a key is pressed and the instant that the key press takes effect. Releasing the key during this pause prevents the key from taking effect. This adaptation, if carefully calibrated, can allow a person to type with fewer mistakes, thereby resulting in higher accuracy and, sometimes, higher productivity. However, if not carefully calibrated, it will slow the typist without advantage.

The scale of the standard keyboard provides a balance between the fine motor control and range of motion (ROM) of an able-bodied individual. The "optimum keyboard," modeled after the IBM Selectric typewriters of the 1960s, was scaled to match the hands of women typists. However, a client with limitations in either ROM or motor control may find the conventional keyboard difficult to use. If the client has limitations in motor control, a keyboard with larger keys and/or additional space between the keys may allow independent control of the device. This adaptation may also assist people with a visual limitation because larger keys provide space for larger labels on the keys. This applies to computer keyboards, but it also applies to such suboptimal keyboards as those of television remote controls, which are available in large scale from a number of vendors. However, providing an equivalent number of options with larger keys increases the size of the keyboard, which may make it unusable for a person with limitations in ROM.

To accommodate limitations in ROM, the keyboard controls can be reduced in size. Smaller controls, placed closer together, allow selection of the full range of options with less demand for joint movement. However, smaller controls are more difficult to target for people with limited motor control. A mini-keyboard is usable only by a person with good fine motor control and may be the only scale of keyboard usable by a person with limited ROM. However, as many users of net books have discovered, smaller keyboards are often not as usable for able-bodied typists.

To accommodate both limited ROM and limited fine motor control, a keyboard can be designed with fewer options. Many augmentative communication devices can be configured with 4, 8, 32, or 64 keys on a keyboard of a single size. Modifier, or "paging," keys can allow access to the full range of options for the keyboard, but with an attendant reduction in efficiency. In this approach the person uses one or more keys of the keyboard to shift the meanings of all of the other keys on the keyboard. Unless this approach is combined with a dynamic display, the user must remember the meanings of the keys.

Physical Pointing Systems

In addition to keyboards, many electronic systems use some sort of pointer to select or activate controls and files. Because humans are good at recognizing shapes, and almost uniquely good at pointing to things of interest (most animals, when you point at something, will look at your finger, rather than in the direction pointed), a pointing interface requires much less cognitive processing than the memory-intensive command line of early computer systems. But, as with all engineering, gaining ease of use in one area usually increases the load in another. In the case of **pointing systems**, the increased demand is in vision and visual processing and in the motor control required to move a pointer to the desired target. To able-bodied individuals who grew up with it, the computer mouse seems a simple, intuitive control system. For a person with limited vision, the challenge of locating the pointer on the screen belies the simplicity. Similarly, a person with tremor would argue that pointing at a very small target is far from simple.

Fortunately, the field of assistive technology includes a wide range of accommodations for pointing systems. When the number of selections is limited, such as the adjustments available on a car radio or in a television guide, selection can occur by turning a knob, pressing Up or Down keys, or pushing a joystick to indicate the desired direction of movement. For systems in which access to any point on the screen is desired, a mouse or track pad is the common access method.

Limited control systems can generally be adapted by moving from one to another of the available access methods. If the current system requires turning a knob and the individual finds knob-turning difficult, adaptations can change the control to up/down buttons or a joystick. Mouse emulation, while more demanding, can also be provided fairly simply in most cases. Touch screens allow a person to point to controls on the screen rather than slide a mouse over the desktop. For tablets and short-term use, touch screens are good solutions, but for long-term work on the desktop, they are less usable. Try holding your arm in front of you for five minutes, and you will see that prolonged shoulder flexion is not physiologically ideal.

Any body part that can move smoothly through a range of motion can be used to drive a mouse emulator. Most commonly, such systems first use head movement as a control point. In currently available systems, a small infrared reflector is mounted on the individual's forehead, glasses, or even on a pen placed behind the ear. A camera shines infrared light on this reflector, then tracks where the reflection lies in the camera's field of view. When the user moves her head, the mouse pointer moves in the same direction. Although these systems are commonly controlled by head movement, they can, in fact, be controlled by any body part that provides sufficient range in two dimensions of movement. Individuals have used these systems to move the mouse with a fingertip or a toe.

When the individual lacks the motor control to select points on the screen with free movement, mouse access can be provided, with less fidelity, by other means. Switch joysticks or even individual switches can be used to move the mouse in the cardinal directions (up, down, left and right). Although this may require some fine tuning as the pointer approaches the target, directional control does provide access to any point on the screen. For the individual who lacks the ability to operate multiple switches, single-switch scanning can also be used. Mouse scanning can be done either as Cartesian, in which the mouse pointer scans vertical and then horizontal, or as radial, in which the mouse projects a “beam” that sweeps the screen like a radar display. When the desired beam sweeps over the target, activating the switch, it moves along the path until stopped by another action. In both cases, a broad path may be the first selector, which is then swept by a narrower beam when stopped.

The ultimate pointing system to date is eye-tracking input. Eye-tracking systems are generally based on reflected infrared light from the surface of the eye. In general, these systems require extreme stability of the physical location of the eye and the camera observing the reflections.[28] Most approaches to eye tracking have depended on the precise relationship of the camera and the user's eye. Traditionally, this has meant that the user must hold his or her head extremely still for the system to be usable. Because of cost considerations, this method of input has not been a reasonable option for a person who can produce head movements, so the requirement for head stabilization has not been a major issue.

For a time it appeared that eye tracking would become part of mainstream products, as EADLs have done, with a resulting decrease in pricing. The first mainstream products that incorporated eye tracking were handheld camcorders, which had eye tracking built into the viewfinder. By tracking the portion of the screen being focused on, eye tracking allowed the camera to focus on the part of the display of special interest to the person taking the video. As with military applications of eye tracking, in which eye-tracking systems are mounted on the helmet of the user, this worked because the camera eyepiece was held against the eye, so the geometry was stable. However, as image analysis became more efficient, it became easier to identify faces in the field of view than to try to determine where the camera user was looking, and eye gaze in the mainstream appears to have receded from common usage.

Virtual Input Techniques

When an individual lacks the motor control to use an array of physical switches, a virtual input system may be used in its place. For language, virtual input systems can be classed as virtual keyboards (systems that act like keyboards, without physical switches for each key), switch encoding systems (patterns of switch closures are used to emulate keyboard input), and speech-based systems (dictation or command-and-control systems driven by the user's native speech).

One type of virtual input system is the on-screen keyboard. An on-screen keyboard is an image of a keyboard, displayed on the device screen, that can be activated by a pointer, such as the mouse or fingertip. Whereas physical keyboards have a rigidly defined layout, an on-screen keyboard can be created with any desired number of rows of keys, with each row having few or many keys. An on-screen keyboard need not be rectangular, and rearranging the keys to a more efficient pattern can be easy (depending on the keyboard). It is even possible for the keyboard to change size and shape, depending on the program to which it is sending characters.

Before smart phones and tablets became widely used, on-screen keyboards were rare in consumer electronics, but they now are part of everyday life. In assistive technology, on-screen keyboards are either added devices when the usual physical keyboard cannot be used, or a keyboard with enhanced features used to improve individual productivity. Historically, keyboards with word prediction (discussed later) were used only as assistive technology, but today many mainstream keyboards include this feature.

One advantage of having a technology go mainstream is the new ideas that influence it. Throughout the time that on-screen keyboards have been used, various methods have been tried to improve accuracy. When on-screen keyboards became mainstream, new approaches were provided. The iOS on-screen keyboard, for example, enlarges the active area around probable keys and shrinks the active area around unlikely keys of the keyboard, making it easier to type the correct letter and more difficult to type inappropriate keys—a very clever idea that was never tried in disability-related keyboards, although similar (and less transparent) approaches have been tried.

Several augmentative communication systems now use dynamic displays, in which the graphic keyboard can be changed as the user makes selections so that the meaning of each location of the keyboard changes as a message is composed. Dynamic displays free the user from having to either remember the current meaning of a key or decode a key with multiple images on it.

Switch-Encoding Input

An individual who lacks the ROM or fine motor control necessary to use a physical or graphic keyboard may be able to use a switch-encoding input method. In switch encoding, a small set of switches (from 1 to 9) is used to directly access the functionality of the device. The meaning of the switch may depend on the length of time it is held closed, as in Morse code, or on the immediate history of the switch set, as in the Tongue Touch Keypad (TTK).

In Morse code, a very small set of switches is used to type. In single-switch Morse, a short switch closure produces an element called a dit, which is typically written as *. A long switch closure produces the dah element, which is written as −. Formally, a long switch closure is three times longer than a short switch closure, but this can be adjusted to fit the needs of the individual. Patterns of switch closures produce the letters of the alphabet, numbers, and punctuation. Pauses longer than five times the short switch closure indicate the end of a character. Two-switch Morse is similar, except that two switches are used: one to produce the dit element and a second to produce the dah. Because the meaning of the switches is unambiguous, it is possible for the dit and dah to be the same length, thereby potentially doubling typing speed. Three-switch Morse breaks the time dependence of Morse by using a third switch to indicate that the generated set of dits and dahs constitutes a single letter.

Morse code is a highly efficient method of typing for a person with severe limitations in motor control and has the advantage over other virtual keyboard techniques of eventually becoming completely automatic.[5,32] Many Morse code users indicate that they do not “know” Morse code; they think in words, and the words appear on the screen, just as in touch typing. Many Morse code users type at speeds approaching 25 words per minute, which makes this a means of functional writing. The historical weakness of Morse code is that each company creating a Morse interface for assistive technology has used slightly different definitions of many of the characters. To address this issue and to promote the application of Morse code, the Morse 2000 organization has created a standard for Morse code development.[36]

Another variety of switch encoding involves switches monitoring their immediate history for selection. The TTK, from newAbilities Systems, uses a set of nine switches on a keypad built into a mouthpiece that resembles a dental orthotic.

Early versions of the product used an “on-screen keyboard” called MiracleTyper (Fig. 17.10). With this input method, the first switch selection selects a group of nine possible characters, and the second switch action selects a specific character. This approach to typing is somewhat more physically efficient than Morse code but does require the user to observe the screen to know the current switch meaning. Later versions of the TTK used the keypad only as a mouse emulator to allow the user to select any on-screen keyboard desired for text entry.

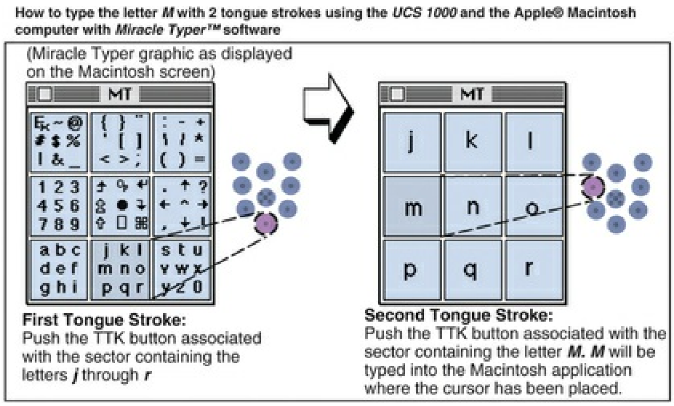

FIG 17.10 MiracleTyper enables character selection by the selection history.

A different approach to switch encoding is provided by the T9 keyboard (Fig. 17.11), which is included in most cell phones with standard keypads. In this novel interface, each key of the keyboard has several letters on it, but the user types as though only the desired character were present. The keyboard software determines from the user's input what word might have been intended. The disambiguation process used in the T9 keyboard allows a high degree of accuracy in determining which character the user intended, in addition to rapid learning of the keyboard. This input technology is potentially compatible with pointing systems, described earlier, and can provide an excellent balance of target size and available options.

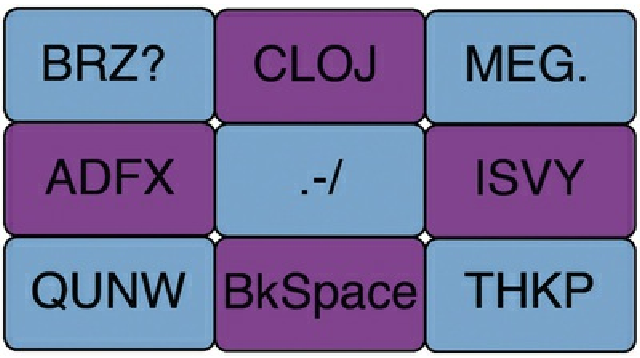

FIG 17.11 T9 keyboard.

Speech Input

For many, speech input has a magical allure. What could be more natural than to speak to an EADL or computer and have one's wishes carried out? When first introduced by Dragon Systems in 1990, large-vocabulary speech input systems were enormously expensive and, for most, of limited utility. Although highly dedicated users were able to type via voice in 1990, almost no one with the option of the keyboard would choose to use voice for daily work. These early systems required the user to pause between each word so that the input system could recognize the units of speech. Technology has evolved to allow continuous speech, with a recognition accuracy greater than 90%.[24,26] (The companies producing speech products claim accuracy greater than 95%.) Even though this advance in speech technology is remarkable, it does not mean that speech input is the control of choice for people with disabilities, for a number of reasons.

Speech recognition requires consistent speech. Although it is not necessary that the speech be absolutely clear, the user must say words the same way each time for an input system to recognize them. Consequently, the majority of people with speech impairments cannot use a speech input system effectively. Slurring and variability in pronunciation results in a low recognition rate.

Speech input requires a high degree of vigilance during training and use. Before current speech technology can be used, it must be “trained” to understand the voice of the intended user. To do this, the system presents text to the potential user, which must be read into the microphone of the recognition system. In Windows 7, the speech system uses responses to a tutorial to learn the individual user, disguise the training process, and provide the user with an overview of the system at the same time. If the user lacks the cognitive skills to respond appropriately to the cues presented, the training process will be very difficult. A few clinicians have reported success in training students with learning disabilities or other cognitive limitations to use speech input systems, but in general, the success rate is poor. Even after training, the user must watch carefully for misrecognized words and correct them at the time the error is made. Modern speech recognition systems depend on context for their recognition. Each uncorrected error slightly changes the context, and eventually the system can no longer recognize the words being spoken. Spell checking a document does not find misrecognized words because each word on the screen is a correctly spelled word. It just may not be the word that the user intended!

Speech input is intrusive. One person in a shared office space talking to a computer reduces the productivity of every other person in the office. If everyone in the office were talking to their computers, the resulting noise levels would be chaotic. Speech input is effective for a person who works or lives alone, but it is not a good input method for most office or classroom settings.[25]

Recently, Internet-based speech recognition has become available on cell phones, tablet computers, and even desktops. Where the local processor might not be powerful enough to perform the complex calculations of speech recognition, vast “server farms” in the cloud can do the hard work. With such systems, an audio recording of the user's speech is transmitted to the server, and recognized text is returned. Because of the vast power of the server farms and the number of users, these systems do not require any training to use. However, they also do not learn the idiosyncratic speech patterns of the individual. In addition, both the audio and the text are sent unencrypted to the servers, so these systems cannot be used for sensitive information (eg, medical records).

The type of speech system used depends on the device being controlled. For EADL systems, discrete speech (short, specific phrases, such as “light on”) provides an acceptable level of control. The number of options is relatively small, and there is seldom a need for split-second control. Misrecognized words are unlikely to cause difficulty. Text generation for narrative description, however, places higher demands for input speed and transparency and may call for a continuous input method. Other computer applications may work better with discrete than with continuous input methods. Databases and spreadsheets typically have many small input areas, with limited information in each. These applications are much better suited to discrete speech than to continuous speech.

The optimum speech recognition program would be a system that would recognize any speaker with an accuracy of better than 99%. Developers of current speech systems say that based on advances in processor speed and speech technologies, this level of usability should be possible within about 5 years. However, they have been making the same prediction (within 5 years) for the past 20 years! Modern speech recognition systems are vastly better than those available 10 years ago and are also available at less than 1% of the cost of the early systems. However, even with these improvements, they are still not preferable to the conventional keyboard for most users.

Scanning Input Methods

For an individual with very limited cognition and/or motor control, a variation of row-column scanning is sometimes used.[2,14,20] In scanning input, the system to be controlled sequentially offers choices to the user, and the user indicates affirmation when the correct choice is offered. Typically such systems first offer groups of choices, and after a group has been selected, the items in the group are offered sequentially. Because in early systems the items were presented as a grid offered a row at a time, such systems are commonly referred to as row-column scanning, even when no rows or columns are present.

Scanning input allows the selection of specific choices with very limited physical effort. Generally, the majority of the user's time is spent waiting for the desired choice to be offered, so the energy expenditure is relatively small. Unfortunately, the overall time expenditure is generally relatively large. When the system has only a few choices to select among, as in most EADL systems, scanning is a viable input method. The time spent waiting while the system scans may be a minor annoyance, but the difference between turning on a light now versus a few moments from now is relatively small. EADL systems are used intermittently throughout the day rather than continuously, so the delays over the course of the day are acceptable in most cases. For AAC or computer systems, however, the picture is very different. In either application, the process of composing thoughts may require making hundreds or thousands of selections in sequence. The cumulative effect of the pauses in row-column scanning slows productivity to the point where functional communication is very difficult and may be impossible. Certainly, when productivity levels are required, the communication rate available by scanning input will not be adequate.

Integrated Controls

One area of current development is the long advocated idea of integrated controls.[16] An individual with a profound disability is likely to require more than one type of control device. A person with severe motor involvement from cerebral palsy, for example, may require an augmentative communication system for interpersonal communication, an EADL for control of the local environment, a computer access system to complete job-related tasks, and a powered mobility device to navigate the community. Historically, each of these systems had their own control systems, with slightly different control strategies. The user of these multiple systems would have to move from control system to control system and have to learn how to control each of the systems.

With an integrated control system, the user would have a single interface that could control each assistive technology device. Because both AAC and computer access commonly involve language, the ability to use an AAC device to control a computer was an early goal. The 1994 standard for the general input device emulating interface (GIDEI)[18] defined characters to be sent from an AAC device to a supporting computer to provide control equivalent to the keyboard and mouse. With GIDEI, an AAC user could use the same control interface to communicate with friends in the same room or to write a business proposal.

Because many devices can be used with a moving pointer, the joystick control of a powered wheelchair may offer another avenue to integrated controls. The same joystick could be used to move a selection icon on the display of an EADL or AAC device or the mouse pointer of a computer screen. Ideally the communication between devices would be wireless, and the current Bluetooth standard for short-range, wireless communications offers to make such controls possible. (Bluetooth is a consortium of electronics companies whose goal is to develop a flexible, low-cost wireless platform capable of short-distance communication.)

For the practitioner, the question will be whether the advantages of a single, generic control that is not optimal for any particular device would outweigh the costs of learning individual, optimal control strategies for each device. Because the demands of controlling a powered wheelchair are significantly different from those for writing a formal proposal, changing channels on a television, or answering a question in a classroom, different control strategies might be necessary for each device. Whether a single control interface can support the optimal strategy for each device remains to be seen.

Rate Enhancement/Efficiency Options

For EADL systems, the rate of control input is relatively unimportant. As noted earlier, the number of control options is relatively limited, and selections are rarely severely time constrained. However, for AAC and computer control systems, the number of selections to be made in sequence is high, and the rate is frequently very important. Because a person with a disability cannot generally make selections at the same rate as an able-bodied person, rate enhancement technologies may increase the information transmitted by each selection. In general, language can be expressed in one of three ways: letter-by-letter spelling, prediction, and compaction/expansion. The latter two options allow enhancement of language generation rates.

Letter-by-Letter Spelling

Typical typing is an example of letter-by-letter representation and is relatively inefficient. In all languages and alphabets, there is a balance between the number of characters used to represent a language and the number of elements in a message. English, using the conventional alphabet, averages about six letters (selections) per word (including the spaces between words). When represented in Morse code, with only two symbols, the same text will require roughly 18 selections per word. By comparison, the basic Chinese vocabulary can be produced by selecting a single ideogram per word; however, thousands of ideograms exist. In general, having a larger number of characters in an alphabet allows each character to convey more meaning but may make selection of each specific character more difficult.

Many AAC systems use an expanded set of characters in the form of pictograms or icons to represent entire words that may be selected by the user. Such semantic compaction allows a large vocabulary to be stored in a device but requires a system of selection that may add complexity to the device.[13] For example, a device may require the user to select a word group (eg, food) before selecting a specific word (eg, hamburger) from the group. Using subcategories, it is theoretically possible to represent a vocabulary of more than 2 million words on a 128-key keypad with just three selections.

Prediction

Because messages in a language tend to follow similar patterns, it is possible to produce significant savings of effort with prediction technology. Two types of prediction are used in language: word completion and word/phrase prediction.

In word completion, a communication system (AAC or computer based), after each keystroke, presents a number of options to the user representing words that might be typed. When the appropriate word is presented by the prediction system, the user may select that word directly rather than continuing to type the entire word out. Overall this strategy may reduce the number of selections required to complete a message.[21] However, it may not improve typing speed.[27] Anson[3] demonstrated that when a person types from copy using the keyboard, typing speed was reduced in direct proportion to the frequency of use of word prediction. The burden of constantly scanning the prediction list overwhelms the potential speed savings of word completion systems under these conditions. However, with an on-screen keyboard or scanning system, for which the user must scan the input array in any case, word completion does appear to increase typing speed and reduce the number of selections made.

Because most language is similar in structure, in some cases it is also possible to predict the word that will be used after a specific word. For example, after a person's first name is typed, the surname frequently is typed next. When this prediction is possible, the next word may be generated with a single selection. Combined with word completion, next-word prediction has the potential to reduce the effort of typing substantially. However, in many cases this potential goes unrealized. Although provided with next-word prediction, many users become so involved in spelling words that they ignore the predictions, even when they are accurate. The cognitive effort of switching between “typing mode” and “list scanning” mode may be greater than the cognitive benefit of not having to spell out the word.[19]

Compression/Expansion

Compression/expansion strategies allow limited sets of commonly used words to be stored in unambiguous abbreviations. When these abbreviations are selected, either letter by letter or through word completion, the abbreviation is dynamically replaced by the expanded form of the word or phrase.[2,14]

Because the expansion can be many selections long, this technology offers an enormous potential for energy and time savings. However, the potential savings are available only when the user remembers to use the abbreviation rather than the expanded form of a word. Because of this limitation, abbreviations must be selected carefully. Many abbreviations are already in common use and can be stored conveniently. Most people refer to the television by the abbreviation TV, which requires just 20% of the selections to represent it. With an expansion system, each use of TV can automatically be converted to “television” with no additional effort from the user. Similarly, TTFN might be used to store the social message “Ta-ta for now.”

Effective abbreviations will be unique to the user rather than general. An example of an effective form of abbreviations would be the language shortcuts commonly used in note taking. These abbreviations form a shorthand generally unique to the individual and allow complex thoughts to be represented on the page quickly in the course of a lecture. A clinician should work carefully with the client to develop abbreviations that she or he finds useful and can remember easily.

Another form of "abbreviation" that is less demanding to create involves corrections of common spelling errors. For individuals such as students or adult writers who have cognitive deficits that influence spelling skills, expansions can be created to automatically correct misspelled words. In these cases the "abbreviation" is the way the client generally misspells the word, and the "expansion" is the correct spelling of the word. Once a library of misspelled words has been created, the individual is relieved of the need to worry about the correct spelling. Some maintain that this form of adaptation prevents the individual from ever learning the correct spelling. If the client is still developing spelling skills, this is probably a valid concern, and the adaptation should not be used. However, for individuals with an irremediable cognitive deficit, accommodation through compression/expansion technology is a desirable choice.

None of these technologies will allow a person with a disability to produce messages at the same rate as an able-bodied person. However, individually and collectively, they can make generation of the message significantly more efficient than it would be without them. The techniques are not mutually exclusive; icons can be predicted by using next-word techniques, and abbreviations can be used in conjunction with word completion and word prediction technologies.

Output Options

Control of assistive technologies involves a cycle of both human output and human input matched to technology input and technology output. Individuals who have sensory limitations may have difficulty controlling assistive technologies (or common technologies) because they are unable to perceive the messages sent to them by the technology. For these individuals, adaptations of the output of the technology may be required. These adaptations generally depend on one of three sensory modalities: vision, hearing, or tactile sensation.

Visual Output

The default output of many types of electronic technology is visual. Computer screens are designed to resemble the printed page. AAC systems have input that looks like a keyboard and, generally, a graphic message composition area. EADLs use display panels and lighted icons to show the current status of controlled devices. Perception of all these controls depends on the user having visual acuity at nearly normal levels. When the client has some vision but it is limited, some adaptations may be required.

Colors and contrast.

Many types of visual impairment affect the ability to separate foreground and background colors. In addition, bright background colors (including white) can produce a visual glare that makes the foreground difficult to perceive. In accommodating visual deficits, the clinician should explore the colors that are easily perceived by the individual and those that are difficult. For most people, background colors should be muted, soft colors that do not produce a strong visual response. Icons and letters, in contrast, may be represented in colors that provide visual contrast with the background. Very bright or strident colors should be avoided in both cases, and the specific colors and contrast levels required by the user must be selected on an individual basis. For many people with color and contrast issues, simply changing the display to white text on a black background provides a functional accommodation.

Image size.

Visual acuity and display size present difficulty in output display that closely mirrors the issues that ROM and fine motor skills present in keyboard design. A person with 20/20 vision can generally easily read text that is presented in letters about $\frac{1}{6}$ of an inch high. (Because a printing "point" is $\frac{1}{72}$ of an inch, this is equivalent to a page printed in a 12-point font.) On a typical display this allows the presentation of 100 to 150 words of text at a time or a similar number of icons for selection. If the user has lower visual acuity, the letter/icon size must be increased to accommodate the loss of acuity. Larger icons, however, require either fewer letters shown at a time or increased display size. For people with severe visual limitations, as with individuals with severe fine motor limitations, it would be impractical to display all choices at once.

Screen enlargement programs[2] typically overcome this limitation by showing a part of the full screen at a time and moving the portion that is expanded to the area most likely to be of interest to the user. The visual effect is similar to viewing the screen through a magnifying glass that the user moves over the display. Most programs can be configured to follow the text insertion point, the mouse pointer, or other changes on the display. Navigation is a serious problem with all such programs. When the user can see only a small portion of the screen at a time, the landmarks that are normally available to indicate the layout of the text on a page may be invisible because they are not in the field of view. Any screen enlargement program must provide a means of orienting to the location on the screen that is usable by the client.

AAC systems can accommodate the needs of a user with low visual acuity by using precisely the same techniques that are used for a person with limited fine motor control. The keyboard of the device can be configured with fewer, larger keys, each of which has a larger symbol to represent its meaning. However, as with keyboards for those with physical limitations, the result is either fewer communication options or a more complex interface for the user. In addition, these accommodations do not adapt the size of the message composition display, which may be inaccessible to a user with visual limitations.

Speech Output

It is very important to keep the difference between voice input and voice output clearly in mind. In voice input, the user speaks and the spoken word is converted into commands in the assistive technology. In voice output, the device communicates with the user through auditory means and converts printed words or commands into voice. Voice output technology has been in existence for much longer than voice input and is a more mature technology—not perfect, but more mature.

The demands of voice output are very different, depending on the application and the intended listener. In general, voice output can be divided into systems in which a second person is the listener or the user is the listener.

Second person as listener.

When used in AAC applications, voice output is almost always intended to be understood by a person who may have little experience with synthetic voices. For example, if an AAC user is at the corner market buying 2 pounds of hamburger for dinner, the butcher most likely has very little experience with a synthetic voice. When an AAC user asks for directions on the street corner, not only will the listener have little previous experience, but the AAC's voice will be competing with the sounds of trucks and buses.

To be understandable by novice listeners in real-world environments, a synthetic voice should be clear and as human sounding as possible. The voice will be easily understood to the extent that it sounds like what the listener expects to hear. Ideally, the voice should provide appropriate inflection in the spoken material and be able to convey emotional content. Current AAC systems do not convey emotional content well, but high-end voice output systems do sound very much like a human speaker. The state of the art in speech output is the Alex voice of the Apple OS X operating system. Alex sounds very nearly human and can even be heard to inhale intermittently. Its ability to correctly pronounce words with abnormal spellings is uncanny. Unfortunately, the Alex voice alone is as large as all the rest of OS X, including all the other voices provided in the system. Under adverse conditions, synthesized voices remain less understandable than a human speaker because the facial and lip movements that provide additional cues to the sounds being produced do not accompany synthetic voices. Until lifelike facial avatars can be provided that match the lifelike voices, noisy environments will remain an issue.

User as listener.

When voice output is used for computer access or EADLs, voice quality need not be as human sounding. In either case, the user has the opportunity to learn to understand the voice during training. In EADL applications, there will be relatively few utterances that must be produced, and they can be designed to sound as different as possible so that there is little chance of confusion. General voice output for an entire language is somewhat more difficult, though, because many words sound similar and can easily be confused.

For general text reading, however, the primary issue is voicing speed. As noted earlier, humans generally talk at a rate of 150 to 175 words per minute. However, most humans read 300 to 400 words per minute. A person who depends on a human-sounding voice for reading printed material will be limited to reading at less than half the speed of able-bodied readers. To be an effective text access method, synthetic voice output must be understandable at speeds in excess of 400 words per minute. This obviously requires significant training because untrained people without disabilities cannot understand speech at such speeds. However, with training, speech output is a very useful way for a person with a visual limitation to access printed material.

Speech is a useful tool in two cases: (1) when it replaces voice for a person with a disability and (2) when the user is not able to use vision to access the technology. AAC devices using voice provide the most "normal" face-to-face communication available. In most conditions, able-bodied people communicate by voice. People with disabilities generally want to communicate in similar fashion. The other application of voice is "eyes free" control. In the mass market for able-bodied consumers, these applications include presenting information over the telephone, while driving, or in other settings in which a visual display might be difficult to use. All these situations also are important for people with disabilities. In addition, assistive technologies using voice output may be intended for use by people with print impairments. The category of print impairments includes conditions that result in very low vision and/or blindness, in addition to conditions that result in an inability to translate visual stimuli to language and those that make manipulation of printed material difficult.

The one weakness of voice output technologies lies in its use for people who are developing language skills. Because English is an irregular language, with many letter combinations making similar sounds, it is almost impossible to learn spelling by listening to the sound of words. Accordingly, children who are blind from birth may not be good candidates for speech output as the primary language access method because the structure of words is lost when converted to speech. For these children and for many others, tactile access is a better tool and in fact is required by the Individuals with Disabilities Education Act (IDEA).[40]

Tactile Output

The oldest method for individuals with visual deficits to access printed material is Braille. In 1829 Louis Braille developed the idea of adapting a military system that allowed aiming artillery in darkness and writing secret messages to provide a method of reading for students at the National Institute for the Young Blind in Paris.[9] Over time, this original system has been extended to allow communication of music, mathematics, and computer code to readers without vision. Basic Braille uses an array of six dots to represent letters and numbers. Traditional Braille, however, is usable only for static text, such as printed books. Dynamic information cannot be represented by raised dots on a sheet of paper.

Technology access requires the use of refreshable Braille. Refreshable Braille displays use a set of piezoelectric pins to represent Braille letters. In a conventional computer display, changing electrical signals cause individual pixels to show light or dark (or intermediate colors) to show a portion of a document. With refreshable Braille, changing electrical signals to the display moves the tactile pins up and down, thereby allowing a single display to represent different portions of a longer document.

Braille is not widely used by individuals who are blind.[9] By some estimates only 10% of the blind population know and use Braille. For example, it is not usable by those who have limited tactile sensation in addition to blindness. Because the largest group of blind individuals in the United States consists of those with diabetic retinopathy, which is frequently matched to peripheral neuropathy affecting touch, a large proportion of blind individuals cannot use Braille. Nonetheless, Braille is a skill that should probably be taught to a person who is blind, provided the person has adequate sensation. Most Braille readers are employed. Most people who are blind but do not read Braille are not employed. Although Braille may not be an essential skill for employment, the ability to learn Braille certainly correlates with the ability to hold a job.[9]

Threaded Case Study

Gianna, Part 2

Gianna has difficulty in her current areas of occupational performance in instrumental activities of daily living (IADLs), education, and social participation, which might be addressed through assistive technology. She will continue to have deficits in her ADLs that will not be addressed through assistive technology. Through the use of an EADL, Gianna can gain control over her immediate environment. She will be able to control the temperature of her home, the radio, and/or television; control the lighting; and open doors as desired. Her verbal communication skills are excellent, but her ability to write letters to friends (graphic communications) would benefit from the same technologies (primarily mobility [not addressed in this chapter] and computer access) that will allow her to pursue her education. Although Gianna can write and print papers, she will not be able to hand them in without assistance unless her professors allow electronic submission.

In view of Gianna's level of motor control, she might consider head pointing, Morse code, or speech recognition as a means of controlling her assistive technology. All of these technologies can be applied to computer control and to her EADL. Careful assessment by her therapist would determine which control strategy best meets her needs and whether the same control strategy would work for all of her assistive technology applications.

Depending on the input method selected, Gianna might benefit from word prediction and abbreviation expansion for her text input. Because her vision and hearing are not affected, no changes in the output systems of her computer would be necessary.

Through the application of appropriate assistive technology, it will become possible for Gianna to have more control over her life in terms of both her immediate surroundings and her future occupations. Gianna will be able to access online resources, write papers for college, and ultimately, if she has the cognitive skills, become a successful lawyer. Her assistive technology does not guarantee that Gianna will succeed, but it does give her the same opportunities to succeed or fail that her peers without functional limitations have.

Summary

An OT should always keep in mind that disability makes few things impossible. It does make many things harder, and some sufficiently difficult that they are "not worth it." Assistive technology can make many things easier for the person with a disability. Because they are easier, many things that were previously not worth the effort can become reasonable activities for a person with a disability. In the terminology of the disability model, assistive technology will never remove a functional limitation. However, it can prevent that functional limitation from resulting in a disability.

Review Questions

1. Compare and contrast rehabilitative and assistive technologies.
2. In what way do devices using universal design assist individuals with disabilities? Why aren't they considered assistive technologies?
3. According to the HIA model, why might a person with a disability not require any assistive technology for the completion of some tasks?
4. In pediatric applications, complex EADL devices might not be considered appropriate. What sort of EADL might be used with a very young child?
5. Some EADL devices allow control of the features of devices in the environment. Discuss the benefit of providing such control. What additional load does this place on the user?
6. AAC devices can be used to provide alternative or augmentative communication. Discuss the difference between these two strategies. Might an AAC device be a rehabilitation technology in some applications?
7. What is the value of having a message composition area that is independent of the message transmission feature of an AAC device? Discuss the value for the communicator and for the communication partner.
8. Discuss the difference between "conversation" and "formal presentation." How might each of these be important in an educational setting? What are the dominant demands of each type of communication?
9. How does a language disorder differ from a communication disorder? What sort of AAC device would help a person with a language disorder?
10. If an individual is able to use a physical keyboard but can only use one hand, what keyboard options might help him or her with text production?
11. Consider the keypad providing control for a microwave oven. How might the keypad present difficulty to an individual who is blind? How might it be modified by an OT to improve its usability?
12. Word prediction and word completion are often touted as means to improve typing speed, yet research suggests that they do not improve speed. What advantage might these technologies offer to improve productivity for a person with a disability?
13. Abbreviation expansion is generally considered a means of typing long words and phrases with only a few keystrokes, although this requires the user to remember the abbreviation. How else can this technology be used for individuals with learning disabilities in ways that do not require memorization of keystroke sequences?
14. Refreshable Braille is expensive, whereas text-to-speech is quite inexpensive. Yet Braille training is mandated by the IDEA. What factors support the teaching of this old technology to individuals who are blind?
15. Integrated control systems allow a single control device to serve as the interface for a range of assistive technologies. What are the advantages of integrated control systems? Why might an integrated control system not be desirable for an individual user?

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PART IV

Performance Skills and Client Factors: Evaluation and Intervention

OUTLINE

18

Performance Skills

Definitions and Evaluation in the Context of the Occupational Therapy Practice Framework

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CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Explain the difference between a performance skill and a client factor.
2. Develop an understanding of client-centered, occupation-based performance.
3. Relate how improvements in performance skills may affect habits, roles, and routines.
4. Define impairment, strategy, and function.
5. Identify principles that may affect client outcomes.
6. Explain how a skilled intervention with clients facilitates cortical reorganization.

KEY TERMS

Adaptive plasticity
Client factor
Contrived
Control parameter
Cortical reorganization
Function
Impairment

Motor control theory
Neuroplasticity
Occupational performance
Performance skill
Plateau
Strategy
Task-oriented approach (TOA)

Current Occupational Therapy Practice Framework (OTPF-3)

The current version of the OT Framework, the "Occupational Therapy Practice Framework: Domain and Process," third edition (OTPF-3), was published in 2014. The revisions in this document were designed both to guide occupational therapy (OT) practice and to convey to others the domain and process of the profession.[1] The Framework is meant to be an "ever-evolving document," and the current revisions were offered to "build on a set of values that the profession has held since 1917"[1] (OTPF-3, p. S3). This chapter reviews the roles of performance skills and client factors as applied to a client case presentation.

Threaded Case Study

John, Part 1

John is a 50-year-old construction worker who has been out of work for a year. He has taken on a new role, keeping the house clean while his wife continues to work full time. He lives with his wife and two children, ages 10 and 15.

John sustained a right middle cerebral artery (MCA) cerebrovascular accident (CVA). The resultant client factor deficits from this CVA include mild impairment in his left lower extremity and moderate impairment in his left upper extremity, with greater impairment in distal motor control compared to proximal motor control. His movement patterns in his left upper limb include lifting his shoulder and bending his elbow to position his hand so that it is better able to pick up items, but he is only able to use gross grasp and has limited precision for release of objects with his left hand. He presents with a left visual field deficit and decreased sustained attention to tasks regardless of environment. He requires occasional indirect verbal cues to attend to tasks and activities. He benefits from the use of strategies to compensate for his deficits. He is currently able to complete all basic self-care activities, with occasional to minimal physical assistance required. Much of the physical assistance required is for starting the activity and the quality of performance. He is medically stable and taking antiseizure medications. He is right-hand dominant.

John lives in a one-story ranch home without any steps inside the house. He is currently walking with the use of a large-based quad cane. He and his family live in an urban setting with access to public transport. He has numerous friends and family members who live nearby. His children participate in several after-school activities, and this requires a parent to pick them up and bring them home. His wife has been picking up the children over the past year because her work is near the children's school.

John wants to improve his home management skills and continue to maintain his role as a homemaker in support of his wife. He has asked that the occupational therapy (OT) practitioner focus on his being able to complete his morning routine, take his medications, and manage the home. He is currently unable to do stovetop cooking activities, and he has difficulty vacuuming the carpet and sweeping the floors in the house. He is unable to perform shaving activities as he did before the CVA. Previously John had used a safety razor with his right hand while holding part of his face with his left hand to allow the safety razor to glide smoothly over the skin, without cuts or nicks. Since the CVA John has used an electric razor, which he holds in his right hand; however, he does not like the poor results, and he often has razor irritation after shaving. He is unable to use his left hand to assist in the shaving process.

Critical Thinking Questions

1. What performance skills would potentially negatively affect John's ability to engage in desired occupations?

2. Given John's stated concerns, what additional occupations may be compromised?

3. What evidence is available to support services designed to improve John's occupational performance?

Role of Performance Skills and Client Factors in Occupational Performance

Performance skills and client factors affect a client's occupational performance. **Occupational performance** is the engagement in meaningful and purposeful activities that relate to habits, routines, and roles. Active client engagement in occupation-based evaluation and intervention can facilitate changes in performance skills and performance patterns, and this may influence habits, roles, routines, and ultimately occupational performance. This chapter addresses how these elements relate to any client throughout the lifespan. It also describes how neuroscientific research supports an occupation-based approach to facilitate changes in the central nervous system (CNS) that directly correlate with improvements in occupational performance and client-centered outcomes.

The importance of client-centered interactions in selecting specific occupations that will help clients progress through their course of occupational therapy (OT) is a concept endorsed by the American Occupational Therapy Association (AOTA)[1] and several leaders in the OT profession.[7,9,16,26] There are several variations of how this process may occur; however, regardless of whether the Assessment of Motor and Process Skills (AMPS),[7] the occupational functioning model,[26] or the task-oriented approach (TOA)[17] is used, the message is similar—analysis of client performance provides the OT practitioner with a means of understanding what is observed.

These authors identify with a common thread, consistent with the World Health Organization's definition and classification of disability,[26] that performance analysis is important. This analysis may be formal or informal. Yet, one particular caution is to make sure that during any informal analysis, the intended outcome is specifically identified. This allows the OT practitioner to anchor what was expected with what is actually performed and observed. Thus, the focus remains on the tasks and corresponding performance skill, rather than on the client factor serving as the key determining variable in the OT process.

Occupation-Based Approaches and Neuroscientific Evidence

Connecting occupation-based approaches to the neuroscientific realm provides a framework to consider these concepts as they relate to learning. Learning, as defined in this context, theoretically occurs as a result of neuroplasticity and assumes that new neuronal connections and axonal sprouting occurs within the central nervous system through multi-sensory input.[24] Application of this concept may be seen with clients who have sustained upper motor neuron (UMN) injuries. Current trends in occupational therapy to ameliorate upper extremity hemiparesis as a result of UMN lesions are varied, yet research indicates that a potentially beneficial way to achieve a successful client-centered outcome is to include those interventions which address how the client interacts with the task and the environment. This particular approach is supported by basic and applied neuroscience concepts which imply that skilled interaction among a client's task performance in an environment may direct cortical changes and facilitate neuromuscular recovery. Consequently, this type of approach may improve completion of ADLs through improvements in performance skills[11] via engagement in occupational performance-based activities. Occupational performance, as such, often arises from a person performing a particular task in a particular environment. This dynamic interaction among the individual, the task, and the environment is consistent with the foundational framework provided by the **task-oriented approach**.[17] The TOA is one of a variety of approaches to evaluation and intervention which incorporates an underlying understanding of a variety of concepts. Among these is the ecologic approach to the performance of functional tasks (and purposeful movements). This approach emphasizes the interaction among the person, environment, and task performance.[17] Within this approach, the term “task” is not equivalent to “occupation.”[7] Although several definitions of the term occupation have been offered, the elements that distinguish occupations from tasks include the specific meaning to the occupational performance and the occupational performance within a context or environment.[6] A task is often a small portion of an occupation, such as the task of cutting with a knife and fork within the occupation of self-feeding. The performance skill in this task may be grasping the fork. Yet, an appreciation for the task-oriented approach can be seen with understanding the potential impact the task has upon occupational engagement. The OT practitioner may then apply motor learning concepts, adapt, modify, or otherwise facilitate successful completion of an occupation-based goal.

Application of the TOA directs occupational therapy practitioners to address the performance skill[11] deficits that their client's experience while simultaneously incorporating current understanding of neuroscience concepts. Both the process and outcome are important with regard to this approach. The net result of this approach is that the client may benefit from improved activity of daily living (ADL) performance. Ultimately, this may support habits and routines and eventually facilitate return to desired, client-centered roles.

Performance Skills and Client Factors

The OTPF-3 identifies client factors and performance skills as separate elements and describes how they impact and are impacted by client interaction with task and the environment in the process of performance of ADLs.[1] Fisher[7] provided a background to the process of how to formally and informally assess performance skills and patterns in relation to occupations. She stated that in order to understand how the client factors impact occupational performance, it is important to thoroughly determine how these components impact performance skills during occupational performance. Thus, it could be inferred that any attempt to assess this relationship without an appreciation and understanding for this dynamic process may lead to potentially "misdirected" conclusions. There will be a mismatch between client need and OT practitioner choice of intervention. In other words, the OT practitioner may make clinical decisions which are not in the best interests of the client and will not reflect "best practice."

Table 18.1 lists the performance skills from the OTPF-3.

TABLE 18.1

Performance Skills in the OTPF-3

Performance Skills	Definition
Motor skills	Skills observed as a person interacts with and moves task objects and herself or himself around the environment
Process skills	Skills observed as a person selects and uses tools and materials, carries out actions and steps, and modifies performance when problems are encountered
Social interaction skills	Skills observed during a social exchange

In what way could the occupational therapy practitioner evaluate John in order to identify what assets and deficits this client may be able to utilize?

It is necessary to understand current client abilities relative to specified task performance. This can be understood with measurement of particular client factors such as John's left upper limb active ROM and strength. As discussed in the chapter, this is important to have an understanding of particular deficit areas prior to the initiation of occupational therapy services. This should then be combined with observation of John participating in certain activities. The activities may occur in a structured or unstructured manner. They could include performance of his morning routine. This may include dressing, brushing his teeth, or shaving. The OT practitioner would observe what specific strategies are utilized. If John turned his body to the side in order to position his left arm across his lap to then place his left arm into the sleeve of a shirt, it is likely that this particular strategy maximizes his performance skill. The evaluation process would be a combination of the client factor measurement with the occupational performance and would most likely reflect what John is able to do for these activities of daily living (ADLs).

Client factors related to body and structure function are important as they inform the OT process and ultimately contribute to understanding of how these functions (or lack thereof) contribute to the evaluation process and development of an intervention plan. Additionally, values, beliefs and spirituality are included as client factors in the OTPF-3.[1] Within the OTPF-3,[1] client factors are differentiated at the person, organization, and population level; this chapter will primarily address client factors applied to the level of the person. Some of the specific client factors identified at the level of the person are: neuromusculoskeletal functions related to strength, muscle tone, motor reflexes, and voluntary and/or involuntary movement. Global and specific mental functions are important client factors which support incorporation of the input from one's interaction with a task within an environment. These mental functions, collectively termed cognition, are required for a person to make sense of sensorimotor input from the environment. These functions are important to overall functional ability. Also, the degree to which the central nervous system is intact following damage or a lesion, will impact a client's occupational performance.

As it relates to upper motor neuron (UMN) cortical lesions, these client factors may result in peripheral soft tissue changes, hypertonia, spasticity, and changes in range of motion. Any combination of these changes will likely impact how a client participates in a particular task. These client factors remain relevant and supportive in their role in the overall OT process. In other words, they are a means to understanding an end which focuses upon performance skills as these skills support performance of occupations.

Client factors differ from performance skills in that they represent the responses to system control. Client factors can often be measured and quantified—strength, range of motion, visual acuity, muscle tone, attention. **Client factors** represent bodily functions and what the body "does," rather than what the person does. This distinction is made clear by Fisher[7] where client factors are the actual body structures and basic body functions. Additionally, client factors represent what a person can utilize to perform a particular task. Thus, client factors facilitate performance skills but merely assessing available client factors is not predictive of occupational performance.[1]

Performance skills include the motor, process, and communication/social interaction skills required to perform specific tasks (ie, ADLs, IADLs, work). Fisher[7] described performance skills as "small units of action [that] are always goal-directed because they are enacted in the context of carrying out and completing a daily life task." Therefore, performance skills are not assessed in the absence of occupational performance but must be assessed while the client is engaged in an occupation. For example, John would like to be able to complete a dinner that includes cooking on the stove, specifically cooking pasta and spaghetti sauce. Although assessment of specific body functions may reveal limited isolated active range of motion (AROM) of his left arm, making it difficult to hold the handle of the sauce pan while stirring the sauce with his right hand, during the actual task performance the OT practitioner would also notice the difficulties with positioning his body appropriately to the stove and poor pacing of the actions which are in the performance skill category of motor and process skills. Motor and process skills are required in adequate and appropriate amounts to interact with an object in the environment during performance of a task in an accurate and efficient manner. This process can be quite dynamic and complex, and understanding this interaction informs and directs the OT evaluation and intervention. The ability to judge and respond to task demands is an aspect of the cognitive performance skills linked to overall occupational performance. Returning to the example of John cooking pasta and spaghetti sauce for dinner would require him to sequence the task appropriately by starting spaghetti sauce, then placing the water on the stove for the pasta, and as the sauce simmers, adding the pasta to the boiling water. These aspects of the task may require reaching, manipulation, and calibration. All of these are motor performance skills. He would need to time all these events appropriately for dinner to avoid serving cold pasta with over-cooked sauce. He needs to endure and pace his performance. With John's difficulties in attention (a client factor) an OT practitioner may assume the complex task of cooking spaghetti and sauce would be a challenge. Without observing the actual performance, the therapist may have suggested a checklist as an intervention method and not understand how the motor and process performance skills interact with cognitive skills during the occupation of meal preparation. Thus, a person presents with specific deficits (client factors) which impact performance skills which relates to occupational performance. Significant changes/impairments with these client factors may sufficiently impact a client's performance patterns and skills and eventually (adversely) impact occupational roles. Research indicates that the TOA is more likely to impact and positively influence outcomes when compared to treatment which only addresses client factors.[20] Neuroscientific research is pointing toward the possibility that the central nervous system is organized in such a way that tasks can be addressed through interaction with the environment rather than specific muscle groups meant to perform specific tasks. This is consistent with the TOA. Thus, understanding a client's roles and routines will guide an OT practitioner's ability to address performance skills as they relate to occupational performance. In summary, performance skills are required for interaction with task, object, and environment.[22]

How would John benefit most from occupational therapy intervention with a focus on performance skills to support improvements in client chosen activities?

John is motivated to improve his self-care and home management skills at home. He is able to complete his morning routine and self-care activities with limited physical assistance from another person. He has a supportive family who provides assistance as needed. He stated that he wants to be able to improve his ability to complete his morning routine, self-care activities, and home management. If the OT practitioner were to focus on prioritizing these activities, it would be possible to determine the best way to address re-acquisition of these abilities. Although there are multiple control parameters (a control parameter refers to the motor element that influences performance) that influence successful task completion, it is likely that in any particular activity, at least one key parameter may be the most limiting factor to successful task completion. For example, with the shaving activity; John's impaired movement in his left hand compromises bilateral task performance and serves as the control parameter. This impairment, as described in the case illustration, comes from the inability to have sufficient distal control. It is important to observe the actual performance of the shaving activity when possible in order to avoid any contrived situations. Merely having John use a safety razor with the cover in place to simulate the act of shaving would not accurately replicate the actual performance of shaving. In this instance, it needs to be determined if focusing on how the performance skill of bilateral control can be achieved will improve shaving or if the task needs to be adapted to maximize independence. The OT practitioner can validate these approaches by observing John with the actual task of shaving. This same approach may be taken with each activity to be addressed.

Motor Control Theory

Interaction among the task, person, and environment represents important aspects of motor control. **Motor control theory** (ie, the ability to make dynamic changes/responses of body and limb to complete a purposeful activity[24]) has undergone much development in recent years. This development has expanded our knowledge base, answered some questions, introduced other questions, and has permitted a further appreciation of the complexity of cortical function as it relates to motor performance.

A variety of sources indicate that multisensory input will provide the nervous system with input which will ultimately lead to improved quality of movement performance, decreased error, and support more efficient movement patterns.[4,20,21] These multiple sensory inputs to learning (or re-learning) will attempt to work together to contribute to understanding interaction with the environment whether they are intact or not intact. When one sensory input (or system) is impaired, others may need to compensate. When one part of a system is impaired, the performance pattern is affected. For example, if a person presents with impaired ability to perform dynamic distal (hand and finger) movements due to decreased motor control, then he or she may move the proximal upper limb in such a manner as to compensate for this impairment. The net result of this compensatory movement may present as “shoulder hiking” and may include other movements such as lateral trunk flexion or even shortening of the lever arm (ie, elbow flexion) to control degrees of freedom.[23]

John “hikes” (abnormally elevates) his left shoulder as movement is initiated with his left arm as he attempts to reach for objects such as his razor or toothbrush. Doing so allows him to be able to move his left arm to a position where he can then access these items. It may be possible that John is aware of the fact that he may have reached differently before the CVA. The OT practitioner may ask John to reach for these items with his right hand for comparison (recall that John is right-hand dominant). This serves as an informal task analysis. If the position of the items and how John interacts with the objects in the environment is changed, it can also be analyzed as to how this may affect the strategy, given available skills.

It is possible that this inefficient movement pattern could then be repeated and eventually develop into a new adapted or maladapted pattern. However, unless this process is properly analyzed, the client is more likely to “learn” and repeatedly use this inefficient movement pattern to accomplish a task. Poor and ineffective patterns may emerge, overuse syndromes may occur, and the net result is potentially poor self-efficacy and extra energy expenditure with occupational performance.

Repetition alone as part of a neuromuscular rehabilitation approach is insufficient to create and reinforce cortical reorganization.[2,12,23] This statement is neither novel nor groundbreaking in its meaning, yet its intent is shared by multiple researchers in a variety of arenas from basic neuroscience to the field of occupational therapy.[2,12,13,19] It is a well-established hallmark of occupational therapy to work with the client to develop an occupational profile and to engage the client in meaningful and purposeful activities. Additionally, intense task-oriented training of the sensorimotor cortex is believed to lead to cortical reorganization. Bayona et al.[2] found that rehabilitation outcomes have greater success when the tasks are meaningful to the patient. Volpe et al.[27] shared this same conclusion.

Yet, client-centered, therapist-driven task-oriented approaches may not directly translate to anecdotal or clinically measurable/significant pre-, post- changes. Motor learning concepts[26] indicate that the degree to which a task is learned is positively correlated with the “depth” of the “well” in which it is kept. In other words, the more ingrained a task is to a person, the more challenging it may be to change or transition the movement or behavior. The key point where that transition occurs may also be influenced by control parameters.

Control parameter is a motor control term that could be anything that shifts a motor behavior from one manner of performance to another type of performance. Control parameters can be internal to the person (strength, vision—for example, John's left visual field deficit) or external (location of an object, lighting). Consider the task of washing your back, the length of your arm, size of your back, established habits from training, all serve as control parameters—do you attempt to wash your left scapular area with your right hand or left? When the control parameter is a client factor, this may be an appropriate instance where the occupational therapy practitioner may attempt to address/remediate the client factor.[17] This approach to the OT process, often termed a "bottom-up" approach, assumes that addressing the fundamental client factors will allow the OT practitioner to interact with the client in order to impact and improve client occupational performance. Yet, doing so may not translate to improved performance skills or occupational performance. In fact, it is likely that the further the intervention for the client factor is from the actual occupational activity, the less likely there will be a positive correlation between these two items. Ultimately, the degree to which the client factor is impaired will impact the end result and how there is compensatory or adaptive interventions by the OT practitioner and the client. These concepts could be at least part of the explanation as to why there have been improvements measured in clinical outcome measures in some well-developed studies in this arena, but that there are limited long-term improvements. Consequently, it may be challenging to overcome (sometimes poorly) practiced performance skills and patterns. Return to the example of John cooking dinner. He has a left visual field cut which compromises his ability to obtain visual information and when the pot with pasta (located on the left side of the stove) begins to boil over John is not receiving that visual input. He could be trained to visually scan the environment to compensate for the visual field cut and it would be most appropriate to provide this training within a natural environment and with preferred occupations.

Fundamentals of experience-driven **neuroplasticity** include the adaptive capacity of the central nervous system to make fundamental changes and alterations on the cellular and eventually the systems level which can then lead to new learned/adapted behaviors. There are key critical "signals" which can facilitate such recovery.[11] Additionally, the brain continually reorganizes itself, with or without damage.[11,13] This process of learning will occur spontaneously—without any explicit learning or formal rehabilitation. Lack of skilled therapeutic intervention may lead to maladaptive behavioral responses. It is the skilled learning which occurs through the use of strategies and adaptation to facilitate this adaptive response. This has been shown to occur with the use of the TOA and task-specific techniques. Focus upon the performance skill in therapy allows the opportunity for skilled learning to occur. A person may present with compensatory movements or adaptations to control parameters such as decreased agonist strength. The TOA, with a focus upon the person interacting with the task in the environment, can address this limiting performance client factor (compensation), in part, by guiding the performance skill via skilled management of the dynamic interaction of these items. Compensatory behavioral changes are a regular part of this process.[13]

John has been attempting to move his left arm as much as possible since the CVA. He tells family and caregivers frequently that he wants to do as much as possible for himself. He is motivated to make improvements. When he attempts to complete self-care activities on his own, he does not make adjustments in the environment. He interacts with objects with poorly coordinated movement patterns. His performance skills are relative to how he uses objects. The OT practitioner can maximize the quality of the performance skills with a focus upon how John brushes his teeth or shaves. This would then serve as the foundation for how to modify the task or the environment.

Kleim and Jones[12] identify ten principles which fit this process: (1) use it or lose it, (2) use it and improve it, (3) specificity, (4) repetition matters, (5) intensity matters, (6) time matters, (7) salience matters, (8) age matters, (9) transference, and (10) interference. These principles come from basic and applied neuroscience research concepts which have shown evidence that they can impact outcomes. These principles can support evaluation and treatment.

Effective evaluation of the client who presents with upper limb hemiparesis as has been described in this chapter should then include an understanding of the specific impairments (client factors) which impact the performance of occupation-based, client-centered tasks. Although addressing specific client factors may be a part of treatment, this may not necessarily reflect changes in occupational performance. A client may need to improve bicep strength in order to complete a hand-to-mouth pattern, yet improving the bicep strength to a point where the strength is sufficient to facilitate the movement does not guarantee that the task can be completed successfully. Thus, the focus should be upon the performance skills and patterns. Observation of the client strategy with use of remaining abilities as it relates to overall function is an important part of the evaluation process. This should occur with respect for current understanding of how skilled interventions by the occupational therapy practitioner may direct learning/re-learning and lead to neuroplastic cortical changes. These changes in performance skills can lead to improvements in occupational performance.

Comprehensive evaluation with respect for the TOA requires a thorough assessment of impairment, strategy, and function. As stated earlier in this chapter, the specific impairments are those which result as a consequence of the UMN lesion. These impairments may include but are not limited to: weakness (of the agonist), decreased coordination, decreased in-hand manipulation, inability to manage agonist and agonist efficiently, impaired/absent sensation, proprioception, impaired vision, and decreased overall cognitive ability. These impairments may be measured with traditional assessment approaches utilized by OT practitioners: manual muscle testing, range of motion testing, sensation testing, vision testing, strength (grip) testing via a dynamometer (for example), coordination testing via the 9-Hole Peg Test (for example), and so on. The appropriate standardized test may be, in part, determined by the site/setting. The benefit of these assessments is that they provide a pre-test foundation from which to measure progress. Yet, these client factors remain relevant in so much as they impact occupational performance via performance skills. Thus, it is important for the OT practitioner to have an appreciation of the strategies and performance patterns utilized by the client.

John has less than five pounds of grip strength in his left hand as measured by the dynamometer. He has impaired sensation on his left hand. He does not visually attend to the environment in his left peripheral visual field. These are client factors. John grasps objects such as eating utensils with insufficient strength and has difficulties when he attempts to use his left hand to hold a fork while cutting foods with the knife in his right hand. He is unable to judge the water temperature from a faucet on his left hand prior to shaving. He does not always attend to the left side of his environment when he is attempting to cook. These are performance skills. He requires assistance and verbal cues to complete his morning routine with good quality. This is occupational performance.

Ultimately, it is the occupational performance that arises from performance skills and patterns supported by clinical observations and leads to clinical decisions for "best practice." The benefit from use of the TOA with respect for current neuroscientific concepts such as cortical neuroplasticity is that the OT practitioner addresses a client's needs from a "top-down" approach rather than from a "bottom-up" approach. The top-down approach directs the OT practitioner to work with the client from the view of actual occupational performance. Fisher[7] describes these approaches along with the benefits and potential pitfalls of each of these approaches. It is possible to complete the impairment-based measurements and progress to function or to start with functional performance and to utilize these observations to guide assessment and treatment, yet caution is suggested when a "motor behavior perspective"[8] is solely utilized.

John has decreased strength and range of motion throughout his left upper limb. This impairment is observable and measurable. Sole measurement of these items is insufficient to create a client-centered occupation-based treatment plan. It might be possible to measure these client factors. Improvement with strength or range of motion may not reflect improvements with John being able to raise his left arm to apply shaving cream to his face. It is important to understand the deficits as they relate to real performance of some client-identified, clinician-driven approach.

Neuroscience Research Related to Practice

Recent research relating neuroscientific concepts from the animal model (rodent and primate) to the human model provide evidence of the potential benefits of provision of skilled learning opportunities to direct cortical reorganization.[19,20,22] **Cortical reorganization** is the concept that the adult brain has a neuroplastic ability to alter or modify its synaptic connections in the context of performance of a skilled activity—whether the brain and central nervous system is intact or not intact. Nudo and Milliken[19] and Nudo et al.[20] completed groundbreaking research which demonstrated that through skilled learning principles, it is possible to create topographical cortical map changes which directly correspond to specific "pellet retrieval" (distal forelimb) tasks after induced focal cortical lesions in these particular representative areas in squirrel monkeys. Task-specific training can lead to increased cortical representation of the trained areas along with a decreased representation of the previously post-infarct compensatory areas. The net result of performance skill in these primates was improved quality of movement. Most of the "improved performance patterns" occurred via observation of and interpretation of behavior by the researcher pre- and post-intervention assessment. This demonstrates the ability of the cortical region to reorganize when demands are placed upon it to function. Of course there are limits to the process of reorganization, particularly if large sections of the cortex are damaged.

It is suggested that the OT practitioner utilize these principles from the animal models with caution, as there are variables which are yet to be clarified. Animal (primate) model research in this area has provided invaluable information, yet these conclusions have resulted from specific, focally induced lesions[23] with clear boundaries as to the lesioned area. In many instances, adjacent tissue is undamaged.[23] In humans, research has demonstrated that peri-infarct (cortical) reorganization may occur. Additionally, in humans, the "edges" of the lesioned area are not always clear.[22] Aside from the clinical implications of these variances, there are other potential issues which may arise from more complex cortical damage. These may include medical complexity, family/caregiver support, comorbidity, cultural expectations, or other client-specific variables. These challenges have not been the focus of nor have they been addressed in the animal model.

What would be the best fit for treatment interventions for John, given the current evidence available and understanding of neuroscience to facilitate occupational performance?

Current research indicates that it may be most beneficial to observe how John participates in particular daily activities. This allows the OT practitioner to understand what repeated behaviors are used and where new strategies may be effective in assisting John in his desired occupational outcomes. In doing so, it may be possible to better fit treatment to his needs. This allows the possibility to focus upon activities which are of interest to John and utilize concepts related to the task-oriented approach (TOA). This approach is both client-centered and occupation-based. The specific treatment activities will focus upon matching the client performance patterns.

Data from both animal and human models lead to the likelihood that client-centered, client-specific intervention plans and approaches may be "best practice." This, of course, may introduce challenges to how to implement such approaches into the current standard of care. Regardless, the distinction between animal and human models will likely continue to be a topic of discussion. This discussion is relevant when we attempt to consider what defines the aforementioned "best practice." Birkenmeier et al.[3] attempted to address this translation from neuroscientific concepts to animal model research to clinical research implementation. Their description of how they made these decisions is one of the most comprehensive presentations of this issue. Lang and Birkenmeier collaborated on a resource book which aligns animal model research with a parallel human model treatment regimen. These examples are comprehensive in nature and include dozens of examples. Additionally, there are suggestions to guide the OT practitioner to upgrade and downgrade (modify) specific interventions.[15]

Research sponsored Northstar Neuroscience Phase III Clinical Trial[14] has taken these neuroplastic concepts and knowledge from animal models and applied them to a treatment protocol based on occupational therapy concepts of client-centeredness. This randomized controlled trial included nearly 150 subjects in close to twenty sites. The study intended to investigate the potential benefits of sub-threshold cortical stimulation in combination with "skilled" (already defined in this chapter) learning via a therapy protocol grounded in the TOA.

Similar investigations have identified that there may be potential benefits from sub-threshold (ie, non-evoked action potentials) cortical stimulation to support synaptic connections, dendritic density, and to facilitate overall cortical reorganization.[22] Although the exact dosage of the stimulation and whether specific cortical stimulation to the region responsible for post-lesion upper limb (distal) control or another approach such as transcranial magnetic stimulation (TMS) remains unclear at this time, this area holds potential future benefits.[22]

The treatment protocol for the Northstar Neuroscience Phase III Clinical Trial[14] study incorporated the approach of evaluation (and corresponding intervention) of **impairment**, **strategy**, and **function** in the realm of the TOA. The impairment corresponds to the client factor. The strategy corresponds to how the person attempts to perform a task as it relates to occupation, given specific impairments. Function corresponds to how the impairment and corresponding strategy relates to performance skills and patterns. Ultimately, subjects in this clinical trial were evaluated and treated with this framework. The research therapists evaluated and treated the subjects with a focus upon performance skills. This focus arose from client-centered occupation-based tasks which were determined by each participant via the Canadian Occupational Performance Measure (COPM).[16] Clients' self-perceived changes in the performance patterns for ADL's were measured by the COPM. Other assessments were utilized as outcome measures which included the Fugl-Meyer[8] and Arm Motor Ability Test.[13] These latter two are well-established and validated clinical measures and were primary outcome measures for this particular study and are focused upon limb movement (Fugl-Meyer) and contrived activity performance (Arm Motor Ability Test). Clients demonstrated improvements in COPM outcome measures but significant changes were not noted in the other two measures. The evaluation of the clients occurred according to the principles outlined by the TOA. The treating therapists were trained and followed standardized procedures to focus with the client on the client-centered goals. Once an individual improved on a client factor or performance skill, the treating therapist reviewed how that change affected the performance pattern and what this represented in the occupational performance. The changes in performance skills with participants in this study—addressed through the utilization of client-centered functional activities focused on the use of strategies related to task performance—corresponded to changes in client factors. This treatment approach and protocol is consistent with neuroscience concepts of skilled learning supporting cortical changes which may lead to changes (improvements) in occupational performance, performance patterns, habits, routines, and roles. A portion of this protocol included evaluation of and understanding of the impact of client factors upon performance skills. Consistent with this chapter, caution was heeded as to how the client factor was a means to understanding its relevance to performance skills and overall occupational performance.

Muscle strength, range of motion, sensation, and a variety of other client factors are necessary to engage in functional activities and therefore important to measure in a quantifiable manner. An adequate amount of strength, for example, is necessary to grip an eating utensil or sufficient active range of motion is necessary to complete a hand-to-mouth pattern. Yet, the key with this protocol was that neuroplastic concepts were utilized to link client factors to performance skills to facilitate adaptive plasticity. Isolated work on the client factors of muscle strength or range of motion was not part of the protocol.

Adaptive plasticity (the innate ability of the central nervous system to adapt or modify behavioral responses after exposure to a challenge to the system) implies that by addressing the performance skill, direct change toward improved quality of occupational performance will occur. As defined, the performance skill occurs in the process of engaging in the occupation and cannot be separated from the occupation.

The examples provided in this chapter reflect neuroscientific knowledge as it relates to how OT practitioners work with the neurologically impaired client, and these same fundamental concepts can guide clinical interventions with a variety of other clients across the lifespan.

Although the approach discussed in this chapter may relate to any client, a few other examples have been provided for consideration. This list is not exhaustive. In this chapter, the focus is upon adults. For example, a client who has cancer, chronic obstructive pulmonary disease (COPD), total knee replacement (TKR), or Parkinson's disease may benefit from the approach discussed in this chapter. The condition will inform the OT practitioner as to etiology, clinical and medical presentations, prognosis, and other valuable information. The client factors impacted by any condition, such as the ones previously listed, may impact performance skills. This may impact performance patterns. Ultimately, this leads to the possibility that habits, routines, and roles may be impacted. Observation and assessment of performance skills may still guide the OT practitioner to a client-centered occupation-based intervention.

Threaded Case Study

John, Part 2

John has sustained a right MCA CVA. This condition informs the OT practitioner that it is likely that he has left upper limb motor impairment. Additionally, there may be other consequences from the CVA. John may have decreased attention and decreased visual attention to the left side. Yet, it remains important to be aware that John is also a parent and a housekeeper. He wants to return to these roles. Thus, mere measurement of the specific client factors which have resulted from the

CVA will not explicitly return him to these roles and routines.

The older client with the TKR may present with decreased bilateral upper extremity strength, not as a result of the TKR but due to deconditioning from diminished activity secondary to knee problems. This decreased bilateral upper extremity strength will limit the ability to efficiently utilize a walker for functional mobility around the home. This client may also have a history of cognitive impairments that affect the ability to learn new concepts. The OT practitioner may need to consider these items to develop a client-centered intervention plan. Relating this example to the framework provided in this chapter, the OT practitioner will likely assess upper limb strength and range of motion. Part of the OT intervention may even include exercises and activities which may improve these client factors. Yet, this does not mean that in doing so, the client will improve the performance skill of (for example) a morning routine. Nor does it imply that engaging a client with a purposeful activity will translate to improved occupational performance. How a task is practiced in the clinic may not translate to the home environment. Thus, the formal or informal occupational profile and analysis will provide the foundation from which the OT practitioner may link the current status to desired outcomes.

Best Practice Occupational Therapy Service

It is important to bring this discussion back to clients who have acquired neurological deficits in order to identify how this particular group of clients can best be treated by occupational therapy practitioners. As occupational therapy practice for the adult neurological practice moves further from an "expert opinion" approach to one which is grounded in evidence (whether that evidence supports or refutes traditional practice approaches), there is much more to be learned in order to determine "best practice." There have been attempts to identify both current trends and task-specific training in order to identify what defines "best practice." In support of this comment, Carter et al.[5] describe that much of the effort in rehabilitation research is going toward the direction of "motor restoration." Additionally, they state that the quality of the research is more rigorous than it has ever been in the past. There is no doubt that these efforts will continue and may involve other novel means to address these deficits such as post-stroke bilateral upper limb training interventions.[25]

When it comes to measuring performance and improvements in clients with neuro-insults, it may be that previous outcome measures used to identify improvements are insufficient at this point in time. For example, some standardized and validated measures which address activities of daily living do so with contrived ADLs. **Contrived** activities are those which are artificially created in an attempt to recreate real scenarios. Although there are potential benefits gained from using a standardized ADL assessment as a common, consistent approach to measuring performance and conveying performance information that is clearly recognized due to the standardization process, if this standardization lacks the fundamental elements of the task or is too "contrived," then it may affect performance and the corresponding measurement of performance. An example of a contrived situation would be having a client "spread" butter on bread by having the client use a knife on a plate in the spreading motion without the actual bread or butter. In this example, the client may possess the motor control needed for the task but in the actual task (real world experience) of spreading butter on the bread the client may fail to notice that all the butter is located on one corner of the bread or may use excessive force and tear the bread. These observations would not be possible using a contrived activity but would be immediately noticed if the client was given an actual piece of bread and butter. Wu et al.[29] describe that "real" performance of activities results in different and "better" results than imagined or contrived activities. Additionally, there is a variety of means to measure performance including time to complete portions of a task, time to complete the entire task, and subjective observations of quality of performance. Further research may advance newer ways to measure performance skills and occupational performance. This does not mean that we, as occupational therapy practitioners, should not attempt to incorporate current trends, concepts, measures/assessments, and techniques.

There are other considerations to make with the impact of how we intervene with clients such as John. Timing, dosage, and method of delivery are important variables to control for in clinical studies and these variables should also be considered in clinical practice. Although evidence-based practice is expected, using data from an investigation which did not attempt to control these factors needs to be considered with some caution,[5] Given the competition for space in the cortex after UMN damage,[19] it is necessary for OT practitioners to respond immediately and effectively to client needs. This clinical reasoning process may affect how performance "plateaus" are determined in clinical practice.

Plateau is a term which is all too common in the realm of current rehabilitation practice with persons with upper limb hemiparesis as well as other conditions across the lifespan. Page et al.[21] suggest that the way in which therapists frame the upper limb hemiparetic population may need to be reconsidered. They state that what defines: (1) "motor recovery plateau," (2) "ability to recover motor function," and (3) when to "use different modalities…" may need to be reconsidered. "Traditional" expectations of most (motor) recovery occurring in 6 to 12 months often guides insurance and is tied into clinical practice. This chapter identifies the reasons as to why this may not necessarily be the case. Immediately following a CVA some clients may be able to participate in a rehabilitative approach designed to foster self-care skills, whereas where other clients may be far too ill. The timing, intensity (dosage), and method of delivery for these two clients will most likely vary, but a similar functional outcome may ultimately be met. Hubbard et al.[11] summarize principles which should be considered for incorporation of task-specific interventions. These suggestions may serve as a guide for "best practice" while addressing the potential for improvements in performance skills. They suggest that such training/intervention should "be relevant to the patient/client and to the context; be randomly assigned; be repetitive and involve massed practice; aim towards reconstruction of the whole task; and be reinforced with positive and timely feedback."[12] They further conclude that, although as noted in this chapter, there is much evidence pointing toward the benefit of task-oriented or task-specific training techniques, "common" practice approaches are grounded in "accepted practice or custom" and may be beneficial at specific points in time. An appreciation for this conclusion and the current state of neuroscience as it relates to this population can serve to transform clinical practice. Given the complexity of human beings, it may ultimately prove that what emerges as "best practice" may incorporate a multifactorial approach to guide client-centered evaluation and treatment and maximize outcomes and facilitate client habits, routines, and roles.

Summary

It is possible to address client-centered, occupation-based needs with a focus on performance skills. Neuroscientific research indicates that this approach can be applied with the use of certain methods, such as the TOA. The TOA emphasizes a dynamic interaction between the person, the task, and the environment. OT practitioners are educated and trained to address control parameters and complete performance analyses to maximize overall occupational performance.

Review Questions

1. What are the advantages of using real situations when assessing clients rather than contrived situations?
2. What are the advantages of using contrived situations when assessing clients instead of real situations?
3. What does the term *plateau* mean in reference to clients who have sustained neurological insults?
4. What is the difference between a client factor and a performance skill?
5. Using the task of brushing your teeth as part of your morning routine, identify two client factors and two performance skills that influence the way you engage in this task.
6. What does the term *control parameter* mean with regard to working with clients who have sustained neurological insults?
7. Explain the term *neuroplasticity*.
8. Explain the term *cortical reorganization*.
9. How do the meanings of the terms *neuroplasticity* and *cortical reorganization* support occupation-based interventions?
10. Explain how the TOA was used with the case of John.

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19

Evaluation of Motor Control

Linda Anderson Preston

CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Differentiate between upper and lower motor neuron pathological conditions.
2. State the principles of neuroplasticity, and explain to clients the potential for recovery after a neurological injury or cerebrovascular disorder.
3. Describe four types of rigidity and the ways each affects movement.
4. Clinically differentiate between spinal and cerebral hypertonia.
5. Rate hypertonia on the Modified Ashworth Scale or the mild-moderate-severe scale.
6. Name standardized assessments designed to evaluate function after a cerebrovascular accident.
7. List the components of the postural mechanism.
8. Describe at least four types of cerebellar disorders.
9. List and describe at least four extrapyramidal disorders.
10. Choose a coordination assessment that objectively assesses function.
11. Name three current medical or surgical treatment options for the management of spasticity.
12. List at least three conservative occupational therapy interventions for spasticity.
13. Describe a conservative, evidence-based, client-centered OT program for treating Parkinson's disease.

KEY TERMS

Clonus
Coordination
Decerebrate rigidity
Decorticate rigidity
Flaccidity
Hypertonicity

Hypertonus
Hypotonus
Intrathecal baclofen pump
Motor control
Movement disorders
Nerve blocks
Neuroplasticity
Paresis
Plegia
Postural mechanism
Rigidity
Serial casting
Spasticity
Spinal hypertonia
Todd's paralysis

Threaded Case Study

Daniel, Part 1

Daniel, a 54-year-old salesman who is right-hand dominant, had an embolic cerebrovascular accident (CVA) 2 months ago that weakened the right side of his body. He has just completed 3 weeks of inpatient rehabilitation services that included occupational therapy, and he is starting outpatient occupational therapy today. His 70-year-old mother must drive him to therapy, and he finds this quite frustrating because he values his independence. His goal is to start his car ignition with his right hand and eventually resume driving. His vision and visual fields were not compromised by the CVA, as assessed by an ophthalmologist and the inpatient occupational therapist. Daniel is concerned about the future, and he wants to return to full-time employment. The occupational therapist knows very well that one-third of the 15 million people affected by a stroke each year are left permanently disabled.[36]

Daniel's right upper extremity (RUE) shows hypertonia in a flexion synergy, with moderate spasticity in his shoulder internal rotators, elbow flexors, forearm pronators, wrist and finger flexors, and thumb adductors. Daniel does not have active range of motion of the right shoulder external rotation or right forearm supination. His active finger extension on his right hand is emerging and is a 2− on the strength grade scale. He is currently at stage 4 of the Modified Brunnstrom Motor Recovery Scale (Table 19.1; also Figs. 19.1 to 19.5). He has only 1 pound of lateral pinch strength in his right hand. His range of motion losses and impairments, coupled with RUE spasticity, prevent him from starting his car ignition with his right hand. He needs OT rehabilitation services to regain the performance skills of holding a steering wheel, releasing a steering wheel, and turning on the ignition with his right hand.

TABLE 19.1

Modified Brunnstrom Stages of Motor Recovery[a]

Stage	Modified Brunnstrom Motor Recovery of Arm and Hand	Interdisciplinary Spasticity Management Options
0	Flaccidity with no active movement.	• Prevent contractures with PROM and consider splinting • Functional electrical stimulation
1	Spasticity developing. Trace muscle contraction in elbow flexors and scapular retractors (see Fig. 19.1).	• Same as stage 0
2	Weak synergistic movement of scapular retractors, scapular elevators, elbow flexors, and forearm pronators. Promote active movement in gravity-reduced planes. Eccentric, side-lying, and supine exercises are good ways to start facilitating movement. Functional electric stimulation may speed up motor recovery. Clients tend to use trunk lateral flexion to substitute for weak shoulder/scapular muscles (see Fig. 19.2).	• Prevent contractures with PROM and consider splinting. Risk for shoulder, elbow, forearm, and finger flexion contractures. • Blocks[b] and surgery generally are not indicated at this stage.
3	Spasticity increasing. Synergy patterns and their components can be performed voluntarily to almost full ROM. Gross grasp is developing; however, there is no active finger release. Lateral pinch is possible via thumb adduction tone and flexor pollicis longus tone. Synergy pattern may be useful for carrying objects (eg, envelopes with lateral pinch, or grocery bags in client's affected hand with finger flexion tone). Clients in this stage also tend to substitute with trunk lateral flexion to make up for shoulder weakness (see Fig. 19.3).	• *Acute:* Client is a good candidate for nerve or motor point blocks to prevent contractures. Recovery may be facilitated by unmasking movement in antagonists if spastic agonists are weakened by blocks. See text for OT treatment suggestions. • *Chronic:* After all conservative measures have failed, orthopedic surgery may be performed to release contractures so as to improve hygiene in the

		hand and ease UE dressing.
4	Spasticity declining, movement combinations from synergies are now possible. Elbow extension and wrist and finger extension are emerging but are not to full range. Occupational therapy should incorporate functional tasks that promote extension of the elbow, wrist, fingers, and thumb (see Fig. 19.4).	• *Acute:* Client is a good to excellent nerve block candidate. Better chance of gaining motor control of antagonists with blocks to the spastic agonists. • *Chronic:* Ongoing blocks three or four times per year if the risk/benefit ratio for orthopedic surgery is not acceptable to client. Orthopedic surgery options include procedures to gain function and to ameliorate contractures.
5	Synergies are no longer dominant. Finger extension is full range. Isolated finger extension is possible. Three-jaw chuck pinch and tip pinches are possible, but motor control is only fair. Emergence of intrinsic function. Occupational therapy should focus on purposeful fine motor activities (see Fig. 19.5).	• Client is an excellent candidate for fine-tuning motor control via blocks (eg, neuromuscular blocks to the extrinsic flexor pollicis longus supports the goal of improved intrinsic motor control of the thumb by allowing action of the opponens pollicis, abductor pollicis brevis, and flexor pollicis brevis to be unmasked). It should be noted that reducing hypertonia does not always result in improved dexterity.[33]
6	Isolated joint movements are performed with ease. Intrinsic function is normal. All types of prehension are possible with normal motor control.	• Client is not a candidate for blocks or surgery. Discharge from occupational therapy if all goals have been met.

[a]These stages may be used as a guideline for OT intervention and interdisciplinary spasticity management in clients with hemiplegia or hemiparesis. *Note:* Upper extremity recovery is variable owing to varying degrees of paralysis. Some clients may never progress through all the stages.

[b]The term *blocks* refers to chemical denervation with botulinum toxin type A or type B; neurolysis; or motor point blocks with phenol or alcohol.

CVA, Cerebrovascular accident; *PROM,* passive range of motion; *ROM,* range of motion; *UE,* upper extremity.

Adapted from Brunnstrom S: *Movement therapy in hemiplegia,* Philadelphia, 1970, Lippincott Williams & Wilkins.

FIG 19.1 Modified Brunnstrom stage 1 in female patient.

FIG 19.2 Modified Brunnstrom stage 2 in female patient.

FIG 19.3 Modified Brunnstrom stage 3.

FIG 19.4 Modified Brunnstrom stage 4. The client cannot actively extend his fingers, which makes it difficult to let go of a coffee cup handle.

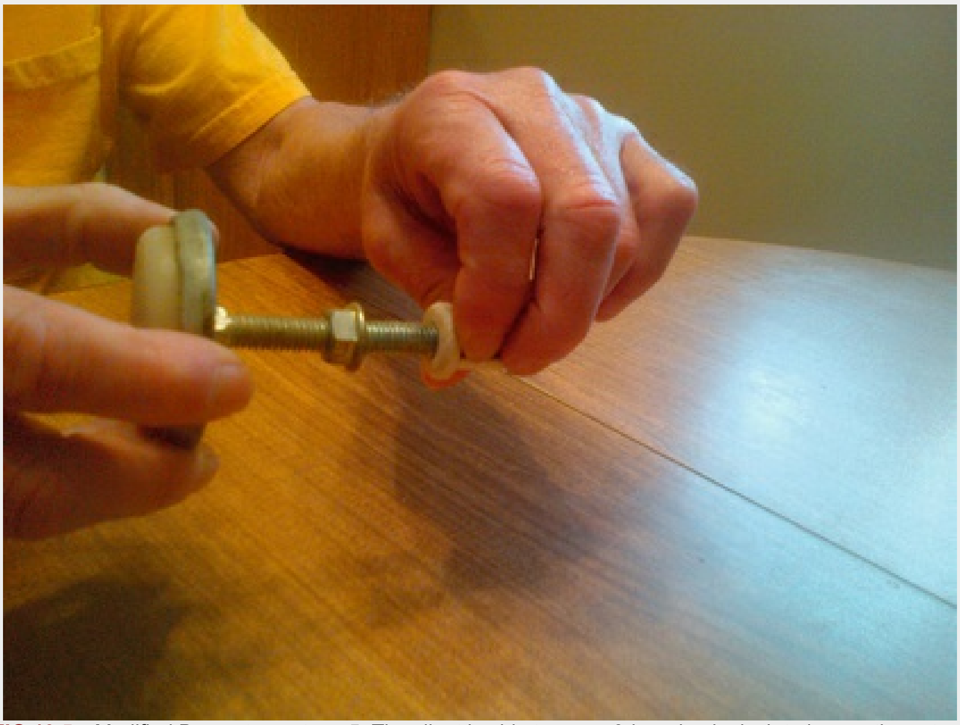

FIG 19.5 Modified Brunnstrom stage 5. The client is able to use a 3-jaw chuck pinch to loosen the nut on the screw.

Critical Thinking Questions

1. What performance skills or standardized assessments would you select as part of your initial evaluation to assess Daniel's motor function?

2. What activities or intervention would you plan for Daniel to reduce the spasticity in his right arm?

3. What home exercises or activity program would you prescribe to help him reach his goals of using his right hand to insert the key into the car ignition and then drive with both hands on the steering wheel?

Motor control is the ability of the central nervous system (CNS) to direct or regulate the musculoskeletal system in purposeful activity.[102] The components necessary for motor control include normal muscle tone, normal postural tone and postural mechanisms, selective movement, and coordination. Complex neurological systems (ie, the cerebral cortex, basal ganglia, and cerebellum) collaborate to make motor control possible. A neurological insult, such as a CVA (stroke), brain injury, or disease such as multiple sclerosis or Parkinson's disease, affects motor control. Functional recovery depends on the initial amount of neurological damage, prompt access to medical treatment to (hopefully) limit the extent of neurological damage, the nature of the neurological damage, whether it is static or progressive, and therapeutic intervention that can facilitate motor recovery.

Plasticity is an important concept in neurological rehabilitation because it helps explain why recovery is possible after a brain injury or lesion. The term *plasticity* simply means the ability to change. **Neuroplasticity** is defined as the capacity for anatomic and electrophysiological changes in the CNS. According to Umphred,[101] neuroplasticity can be viewed as a progression from short-term changes in the "efficiency or strength of synaptic connections to long-term structural changes in the organization and numbers of connections among the neurons."[101]

In some instances the CNS is able to reorganize and adapt to functional demands after injury. Motor relearning can occur through the use of existing neural pathways (unmasking) or through the development of new neural connections (neural sprouting) (Fig. 19.6). With unmasking, it is believed that seldom-used (secondary) pathways become more active after the primary pathway has been injured. Adjacent nerves take over the functions of damaged nerves.[26] With sprouting, dendrites from one nerve form a new attachment or synapse with another. Axonal sprouting also occurs and allows for flexible synaptic connections to be formed. Neural sprouting is believed to be the primary process for neuroplasticity, leading to improvement in function.[61]

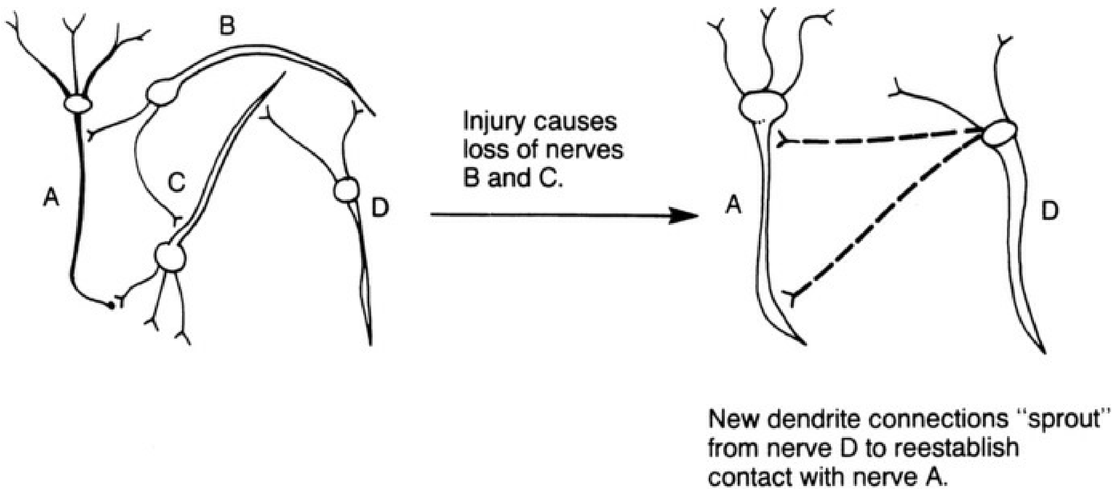

FIG 19.6 Sprouting theory of nerve cell replacement. Injury causes loss of nerves B and C. New dendrite connections "sprout" from nerve D to reestablish contact with nerve A. (From DeBoskey DS, et al: *Educating families of the head injured,* Rockville, MD, 1991, Aspen.)

Observing movements during occupational performance is a way to assess motor control. Then, after occupational performance has been evaluated, it may be necessary to evaluate the specific components that underlie motor control. These components include muscle tone, postural tone and the postural mechanism, reflexes, selective movement, and coordination.

The Upper Motor Neuron and Lower Motor Neuron Systems

This chapter focuses on the functional effects of lesions in the upper motor neuron system (UMNS). The UMNS includes any nerve cell body or nerve fiber in the spinal cord (other than the anterior horn cells) and all proximal structures. These structures include the brainstem, the descending nerve tracts, and the brain cells of both gray and white matter that serve motor function. UMN "signs" often seen after damage has occurred include hyperreflexia, a positive Babinski's sign, and spasticity.[33] Weakness, paralysis, and fatigue often accompany UMN syndrome. CVA and traumatic brain injury (TBI) can lead to UMN dysfunction. The results of electromyography and nerve conduction studies are normal with UMN dysfunction.

The lower motor neuron system (LMNS) includes the anterior horn cells of the spinal cord, the spinal nerves, the nuclei and axons of the cranial nerves, and the peripheral nerves. LMN dysfunction results in diminished or absent deep tendon reflexes and muscle weakness, atrophy, or flaccidity. An example of an LMN disease is Guillain-Barré syndrome. Individuals who have sustained a spinal cord injury can show both UMN and LMN signs if the anterior horn cells have been damaged. The findings of electromyography and nerve conduction studies are abnormal with LMN dysfunction.[4] Fig. 19.7 illustrates the influence of the UMNS on the LMNS.[25]

OT Practice Notes

These questions may help guide evaluation of motor control dysfunction.

1. Is the client having difficulty with sitting or standing balance?
2. Is trunk control adequate to perform the activity?
3. Do changes in body position affect muscle tone (eg, more hypertonia when standing than supine, more hypertonia when walking than standing)?
4. Are primitive reflexes evoked during performance?
5. Is spasticity limiting antagonist movement?
6. Are spatial or temporal sequencing problems interfering with coordinated movement?
7. Does weakness prohibit antigravity activity?
8. Is tremor present?
9. Is incoordination apparent (ie, overshooting or undershooting the target)? Are there extraneous movements?

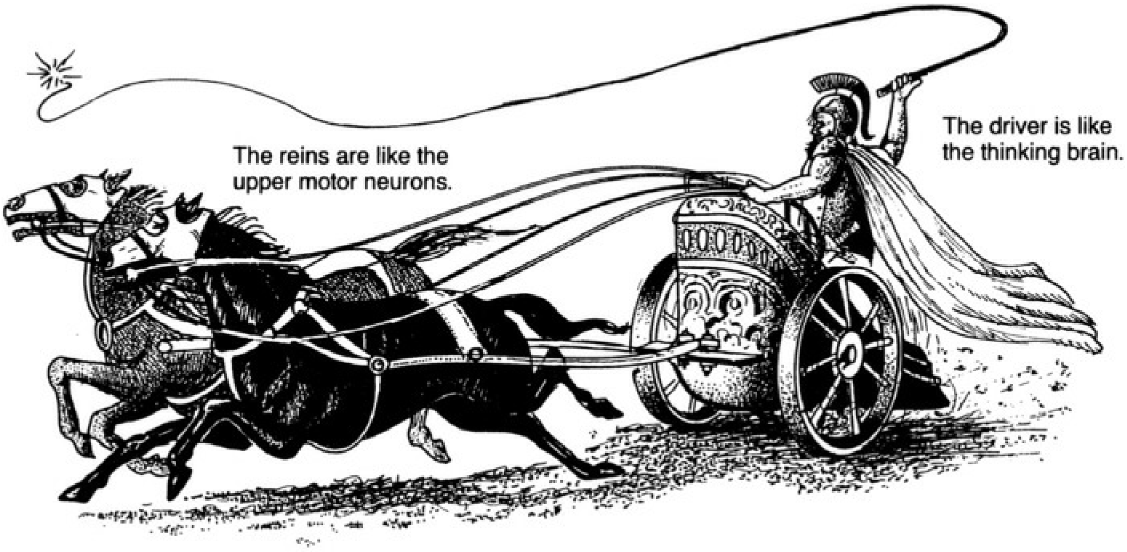

FIG 19.7 The control of movement works much as does a chariot driver with a team of horses. Remember, the upper motor neuron system facilitates or inhibits the lower motor neuron system. Therefore, think of the driver as the brain; the reins as the upper motor neurons; and the horses as the lower motor neurons and muscles. (From DeBoskey DS, et al: *Educating families of the head injured,* Rockville, MD, 1991, Aspen.)

Client-Centered Performance Interviews to Detect Problem Areas in Motor Control

The occupational therapist faces the challenge of maximizing the client's ability to return to purposeful and meaningful occupation in his or her physical, cultural, and social environment. Therefore, evaluating functional performance is primary in helping clients set realistic goals. A simple method of goal setting is to ask the client to name the top two or three things he or she would like to be able to resume doing. The Canadian Occupational Performance Measure (COPM), an assessment tool, is a more structured interview that ensures client-centered therapy.[67] It helps prioritize the client's functional activity goals in the areas of self-care, leisure, and productivity.

Two other noteworthy, client-centered, quality of life surveys frequently are used in interdisciplinary settings with clients who have been diagnosed with a CVA. The Stroke Impact Scale (SIS) version 3.0 contains 59 items grouped into eight domains that include items addressing strength, hand function, activities of daily living (ADLs), instrumental activities of daily living (IADLs), mobility, communication, emotion, memory, thinking, and social participation.[28] The Stroke Specific Quality of Life Scale consists of 49 items divided into 12 domains: energy, family roles, language, mobility, mood, personality, self-care, social roles, thinking, upper extremity function, vision, and work/productivity.[105] Both scales are scored on a 5-point Likert scale.

The occupational therapist (OT) can observe the client for motor control dysfunction during assessment of ADLs and IADLs, and of productive and leisure activities. The therapist must observe how problems in motor control affect occupational performance while considering the client's sensation, perception, cognition, and medical status.

Standardized Activities of Daily Living Assessments for Motor Control

Many standardized ADL tests are available for assessing occupational performance and are useful for observing motor control. The Test d'Évaluation des Membres Supérieurs de Personnes Âgées (TEMPA) is an upper extremity functional activity performance test developed to help therapists distinguish between "normal and pathologic[al] aging in upper extremity performance."[27] Test items include picking up and moving a jar, writing on an envelope, tying a scarf, and handling coins, among others.

Several assessments have been designed to assess function after a CVA. These can be used to observe for motor control problems.

1. The Graded Wolf Motor Function Test[75] (GWMFT) was developed to measure functional gains after a hemiparetic event from a CVA or TBI. This test was based on the Wolf Motor Function Test.[16] It is called "graded" because there are two levels of difficulty for each task; level A is more advanced, and level B is easier. Gorman[45] investigated the interreliability and intrareliability of the GWMFT with a sample of eight physical therapists and three subjects. Intrarater and interrater reliability was .935 on the timing scores. Intrarater reliability was .897, and interrater reliability was .879 on the functional ability scores. This is a very useful test that can be used with a wide variety of clients with hemiparesis who have varying degrees of motor recovery. More research is needed to confirm the validity and reliability of this test.

2. The Wolf Motor Function Test (WMFT) has been and continues to be widely used to quantify the motor abilities of clients with chronic and persistent high levels of upper extremity dysfunction after a CVA or TBI.[1,91,107] It has an interrater reliability range of .95 to .97 (Fig. 19.8).

WOLF MOTOR FUNCTION TEST
DATA COLLECTION FORM

Subject's Name: ______________________________ Date: ________________

Test (check one): Pre-treatment ______ Post-treatment ______ Follow-up ______

Arm tested (check one): More-affected ______ Less-affected ______

Task	Time	Functional Ability	Comment
1. Forearm to table (side)		0 1 2 3 4 5	
2. Forearm to box (side)		0 1 2 3 4 5	
3. Extend elbow (side)		0 1 2 3 4 5	
4. Extend elbow (weight)		0 1 2 3 4 5	
5. Hand to table (front)		0 1 2 3 4 5	
6. Hand to box (front)		0 1 2 3 4 5	
7. Weight to box	______________	______________lbs.	
8. Reach and retrieve		0 1 2 3 4 5	
9. Lift can		0 1 2 3 4 5	
10. Lift pencil		0 1 2 3 4 5	
11. Lift paper clip		0 1 2 3 4 5	
12. Stack checkers		0 1 2 3 4 5	
13. Flip cards		0 1 2 3 4 5	
14. Grip strength	______________	______________kgs.	
15. Turn key in lock		0 1 2 3 4 5	
16. Fold towel		0 1 2 3 4 5	
17. Lift basket		0 1 2 3 4 5	

A

FUNCTIONAL ABILITY SCALE

0 – Does not attempt with upper extremity (UE) being tested.

1 – UE being tested does not participate functionally; however, attempt is made to use the UE. In unilateral tasks the UE not being tested may be used to move the UE being tested.

2 – Does, but requires assistance of the UE not being tested for minor readjustments or change of position, or requires more than two attempts to complete, or accomplishes very slowly. In bilateral tasks the UE being tested may serve only as a helper.

3 – Does, but movement is influenced to some degree by synergy or is performed slowly or with effort.

4 – Does; movement is close to normal,* but slightly slower; may lack precision, fine coordination or fluidity.

5 – Does; movement appears to be normal.*

*For the determination of normal, the less-involved UE can be utilized as an available index for comparison, with pre-morbid UE dominance taken into consideration.

B

FIG 19.8 Wolf Motor Function Test score sheet (A) and functional ability scale (B). (From Taub E, Morris DM, Crago J: *Wolf Motor Function Test [WMFT] manual,* revised 2011, University of Alabama at Birmingham CI Therapy Research Group. http://www.uab.edu/citherapy/.)

3. The Functional Test for the Hemiplegic/Paretic Upper Extremity[106] assesses the client's ability to use the involved arm for purposeful tasks. This test provides objective documentation of functional improvement and includes tasks ranging from those that involve basic stabilization to more difficult tasks requiring fine manipulation and proximal stabilization. Examples include holding a pouch, stabilizing a jar, wringing a rag, hooking and zipping a zipper, folding a sheet, and putting in a light bulb overhead.[106]

4. The Fugl-Meyer Assessment[62] (FMA) is based on the natural progression of neurological recovery after a CVA. Low scores on the FMA have been closely correlated with the presence of severe spasticity. Fugl-Meyer et al. developed a quantitative assessment of motor function after a stroke by measuring such parameters as range of motion (ROM), pain, sensation, and balance.[41a] Scores on the FMA correlate with ADL performance, and this tool is widely used to document upper extremity (UE) recovery after a CVA.[1,57,91,107]

5. The Arm Motor Ability Test[65] (AMAT) is a functional assessment of UE function. Cutting meat, making a sandwich, opening a jar, and putting on a **T**-shirt are some of the tasks included in this test. It has high interrater and test-retest reliability.

6. The Motricity Index[23] (MI) is a valid and reliable test of motor impairment that can be performed quickly. The test assesses the client's ability to pinch a cube with the index finger and thumb, in addition to elbow flexion, shoulder abduction, ankle dorsiflexion, knee extension, and hip flexion.

7. The Assessment of Motor and Process Skills (AMPS)[12] is a standardized test that assesses the quality of performance in ADLs, in addition to motor and process skills in ADLs and IADLs. The test was created by occupational therapists. Although this test is not diagnosis specific, it has been widely used with clients who have had a CVA. OT practitioners can become certified in the use of this test by completing a 5-day training course.[12]

As mentioned, after observing functional performance, the occupational therapist usually finds it necessary to assess the performance components that underlie motor control: muscle tone (normal/abnormal), the postural mechanism, muscle tone assessment/reflexes, sensation, and coordination.

Muscle Tone

Muscle tone is the resistance felt by the examiner as he or she passively moves a client's limb.[94] It is dependent on the integrity of peripheral and CNS mechanisms and the properties of muscle. It should be high enough to resist gravity, yet low enough to allow movement. The tension is determined partly by mechanical factors (eg, the connective tissue and viscoelastic properties of muscle) and partly by the degree of motor unit activity. When passively stretched, normal muscle offers a small amount of involuntary resistance.

Normal muscle tone relies on normal function of the cerebellum, motor cortex, basal ganglia, midbrain, vestibular system, spinal cord, and neuromuscular system (including the mechanical-elastic features of the muscle and connective tissues) and on a normally functioning stretch reflex. The stretch reflex is mediated by the muscle spindle, a sophisticated sensory receptor that continuously reports sensory information from muscles to the CNS.

Normal muscle tone varies from one individual to another. Within the range considered normal, the degree of normal tone depends on such factors as age, gender, and occupation. Normal muscle tone is characterized by a number of factors:

1. Effective coactivation (stabilization) at axial and proximal joints

2. Ability to move against gravity and resistance

3. Ability to maintain the position of the limb if it is placed passively by the examiner and then released

4. Balanced tone between agonistic and antagonistic muscles

5. Ease of ability to shift from stability to mobility and to reverse as needed

6. Ability to use muscles in groups or selectively with normal timing and coordination

7. Resilience or slight resistance in response to passive movement

Hypertonicity (increased tone) interferes with the performance of normal selective movement because it affects the timing and smoothness of agonist and antagonist muscle groups (see Chapters 31, 32, and 33). Normalization of muscle tone and amelioration of **paresis** (incomplete paralysis/weakness) are desirable when striving for selective motor control. Some function can be achieved even though tone may not be normal. **Plegia** is defined as complete paralysis.

Abnormal Muscle Tone

Abnormal muscle tone usually is described with the terms *flaccidity, hypotonus, hypertonus, spasticity,* and *rigidity.* To plan the appropriate intervention, the OT practitioner must recognize the differences among these tone states and must be able to identify these states during the clinical assessment.

Flaccidity

Flaccidity refers to the absence of tone. Deep tendon reflexes (DTRs) and active movement are absent. Flaccidity can result from spinal or cerebral shock immediately after a spinal or cerebral insult. With traumatic UMN lesions of cerebral or spinal origin, flaccidity usually is present initially and then often, but not always, changes to hypertonicity within a few weeks, depending on the location and amount of brain damage.

Flaccidity also can result from LMN dysfunction, such as peripheral nerve injury or disruption of the reflex arc at the alpha motor neuron level. The muscles feel soft and offer no resistance to passive movement. If the flaccid limb is moved passively, it will feel heavy. If moved to a given position and released, the limb will drop because the muscles are unable to resist the pull of gravity.[4]

Hypotonus

Hypotonus is considered by many to be a decrease in normal muscle tone (ie, low tone). DTRs are diminished or absent. Van der Meche and Van der Gijn[102] suggested that hypotonus could be an erroneous clinical concept. They performed electromyographic (EMG) analysis on the quadriceps muscles in "hypotonic" clients (eg, those with peripheral neuropathy, cerebral infarction, and other diagnoses) and in relaxed normal subjects in a lower leg free-fall test. They concluded that if a client's limb feels hypotonic or flaccid, this is the result of weakness, not of long-latency stretch reflexes.

Hypertonus

Hypertonus is increased muscle tone. Hypertonicity can occur when a lesion is present in the premotor cortex, the basal ganglia, or descending pathways. UMNs tend to have an inhibitory influence on LMNs. Damage to the UMNS has the effect of increasing stimulation of the LMNs, with resultant increased alpha motor activity. Any neurological condition that damages and compromises the function of the UMN pathways can directly or indirectly facilitate alpha motor neuron activity, which may result in hypertonicity. Other spinal or brainstem reflexes may become hyperactive, which leads to hypertonic patterns, such as flexor withdrawal or the dominance of primitive reflexes during movement activities.[33]

Hypertonicity often occurs in a synergistic neuromuscular pattern, particularly when seen after a CVA or TBI. Synergies are defined as patterned movement characterized by co-contraction of flexors or extensors. A typical synergy seen in the upper extremity after a CVA or TBI is a *flexion synergy*. The flexion synergy is shoulder adduction; internal rotation; elbow flexion; forearm pronation; wrist, finger, and thumb flexion; and thumb adduction. In contrast, an extension synergy is seen in the lower extremity.

For the client who has sustained damage to the UMNs, the energy cost of moving against hypertonicity is considerable. It takes a great deal of effort for clients with moderate to severe hypertonicity to move against this force. Antagonist power may be insufficient to overcome the spastic agonist muscle groups. Daniel, in the case study, had problems overcoming the pull of his spastic finger flexors with his weak finger extensors. Even clients with mild hypertonicity report frustration during functional activities. Loss of reciprocal inhibition is noted between spastic agonists and antagonists.[4] Clients are unable to rapidly and efficiently coordinate the activity between agonist and antagonist groups of muscles. The client with a UMN lesion will have dysfunction in spatial and temporal timing of movement. This makes his or her movements uncoordinated. This frustration, coupled with the fatigue, decreased dexterity, and paresis associated with UMNS, can influence therapy participation. Furthermore, the architecture of hypertonic muscles changes over time. The muscles lose their ability to lengthen and shorten because of viscoelastic changes that result from the hypertonia.[87]

Not everyone recovers full UE motor function after a CVA or TBI. Table 19.1 can help the OT practitioner to explain the stages of motor recovery to families, and to clarify that not all clients will progress through all seven stages. The table can be used for preparation for discharge, allowing the therapist to explain to the client and family that the client has reached a plateau in motor recovery.

Hypertonicity can increase as a result of painful or noxious stimuli. These stimuli often can be reduced with appropriate medical care. Stimuli that can increase tone include pressure sores, ingrown toenails, tight elastic straps on a urine collection leg bag, tight clothing, an obstructed catheter, a urinary tract infection, and fecal impaction. Other triggering factors include fear, anxiety, environmental temperature extremes, heterotopic ossification, and sensory overload. These triggering factors are seen in both cerebral and spinal hypertonicity; however, they are more pronounced in spinal hypertonia. Therapeutic intervention should be designed to reduce, eliminate, or cope with the various external factors.[77]

Clients with hypertonicity often have difficulty initiating movement, especially rapid movement. Although hypertonic muscles appear to be able to resist substantial external force (as in manual muscle testing), they do not function as normal, strong muscles. Through the mechanism of reciprocal inhibition, hypertonic muscles inhibit the activity of their antagonists and thus can mask potentially good or normal function of antagonists.[77] Four types of hypertonia are described in the following sections: cerebral hypertonia, spinal hypertonia, spasticity, and rigidity.

Cerebral Hypertonia

Cerebral hypertonia is caused by TBI, stroke, anoxia, neoplasms (brain tumors), metabolic disorders, cerebral palsy, and diseases of the brain. In multiple sclerosis, hypertonia is produced from both spinal and cerebral lesions. With cerebral hypertonia, muscle tone fluctuates continuously in response to extrinsic and intrinsic factors. Cerebral hypertonia usually occurs in definite patterns of flexion or extension, causing the limb to frequently assume and remain in a specific position (Fig. 19.9). Typically, these patterns occur in the antigravity muscles of the upper and lower extremities (eg, flexors of the upper extremities, extensors of the lower extremities).

FIG 19.9 A client with dystonia in his right index finger (extension). His left wrist shows severe hypertonicity. Tone abnormalities are the result of a traumatic brain injury.

The dominance of primitive reflexes and associated reactions alters postural tone. When an individual is supine, muscle tone is less than when the individual is sitting or standing. Tone is highest during ambulation. Thus, attention to postural tone is important when positioning a client for splinting or casting. A cast or splint fabricated on a client in a supine position may not fit when the client is sitting up because of the influence of gravity and posture on increasing muscle tone.[87]

Spinal Hypertonia

Spinal hypertonia results from injuries and diseases of the spinal cord. In slow-onset spinal disease (eg, spinal stenosis, tumor), there is no period of spinal shock. With a traumatic spinal cord injury, spinal shock occurs and is characterized by initial flaccidity. Over time (weeks or months), the flaccidity diminishes and hypertonia develops. The affected extremities first develop flexor and adductor tone. Over time, extensor tone develops and becomes predominant in the lower extremities. Spinal hypertonia can lead to muscle spasms severe enough to cause an individual to fall out of a wheelchair, off a gurney, or out of bed. The degree of hypertonicity in incomplete spinal lesions varies, depending on the degree of damage to the spinal cord. Tone tends to be more severe in individuals with incomplete spinal cord lesions than in those with complete lesions.[87]

Spasticity

According to Nance et al.,[77] the most commonly cited definition of **spasticity** is from the American Academy of Neurology: “Spasticity is a motor disorder that is characterized by a velocity dependent increase in tonic stretch reflexes (muscle tone) with exaggerated tendon jerks, resulting from hyperexcitability of the stretch reflex, as one component of the upper motor neuron syndrome.”[7]

Spasticity has two characteristics:

- *Velocity dependence:* The stretch reflex is elicited only by the examiner's rapid passive stretch.
- *Clasp-knife phenomenon:* When the examiner takes the extremity through a quick passive stretch, a sudden catch or resistance is felt, followed by a release of the resistance. What actually happens is that the initial high resistance felt by the therapist is due to spasticity and then the hypertonia is suddenly inhibited, allowing the extremity to be moved through the full passive range of motion.

One of the main CNS tracts involved in the pathophysiology of spasticity is the corticospinal tract. It is a major motor tract that originates from many areas in the cerebral cortex, including the cells of the prefrontal region, the cingulate gyrus, and the postcentral gyrus of the parietal lobe.[33]

Clonus.

Clonus is a specific type of spasticity. This condition often is present in clients with moderate to severe spasticity. Clonus is characterized by repetitive contractions in the antagonist muscles in response to rapid stretch. Recurrent bursts of Ia afferent activity result in a cyclical oscillation of phasic stretch reflexes. Clonus is seen most commonly in the finger flexors and ankle plantar flexors. The occurrence of clonus can interfere with participation in purposeful activity, transfers, and mobility. Therapists should educate clients and their families in how to use weight bearing actively because this usually stops the clonus. Therapists and physicians record clonus by counting the number of beats elicited after a quick stretch to an extremity, such as a quick stretch of the ankle plantar flexors or finger flexors. A 3-beat clonus can be rated as mild and is less likely to interfere with ADLs than a clonus of 10 beats or more. Clonus may be elicited during quick stretch tone evaluation or may become apparent during assessment of occupation (eg, grasping, ambulation, pushing the involved foot into a shoe). If clonus greatly interferes with ADLs, the client may be referred to a physiatrist or neurologist for oral medication, Botox[16] injection, Myobloc[76] injection, or phenol motor point block.[87]

Daniel is going to have a Botox injection in his flexor carpi ulnaris and ring finger flexor digitorum profundus to help reduce the spasticity in these muscles; this will help him work on finger and wrist extension ROM and strength.

Rigidity

Rigidity is a simultaneous increase in muscle tone of agonist and antagonist muscles (ie, muscles on both sides of the joint). Both groups of muscles contract steadily, leading to increased resistance to passive movement in any direction and throughout the ROM. Rigidity signals involvement of the extrapyramidal pathways in the circuitry of the basal ganglia, diencephalon, and brainstem. It occurs in isolated forms in disorders such as Parkinson's disease, TBI, some degenerative diseases, encephalitis, and tumors, and also after poisoning with certain toxins and carbon monoxide. Rigidity also is seen in conjunction with spasticity in individuals with stroke and TBI. Rigidity is not velocity dependent (ie, the tendon reflexes are not exaggerated, and no catch is felt upon quick stretch).[2]

Rigidity is evaluated during muscle tone evaluation and can be rated as mild, moderate, or severe. Four types of rigidity are commonly seen:

- Lead pipe rigidity
- Cogwheel rigidity
- Decorticate rigidity
- Decerebrate rigidity

Both lead pipe and cogwheel rigidity can occur in Parkinson's disease. In lead pipe rigidity, constant resistance is felt throughout the ROM when the part is moved slowly and passively in any direction, not unilaterally, as in spasticity. This rigidity feels similar to the bending of solder or a lead pipe (thus its name). In cogwheel rigidity, a rhythmic give in resistance occurs throughout the ROM, much like the feeling of turning a cogwheel. It is thought that cogwheel rigidity is lead pipe rigidity with concomitant tremor, which results in the ratchety pattern of movement.[73] DTRs are often normal or are only mildly increased in clients with Parkinson's rigidity.

Decerebrate and decorticate rigidity can occur after severe TBI with diffuse cerebral damage or anoxia. These abnormal postures occur immediately after injury and can last a few days or weeks if recovery occurs, or can persist indefinitely if there is little or no recovery.

Decerebrate rigidity results from lesions in the bilateral hemispheres of the diencephalon and midbrain. It appears as rigid extension posturing of all limbs and the neck. Bilateral cortical lesions can result in **decorticate rigidity,** which appears as flexion rigidity in the upper extremities and as extension rigidity in the lower extremities. Supine positioning increases the abnormal tone, and with either type of rigidity, it may be extremely difficult to position clients in a sitting position.

Seizures and Todd's Paralysis

OT practitioners will encounter clients with seizures. **Todd's paralysis** sometimes occurs after a seizure (postictal). It usually occurs on one side of the body and can affect speech and vision. It can last anywhere from 30 minutes to 36 hours. Occupational therapists may be asked to complete an ADL assessment and discharge recommendations if the paralysis/paresis has not completely resolved before the client is discharged. Physicians need to differentiate Todd's paralysis from a CVA, which it resembles, because a CVA requires different treatment.[100]

Muscle Tone Assessment

Objective assessment of muscle tone in the client with cerebral spasticity is difficult because the tone fluctuates continuously in response to extrinsic and intrinsic factors. The postural reflex mechanism, the position of the body and head in space, the position of the head in relation to the body, synergies, the presence of primitive reflexes, and associated reactions all influence the degree and distribution of abnormal muscle tone.[92]

Guidelines for Muscle Tone Assessment

The following steps describe correct procedures for assessing muscle tone.

1. It is helpful to rate spasticity and hypertonia with the client in the same position, preferably at the same time of day, to enhance reliability because the body and head position influence cerebral hypertonia. The client's upper extremity muscle tone usually is evaluated with the client sitting on a mat table when possible. Remember that the client's trunk posture (eg, seated, bearing weight symmetrically rather than slumped or leaning to one side) will affect the results of the tone evaluation. Tone fluctuates from hour to hour and from day to day because of intrinsic and extrinsic factors that influence it. This fluctuation makes accurate measurement difficult, particularly for cerebral hypertonia. Nevertheless, rating tone is still worthwhile, especially in the managed care environment, in which objective measures of progress are needed to justify the continuation of therapy.

2. Grasp the client's limb proximal and distal to the joint to be tested and move the joint slowly through its range to determine the free and easy ROM available. Note the presence and location of pain. If there is no active movement and if the limb feels heavy, record that the limb is flaccid or “0” in strength. If the limb has some active movement and no evidence of increased tone, the affected muscle or muscle group may be labeled “paretic” instead of “hypotonic.” The paretic antagonist muscle can then be graded in strength (usually the strength grade will fall between 1 and 4−). Grading the paretic antagonist muscles provides more objective clinical information than merely labeling the muscles as hypotonic. Strength-grading antagonists can help the occupational therapist triage candidates for phenol block and botulinum toxin type A or type B injection who have the potential to improve function; for example, a client with an elbow extension strength grade of 2− (in the presence of elbow flexor tone) would be a better block candidate than a client with a triceps strength grade of 0.

3. Hold the limb on the lateral aspects to avoid giving tactile stimulation to the belly of the muscle being tested.

4. Clinical assessment of spasticity involves holding the client's limb as just described and moving it rapidly through its full range while the client is relaxed. The easiest scale to use is the mild/moderate/severe scale. Some physicians find goniometric measurement of the location of the first tone helpful before and after long-acting nerve block. Record the findings for various muscle groups (see the tone rating scales in the next section.)

5. Clinical assessment of rigidity involves moving the limb slowly during the range, noting the location of first resistance to movement in degrees; label it mild, moderate, or severe.

OT Practice Notes

It is important to note the client's overall posture during evaluation of muscle tone. Is the client's posture symmetric, with equal weight bearing on both hips (if sitting) or on both feet (if standing)? Note how the client moves in general. Is the head aligned or tilted to one side? Is one shoulder elevated? Does the client have a forward head posture? Is the trunk rotated or elongated on one side and shortened on the other? Such postural deviations affect the client's ability to move the limbs functionally. Current intervention focuses heavily on quality of movement, achieving as normal motor control as possible during occupation.

Manual Rating Scales for Spasticity and Hypertonicity

Ashworth Scale

The Ashworth Scale[8] (Box 19.1) and the Modified Ashworth Scale[15] (MAS) are the two scales most widely used to manually rate spasticity. The literature reflects some controversy over the validity and reliability of these scales. Fleuren et al.[39] studied 30 clients with elbow flexion spasticity, correlating the Ashworth Scale with EMG studies, and concluded that the Ashworth Scale is not a reliable measure of spasticity.[39] Pandyan et al.[80,82] noted that the Ashworth Scale and the Modified Ashworth Scale should be used as an ordinal scale of resistance to passive movement, but that they are not valid for assessing spasticity.

Box 19.1

Ashworth Scale

0 = No increase in muscle tone

1 = Slight increase in muscle tone; "catch" when limb moved

2 = More marked increase in muscle tone, but limb easily flexed

3 = Considerable increase in muscle tone; passive movement difficult

4 = Limb rigid in flexion or extension

From Ashworth B: Preliminary trial of carisoprodol in multiple sclerosis, *Practitioner* 192:540, 1964.

Four studies have demonstrated that the MAS is a reliable scale for the assessment of spasticity[15,49,50]; four other studies have reported that it is not reliable.[5,13,38]

Therapists familiar with the Ashworth Scale or the MAS can help physicians evaluate candidates for neurosurgical procedures. For example, some of the selection criteria for implantation of the Synchromed Intrathecal Baclofen Pump (ITB)[72] are based on the occurrence of a point reduction, on either of the aforementioned scales, after administration of a test dose of medication; a 2-point reduction is required in spinal spasticity, and a 1-point reduction is required in cerebral spasticity.

Tardieu Scale

Both the Modified Tardieu Scale (MTS)[17] and the Tardieu Scale[53] measure spasticity.[40] The Tardieu Scale is written in French and has been shown to have excellent test-retest and interrater reliability, when used with inertial sensors, in assessing elbow flexor tone in patients with a CVA.[83] The MTS had an interrater reliability coefficient of .7 and was shown to be more reliable than the MAS.[47]

Mild/Moderate/Severe Spasticity Scale

Some therapists and physicians find a mild/moderate/severe scale easier to use than the scales just discussed. The scale in Box 19.2 is suggested as a guide for estimating the degree of spasticity.[36] The scale in Box 19.3 is suggested as a guide for estimating the extent of hypertonia.[85]

Box 19.2

Mild/Moderate/Severe Spasticity Scale

Mild: Stretch reflex (palpable catch) occurs at the muscle's end range (ie, the muscle is in a lengthened position).

Moderate: Stretch reflex (palpable catch) occurs in midrange.

Severe: Stretch reflex (palpable catch) occurs when the muscle is in a shortened range.

Farber S: *Neurorehabilitation: a multisensory approach*, Philadelphia, 1982, Saunders.

Box 19.3

Preston's Hypertonicity or Rigidity Scale

0	No abnormal tone is detected during slow, passive movement.
1 (mild)	First tone or resistance is felt when the muscle is in a lengthened position during slow, passive movement.
2 (moderate)	First tone or resistance is felt in the midrange of the muscle during slow, passive movement.
3 (severe)	First tone or resistance occurs when the muscle is in a shortened range during slow, passive movement.

Mechanical and Computer Rating Systems for Spasticity and Hypertonicity

Mechanically determined parameters for assessing hypertonia may be more reliable than the manual methods. McCrea et al.[70] concluded that using a linear spring-damper model to assess the hypertonic elbow was reliable and valid. This model is not widely used in clinical practice, nor even in research practice, because of time constraints and difficulty accessing certain muscle groups (eg, it is easier to set up and measure elbow hypertonia than hip hypertonia in a mechanical tone rating device).

Leonard et al.[68] investigated the construct validity of the Myotonometer (Neurogenic Technologies, Missoula, Montana), a computerized electronic device with a probe (resembling an ultrasound transducer) that is placed on top of the skin over the muscle belly. Measurements were taken over the biceps brachii at rest and during maximum voluntary muscle contraction. They revealed a significant difference between affected and unaffected extremities in subjects with UMN spasticity. The authors concluded that the Myotonometer could provide objective data about the tone reduction efficacy of various tone-reducing procedures.

Clearly, more research is needed in the areas of manual, mechanical, and computer rating systems for the assessment of hypertonia. Identification of a uniformly acceptable, reliable, and valid measure of spasticity continues to confound clinicians.

Range-of-Motion Assessment in Evaluation of Tone

Assessment of passive ROM (PROM) supplements and often correlates with tone assessment. For example, if a client with an acute CVA (1 month after onset) has a wrist ROM measurement of 20 degrees extension (normal, 70 degrees) and if orthopedic causes have been ruled out (eg, arthritis, fixed contracture), the therapist should assess the tone in the wrist flexors and the extrinsic finger flexors. Spasticity of any of these muscles can inhibit full wrist extension. Assessment of PROM can reveal possible signs of joint changes (eg, subluxation, dislocation, and contracture) resulting from chronic hypertonia, such as proximal interphalangeal joints (PIPs) that measure −45 degrees (extension) to 125 degrees (flexion) instead of 0/100 degrees (the norm). Some physicians find PROM measurements useful for documenting the location of the first tone, or resting position, before and after Botox[16] or Myobloc[76] injections.

Other Considerations in Tone Assessment

Changes in bone or other peripheral structures can lead to ROM limitations. For example, heterotopic ossification can limit joint ROM. Heterotopic ossification is the formation of new bone in soft tissue or joints, which can lead to pain and/or joint contracture. Heterotopic ossification can occur in individuals with TBI and spinal cord injury, along with severe spasticity, or with other types of severe injuries. Conversely, the presence of fixed contractures may be incorrectly labeled as hypertonia. Physiatrists and other physician specialists can aid in the diagnosis of contractures through the use of diagnostic short-term nerve blocks, EMG, and/or radiographs.[87]

Assessing Movement and Control

Along with the assessment of muscle tone, the occupational therapist performs an assessment of UE movement and control. The therapist identifies where and how much the client's motor control is dominated by synergies, and where selective, isolated movement is present. The degree to which abnormal tone interferes with selective control is identified. Also, identifying in which direction of movement spasticity occurs and how it affects function helps in determining the need for intervention.

Manual muscle testing usually is not appropriate for clients who show moderate to severe spasticity or rigidity because the relative tone and strength of the muscles are not normal, and movement is not voluntary or selective. Tone and strength are influenced by the position of the head and body in space, and by abnormal contraction, deficits in tactile and proprioceptive sensation, and impaired reciprocal inhibition. However, if hypertonia is mild and selective movements are possible, it is helpful to grade the strength of the antagonists to measure progress objectively.[87]

Sensation

The sensibility tests recommended for clients with CNS damage include static two-point discrimination, kinesthesia, proprioception, pain, and light touch using the Semmes-Weinstein monofilament test.[5] The therapist can assess light touch more accurately with the Semmes-Weinstein monofilaments because they provide better pressure control than a cotton ball (see Chapter 23 for the procedures for administering these sensory tests). If a client has a significant sensory impairment (ie, is unable to detect deep pressure or pain), the therapist must instruct the individual to watch his or her limb to help compensate for the sensory loss. Sensory impairment is one of the main reasons clients do not automatically use their neurologically impaired hand during ADL tasks. Another reason is unilateral neglect, also known as hemi-inattention.

Medical Assessment of Muscle Tone

Physiatrists, orthopedic surgeons, and neurologists are some of the physicians who may specialize in assessment of muscle tone. They may use static or dynamic surface or percutaneous (needle) EMG. Multiple channels are used in dynamic EMG to evaluate the hypertonicity of many contributing muscles. EMG helps the physician determine abnormal, excessive electrical activity in muscles. EMG can help physiatrists and neurologists plan and implement short- and long-acting nerve blocks to treat hypertonia.[87]

Normal Postural Mechanism

The **normal postural mechanism** is composed of automatic movements that provide an appropriate level of stability and mobility. These automatic reactions develop in the early years of life and allow for trunk control and mobility, head control, midline orientation of self, weight bearing and weight shifting in all directions, dynamic balance, and controlled voluntary limb movement. Components of the normal postural mechanism include normal postural tone and control, integration of primitive reflexes and mass movement patterns, righting reactions, equilibrium and protective reactions, and selective movement.

In clients with UMNS damage, the normal postural mechanism has been disrupted. Abnormal tone and synergistic patterns of movement dominate clients' movements, and these clients have impaired balance and stability. Movements are slow and uncoordinated. Therapists must assess the extent of damage to the postural mechanism in clients with CNS trauma or disease.

Normal postural tone allows automatic and continuous postural adjustment to movement. Postural control is the ability to control "the body's position in space for the dual purposes of stability and orientation."[4] It is important to assess the automatic righting, equilibrium, and protective reactions, which are part of the postural mechanism, in clients with CNS trauma or disease.

Righting Reactions

Righting reactions direct the head to an upright position. They help a person assume a standing position. Automatic reactions maintain and restore the normal position of the head in space and the normal relationship of the head to the trunk, in addition to the normal alignment of the trunk and limbs. Without effective righting reactions, the client will have difficulty getting up from the floor, getting out of bed, sitting up, and kneeling.[4]

Equilibrium Reactions

Equilibrium reactions help the individual sustain or keep a position. According to Ryerson,[92] they are the "first line of defense against falling." Equilibrium reactions, which are elicited by stimulation of the labyrinths in the inner ear, are used to maintain and regain balance in all activities. These reactions ensure sufficient postural alignment when the body's center of gravity is altered by a change in the supporting surface. Without equilibrium reactions, the client will have difficulty maintaining and recovering balance in all positions and activities.

Protective Reactions

Protective reactions are the second line of defense against falling if the equilibrium reactions cannot correct a balance perturbation. They consist of protective extension of the arms and hands, which is used to protect the head and face when an individual is falling. Stepping and hopping are examples of lower extremity protective reactions. Without protective reactions, the client may fall or may be reluctant to bear weight on the affected side during normal bilateral activities.[91]

Assessment of Righting, Equilibrium, and Protective Reactions and Balance

Formal testing of the righting, equilibrium, and protective reactions may be difficult because of the cognitive and physical limitations of the client or time constraints of the therapist. The therapist can evaluate righting reactions, however, during transfers and ADLs. Equilibrium and protective reactions can be observed when the client shifts farther out of midline than necessary during functional activities, such as lower extremity dressing.

Postural stability is also known as balance. Balance depends on normal equilibrium and protective reactions. Balance is the ability to maintain the center of mass over the base of support.[95] Balance involves the complex interaction of many systems, including the vestibular, proprioceptive, and visual systems, in addition to motor modulation from the cerebellum, basal ganglia, and cerebral cortex. Occupational and physical therapists must also observe the client's ankle, hip, and step strategies and note areas of breakdown in the kinetic chain.

When assessing a client with CNS dysfunction, the therapist should assess the client's static and dynamic balance before leaving the client unattended on a mat table, in a wheelchair, or during ambulatory ADLs. Dynamic balance involves maintaining balance while moving, and static balance involves maintaining equilibrium while stationary.

The Physical Performance Test assesses physical function during activity. Seven of the nine items in this assessment involve static and dynamic balance.[104] The test takes only 10 minutes to complete.[89] Fig. 19.10 shows the test form and test protocol. Four other noteworthy balance assessments are the Tinetti Balance Test of the Performance-Oriented Assessment of Mobility Problems[98] and the Berg Balance Scale.[11] The Berg Balance Scale is a good assessment for lower functioning clients (eg, those who are less ambulatory). Shumway-Cook[92] developed the Dynamic Gait Index (DGI) to assess balance with changes in task demands in ambulatory patients. It has been widely used with ambulatory clients who have been diagnosed with vestibular disorders, CVA, multiple sclerosis, or Parkinson's disease, and in the geriatric population. It is a reliable and valid test.[30] The Functional Gait Assessment (FGA) is another reliable and valid balance assessment.[109]

PHYSICAL PERFORMANCE TEST SCORING SHEET

		Time*	Physical Performance Test Scoring	Score
1.	Write a sentence (Whales live in the blue ocean.)	_______ sec	≤10 sec = 4 10.5-15 sec = 3 15.5-20 sec = 2 >20 sec = 1 unable = 0	_______
2.	Simulated eating	_______ sec	≤10 sec = 4 10.5-15 sec = 3 15.5-20 sec = 2 >20 sec = 1 unable = 0	_______
3.	Lift a book and put it on a shelf	_______ sec	≤2 sec = 4 2.5-4 sec = 3 4.5-6 sec = 2 >6 sec = 1 unable = 0	_______
4.	Put on and remove a jacket	_______ sec	≤10 sec = 4 10.5-15 sec = 3 15.5-20 sec = 2 >20 sec = 1 unable = 0	_______
5.	Pick up penny from floor	_______ sec	≤2 sec = 4 2.5-4 sec = 3 4.5-6 sec = 2 >6 sec = 1 unable = 0	_______
6.	Turn 360°	discontinuous steps continuous steps unsteady (grabs, staggers) steady	0 2 0 2	_______
7.	50-foot walk test	_______ sec	≤15 sec = 4 15.5-20 sec = 3 20.5-25 sec = 2 >25 sec = 1 unable = 0	_______
8.	Climb one flight of stairs	_______ sec	≤5 sec = 4 5.5-10 sec = 3 10.5-15 sec = 2 >15 sec = 1 unable = 0	_______
9.	Climb stairs†		Number of flights of stairs up and down (maximum 4)	_______

TOTAL SCORE (maximum 36 for nine-item, 28 for seven-item)

_______ nine-item
_______ seven-item

*For timed measurements, round to nearest 0.5 second.
†Omit for seven-item scoring.

FIG 19.10 Physical performance test scoring sheet. (From Reuben DB, Siu AL: An objective measure of physical function of elderly outpatients: the physical performance test, *J Am Geriatr Soc* 38:1111, 1990.)

Primitive Reflexes

Dominance of primitive reflex movement patterns can interfere with the client's occupational performance. Difficulties that may be encountered are described in the following sections.

Observation of these motor behaviors is a way of evaluating for the presence of primitive reflexes.

Brainstem-Level Reflexes

Asymmetric tonic neck reflex.

The asymmetric tonic neck reflex (ATNR) is tested with the client positioned supine or sitting.

- *Stimulus:* Actively or passively turn the client's head 90 degrees to one side.
- *Response:* An increase in the extensor tone of both extremities (upper and lower) on the face side, and an increase in the flexor tone of both extremities (upper and lower) on the skull side.[44]

Symmetric tonic neck reflex.

The symmetric tonic neck reflex (STNR) is tested with the client positioned sitting or quadruped.

- *Stimulus 1:* Flex the client's head and bring the chin toward the chest.
- *Response:* Flexion of the upper extremities and extension of the lower extremities.
- *Stimulus 2:* Extend the client's head.
- *Response:* Extension of the upper extremities and flexion of the lower extremities.[64]

Tonic labyrinthine reflex.

The tonic labyrinthine reflex (TLR) can be tested with the client supine with his or her head in midposition.

- *Stimulus:* The test position.
- *Response:* An increase in extension tone or extension of the extremities.

The TLR can also be tested with the client prone with the head in midposition.

- *Stimulus:* The test position.
- *Response:* An increase in flexor tone or flexion of the extremities.

Positive supporting reaction.

The positive supporting reaction is caused by pressure on the ball of the foot.

- *Stimulus:* Pressure on the ball of the foot.
- *Response:* Rigid extension of the lower extremities due to co-contraction of the flexors and extensors of the knee and hip joints. The practitioner may also see internal rotation of the hip, ankle plantar flexion, and foot inversion.[64]

Spinal-Level Reflexes

Spinal reflexes can occur after an UMN lesion. They appear because of lack of integration with higher centers. Some examples of exaggerated spinal reflexes are hyperactive DTRs, Babinski's sign, and the flexor withdrawal, crossed extension, and grasp reflexes.[58]

Crossed extension reflex.

The crossed extension reflex causes increased extensor tone in one leg when the other leg is flexed. Therefore, if the client with hemiplegia who is influenced by this reflex flexes the unaffected leg for walking, a strong extensor hypertonicity occurs in the affected leg and interferes with the normal pattern of ambulation.

Flexor withdrawal reflex.

The client with a flexor withdrawal reflex shows flexion of the ankle, knee, and hip when the sole of the foot is touched (swiped heel to ball of foot). This reflex clearly interferes with gait pattern and transfers.

Grasp reflex.

The client with a grasp reflex will not be able to release objects placed in the hand, even if active finger extension is present.

The flexor withdrawal, crossed extension, and grasp reflexes are rarely seen in isolation.[64]

Trunk Control Assessment

Collin and Wade[23] designed a quick and easily administered test of trunk control that is valid and reliable in clients with a diagnosis of CVA. It involves four timed tests: (1) rolling to the weak side, (2) rolling to the sound side, (3) moving from supine to sitting, and (4) sitting on the side of the bed with the feet off the floor for 30 seconds.

To accurately assess trunk control, the therapist must evaluate strength and control in four muscle groups—the trunk flexors, the extensors, the lateral flexors, and the rotators. For all the tests, the client should be sitting upright on a mat table with the feet supported. Remember that the client should not be left unattended on the mat table until the therapist determines that he or she has adequate trunk control and sitting balance. The procedures described in the following sections are condensed from Gillen's *Stroke Rehabilitation: A Function-Based Approach.*[42]

Trunk Flexors

The examiner asks the client to sit upright, to slowly move his or her shoulders behind the hips (eccentric control), and to hold the end-range posture (isometric control) (Fig. 19.11A). The client then is asked to move forward (concentric control) to resume the initial upright posture (Fig. 19.11B).

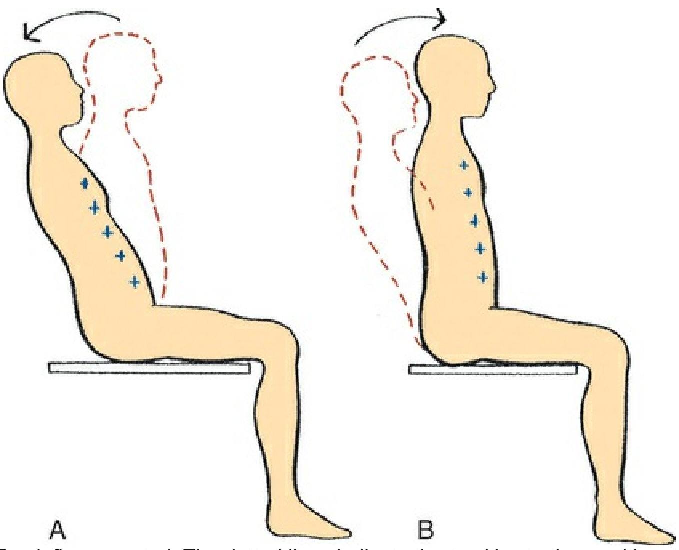

FIG 19.11 Trunk flexor control. The dotted lines indicate the trunk's starting position; the solid lines indicate the trunk's final position. The arrows indicate the direction of movement, and the plus symbols indicate the muscle groups primarily responsible for control of the pattern. Skeletal muscle activity occurs on both sides of the trunk (reciprocal innervation). (From Gillen G, Burkhardt A: *Stroke rehabilitation: a function-based approach,* ed 4, St Louis, 2015, Elsevier/Mosby.)

The examiner should observe for evidence of unilateral weakness, potential for falls, and symmetry of weight shift. A functional test for trunk flexor control is to observe the client move from supine to sitting.

Trunk Extensors

Test 1.

The client sits in a position of spinal flexion with a posterior pelvic tilt and moves into trunk extension while simultaneously moving the pelvis into neutral or into a slight anterior tilt. This test assesses concentric trunk extensor control, which is a prerequisite for lower extremity dressing and forward reach (Fig. 19.12A).

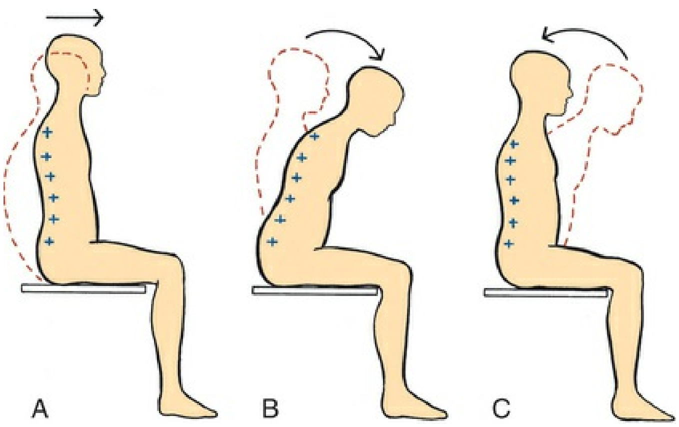

FIG 19.12 Trunk extensor control. The dotted lines indicate the trunk's starting position; the solid lines indicate the trunk's final position. The arrows indicate the direction of movement, and the plus symbols indicate the muscle groups primarily responsible for control of the pattern. Skeletal muscle activity occurs on both sides of the trunk (reciprocal innervation). (From Gillen G, Burkhardt A: *Stroke rehabilitation: a function-based approach,* ed 4, St Louis, 2015, Elsevier/Mosby.)

Test 2.

The client is seated in an upright posture. The examiner asks the client to maintain an erect spine and lean forward. This test evaluates eccentric trunk extensor control (Fig. 19.12B).

For both trunk extensor tests, the examiner should observe for signs of unilateral weakness and note end-range control.

Test 3.

The client is asked to move his or her shoulders back to assume a seated, aligned, upright position. The trunk extensors are contracting concentrically (Fig. 19.12C).

Lateral Flexors

The client sits in an upright posture. The pelvis is stationary, and the upper trunk laterally flexes toward the mat table. Fig. 19.13 shows eccentric contraction of the left side and muscle shortening of the right side. The client is asked to return to the original test position (concentric control of the left side) (Fig. 19.13).

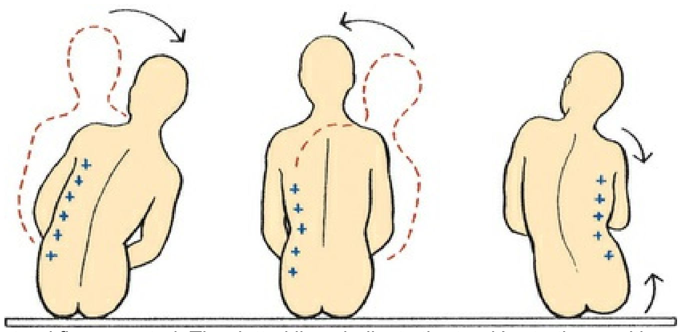

FIG 19.13 Lateral flexor control. The dotted lines indicate the trunk's starting position; the solid lines indicate the trunk's final position. The arrows indicate the direction of movement, and the plus symbols indicate the muscle groups primarily responsible for control of the pattern. Skeletal muscle activity occurs on both sides of the trunk (reciprocal innervation). (From Gillen G, Burkhardt A: *Stroke rehabilitation: a function-based approach*, ed 4, St Louis, 2015, Elsevier/Mosby.)

Fig. 19.13 shows assessment of trunk and pelvis lateral flexion, in which movement is initiated from the lower trunk and pelvis. The end position is one of trunk elongation on the weight-bearing side and shortening on the non-weight-bearing side, which involves concentric contraction of the right side.

Lateral flexion is needed for fall prevention when a client is reaching to the side (eg, shutting a car door).[36]

Trunk Rotation

The primary muscles responsible for rotation are the obliques. When a person rotates the trunk to the left, the right external and the left internal obliques are recruited. Rotational control is a prerequisite for upper extremity dressing and reaching across the midline. Three movement patterns are evaluated.

1. The client sits upright with the pelvis in a neutral, stable position. The client reaches with his or her right arm, across the body, in the direction of the floor. This motion helps in assessment of concurrent flexion and rotation. The motion tests concentric control of the obliques and the back extensors (particularly the thoracic region). Both sides need to be tested.

2. The second movement pattern involves trunk extension with rotation. The upper trunk remains stable, and the lower trunk and pelvis move forward on one side (ie, shifting forward). Again, both sides are tested.

3. The client is positioned supine for the third movement. Farber[36] described this as the client initiating a "segmental roll by lifting the shoulders from the support surface and toward the opposite side of the body. This pattern is controlled by a concentric contraction of the abdominals (obliques)."

Coordination

Coordination is the ability to produce accurate, controlled movement. Characteristics of coordinated movement include smoothness, rhythm, appropriate speed, refinement to the minimum number of muscle groups needed, and appropriate muscle tension, postural tone, and equilibrium. Coordination of muscle action is under the control of the cerebellum and is influenced by the extrapyramidal system.

For coordinated movement, all elements of the neuromuscular mechanism must be intact. Coordinated movement depends on contraction of the correct agonist muscles with simultaneous relaxation of the correct antagonist muscles, together with contraction of the joint fixator and synergist muscles. Other functions that must be intact include proprioception, body scheme, and the ability to judge space accurately and to direct body parts through space, with correct timing, to the desired target.

Incoordination

Many types of lesions can produce disturbances in coordination. Disturbances in coordination often stem from cerebellar and extrapyramidal disorders. Noncerebellar causes include diseases and injuries of muscles and peripheral nerves, lesions of the posterior columns of the spinal cord, and lesions of the frontal and postcentral cerebral cortex.[32]

Cerebellar Disorders

Cerebellar dysfunction can cause incoordination that may affect any body region and cause a variety of clinical symptoms. For example, the client may have postural difficulties that include slouching or leaning positions (caused by bilateral lesions) or spinal curvature (caused by unilateral lesions) and wide-based standing. Eye movements, both voluntary and reflexive, may be affected, as may the resting position of the eye.[73] One interesting fact about the cerebellum is that lesions or disease in one cerebellar hemisphere show signs of impairment on the same side of the body (ipsilateral).[3] Common signs of cerebellar dysfunction that the therapist may encounter include ataxia, dysdiadochokinesis, dysmetria, dyssynergia or asynergia, nystagmus, and dysarthria.

Ataxia

Ataxia is manifested as delayed initiation of movement responses, errors in range and force of movement, and errors in the rate and regularity of movement. Poor coordination is noted between the agonist and antagonist muscle groups. This results in jerky, poorly controlled movements. When a client with ataxia reaches for an object, it is apparent that the shortest distance between the client and the object is not a straight line. The client with gait ataxia has a staggering, wide-based gait with reduced or no arm swing. The person is unable to tandem walk (heel to toe); step length may be uneven; and the client may have a tendency to fall.[34] The client with cerebellar dysfunction isolated to one cerebellar hemisphere will have a tendency to fall on the side of the lesion or dysfunction because of the ipsilateral (same side) influence of the cerebellum on the lower motor neurons.

Many ataxias are hereditary and are classified by chromosomal location and type of inheritance: autosomal dominant, in which the affected client inherits a normal gene from one parent and a faulty gene from the other parent; or autosomal recessive, in which both parents pass on the faulty gene. Two of the more common inherited ataxias are Friedreich's ataxia and Machado-Joseph disease. Ataxia can also be acquired. Conditions that can cause acquired ataxia include stroke, multiple sclerosis, tumors, alcoholism, peripheral neuropathy, metabolic disorders, and vitamin deficiencies.[79]

Dysdiadochokinesis

Dysdiadochokinesis is an inability to perform rapid alternating movements, such as pronation and supination or elbow flexion and extension. There is a breakup and irregularity that happens when the client attempts to perform these movements.[34] This author tests this by counting how many cycles a client can perform in a 10-second time frame. A cycle consists of one full repetition of supination and pronation. It is best to test the unaffected (or lesser affected) side first. The affected side is then compared with the unaffected side.[84]

Dysmetria

Dysmetria is an inability to estimate the ROM necessary to reach the target of movement. The target is missed. The two types of dysmetria are hypermetria, in which the limb overshoots the target, and hypometria, in which the limb undershoots the target.

Dyssynergia or Asynergia

Literally, dyssynergia is a decomposition of movement in which voluntary movements are broken up into their component parts and appear jerky. Dyssynergia is one of the main clinical signs of cerebellar dysfunction or lesions involving pathways to and from the cerebellum.[34]

Nystagmus

Nystagmus is an involuntary movement of the eyeballs in an up-and-down (vertical), back-and-forth (horizontal), or rotating direction. It interferes with head control and fine adjustments required for balance. Nystagmus can be induced by specific procedures, but induced nystagmus is typically brief in neurotypical clients (eg, nystagmus is observed for a few seconds after quickly spinning the person around several times and then stopping the motion). Nystagmus can also occur as a result of vestibular system, brainstem, or cerebellar lesions or dysfunction.[3] When nystagmus occurs after a CNS lesion or dysfunction, it is typically sustained for a longer time and with a larger excursion or movement range of the eyeball in the socket. This can significantly disrupt an individual's functional performance.

Dysarthria

Dysarthria is explosive or slurred speech caused by incoordination of the speech mechanism. The client's speech may also vary in pitch or may seem nasal and tremulous, or both.[26]

Extrapyramidal Disorders

Extrapyramidal disorders are characterized by hypokinesia (small movement) or hyperkinesia (exaggerated movement). Hypokinesia examples are discussed first. Parkinson's disease is characterized by hypokinesia, bradykinesia (slow movement), cogwheel and lead pipe rigidity, a decrease in or loss of postural mechanisms, and a resting, pill-rolling tremor.[35]

Parkinson's plus is the name given to a group of **movement disorders** that have signs of Parkinson's disease with concomitant neurological deficits. Progressive supranuclear palsy (PSP) is an example of a Parkinson's plus disorder. Clients affected with PSP have loss of vertical ocular gaze, balance dysfunction, rigidity of the neck and trunk muscles, dementia, and usually absence of tremor. The life expectancy is shorter than in Parkinson's disease; death often occurs within 6 to 10 years.[48]

Chorea

Chorea is characterized by irregular, purposeless, quick movements. They are not movements that occur in a regular pattern, such as the alternating movement seen with clonus, nor is chorea as quick as clonus. The jerky movements randomly flow from one muscle to another. Chorea usually stems from disorders in the caudate nucleus.[34] These movements may occur during sleep.[26] Two diagnoses often present with chorea: tardive dyskinesia (TD) and Huntington's disease. TD is a drug-induced disorder, often associated with neuroleptic drug use. Occupational therapists may see clients who have TD in psychiatric settings. It also can occur as a side effect of certain medications for Parkinson's disease. Huntington's disease is an inherited, autosomal dominant disease. Clients with Huntington's disease have chorea that compromises functional movement (eg, walking) or tasks that require fine coordination of movements. As the disease progresses, rigidity develops.

Athetoid Movements

Athetoid movements are continuous, slow, writhing, arrhythmic movements that primarily affect the distal portions of the extremities. These movements are not present during sleep. Adult athetosis can occur after cerebral anoxia and with Wilson's disease. Movement patterns include alternating extension and flexion of the arm, supination and pronation of the forearm, and flexion and extension of the fingers. Athetosis that occurs with chorea is called *choreoathetosis.*

Dystonia

Dystonia results in sustained muscle contraction of the extremities (eg, hyperextension or hyperflexion of the wrist and fingers), often with concurrent torsion of the spine and associated twisting of the trunk.[34] Dystonic movements are often continuous and often seen in conjunction with spasticity. The client in Fig. 19.14 sustained a TBI, and his right wrist and fingers show dystonia. Dystonia can be primary or secondary, the latter occurring with other CNS disorders (eg, hypoxic brain injury, tumor). Segmental dystonia involves two or more adjacent body parts. Generalized and multifocal types of dystonia also exist. Focal dystonia involves only one limb, as is seen in writer's cramp, musician's cramp, and spasmodic torticollis.[32]

FIG 19.14 A client with right upper extremity dystonic posturing of the wrist and finger extensors. His left wrist shows severe hypotonicity. Tone abnormalities are the result of a traumatic brain injury.

Ballism

Ballism is a rare symptom produced by continuous, abrupt contractions of the axial and proximal musculature of the extremity. Ballism causes the limb to fly out suddenly, with a much greater amplitude than chorea. It occurs on one side of the body (hemiballism) and is caused by lesions of the opposite subthalamic nucleus.

Tremor

Tremors stem from alternating contractions of opposing muscle groups. They are rhythmic. oscillatory movements. There are three common types of tremor.

- *Action tremor,* formerly known as intention tremor associated with cerebellar disease, occurs during voluntary, intentional movement. It is intensified at the termination of the movement and is often seen in multiple sclerosis. The client with action tremor may have trouble performing tasks that require accuracy and precision of limb placement (eg, drinking from a cup, inserting a key into a lock).
- *Resting tremor* occurs at rest and subsides when voluntary movement is attempted. It occurs as a result of damage to or disease of the basal ganglia and is seen in Parkinson's disease.[34]
- *Essential familial tremor* is inherited as an autosomal dominant trait. It is most visible when the client is carrying out a fine precision task, such as writing or pouring liquids. The pathophysiology is not known. This is the most common movement disorder.[32]

Assessment of Coordination

Medical Assessment of Coordination

Incoordination consists of errors in rate, rhythm, range, direction, and force of movement. Therefore, observation is an important element of the clinical examination. The neurological examination for incoordination may include the nose-finger-nose test; the finger-nose test; the heel-knee test; the knee pat (pronation-supination), hand pat, and foot pat tests; finger wiggling; and drawing a spiral. Such tests can reveal dysmetria, dyssynergia, adiadochokinesis, tremors, and ataxia. Usually the neurologist or the physiatrist performs these examinations. Magnetic resonance imaging (MRI) and computed tomography (CT) scans also may be ordered. Infrequently EMG is used to better characterize the frequency and pattern of the tremor. For example, the rate of the resting tremor often seen in a client with Parkinson's disease is 3 to 5 per second. A faster or slower tremor effectively rules out this condition.[51]

Occupational Therapy Assessment of Coordination

Selected activities and specific performance tests can reveal the effects of incoordination on function. The occupational therapist can observe for coordination difficulties during ADL assessment by observing the client write, open containers, or button a garment. The therapist should observe for irregularity in the speed of movement. Movement during the performance of various activities may appear irregular and jerky and may overreach the mark. The following general guidelines and questions can be used when evaluating incoordination.

1. Assess muscle tone and joint mobility first in a sitting position.

2. Observe for ataxia, proximal to distal, during functional upper extremity movement. Are movements away from or toward the body more difficult for the client?

3. Stabilize joints proximally to distally during the functional task, and note differences in client performance compared with performance without stabilization. (Stabilization can be attained by splinting, holding the wrist stable with the other hand, or stabilizing the affected body part against a wall.) Weighted cuffs may be applied to the extremity during task performance to determine whether weighting or resistance reduces the tremor. Note the amount of resistance provided. Observe whether the cuff weights make the coordination worse because sometimes the use of weights increases tremor.

4. Observe for tremor. Are the head and speech affected by the tremor?

5. How do the client's ataxia and coordination problems affect participation in occupation?

Perform an occupational profile, in addition to a performance patterns interview, to ask about the client's roles, routines, goals, and environment to determine which activities are important for the client.

Numerous standardized tests of motor function and manual dexterity are available and can be administered to evaluate coordination. These tests include the Purdue Pegboard,[88] the Minnesota Rate of Manipulation Test,[74] the Bennett Hand Tool Test,[10] the Jebsen-Taylor Hand Function Test,[60] and the 9-Hole Peg Test.[69]

Standardized functional assessments for a CVA (eg, the WMFT), mentioned earlier, may be useful for measuring the efficacy of OT intervention for impaired coordination.[14]

Occupational Therapy Intervention

Intervention for Hypertonicity and Spasticity

Hypertonicity is only one part of the UMNS. It is very important to treat other performance deficits of the UMNS, such as paresis, fatigue, and decreased dexterity. These deficits can impede function to a greater extent than hypertonia.[32]

Before treating hypertonia, the therapist and physician need to closely evaluate the function of the tone. Hypertonicity can have beneficial effects, such as aiding in standing and transfers, maintaining muscle bulk, and preventing deep vein thrombosis, osteoporosis, and edema. Intervention is necessary when spasticity interferes with ADLs, gait, sleep, or wheelchair positioning, or when it causes severe pain and limits hygiene (eg, the client is unable to wash the hand or axilla) or leads to contractures or decubitus ulcers. Hypertonicity or spasticity may be treated with conservative therapeutic interventions, pharmacologic agents, or surgery.[32,87]

Conservative Treatment Approaches

Weight bearing.

For hypertonicity reduction and paresis remediation in the upper extremity, therapists have been using weight-bearing skills and activities for many years with clients who have UMN lesions, but evidence of treatment efficacy has not been fully established.

Brouwer and Ambury[18] concluded that corticospinal facilitation of motor units occurred during upper extremity weight bearing. They believed that afferent input from weight bearing increased motor cortical excitability. Chakerain and Larson[21] studied the effects of upper extremity weight bearing on hand opening and prehension in children with spastic cerebral palsy. Computer calculations of clients' hand surface area were performed. An increase in surface area was noted after weight bearing, along with an increase in the maturity of movement components needed for prehension. McIlroy and Maki[71] demonstrated that if the affected arm is used when weight bearing, postural responses occur throughout the weight-bearing extremity and during other perturbations of posture.

Despite the fact that few well-controlled studies document how and why weight bearing works physiologically, it certainly is a requirement for improving functional performance. Seated clients who reach to the floor to pick up an object need upper extremity postural support to prevent them from falling. Standing clients who reach into a high cabinet need upper extremity weight bearing to facilitate balance.[42]

Traditional Sensorimotor Approaches

Proprioceptive neuromuscular facilitation (PNF) has been shown to be effective in gaining motor control for clients with a variety of diagnoses (see Chapter 31).[92] The Neuro-Developmental Treatment (NDT) Association[56a] has stated that therapists who follow an NDT approach:

- Perform an in-depth analysis of the intricacies of movement and of how the details relate to the whole to allow for functional movement in a wide variety of environments.
- Believe that control of movement is based on a complex interaction of many body systems, which are plastic and adaptable, and on the tasks presented and the environments in which the tasks are performed. Therefore, function can be altered by changing one or more of these elements.
- Implement an understanding of the development of atypical movement, in addition to the compensations, to help minimize the impact of CNS pathology and prevent the emergence of contractures and deformities, which contribute to the functional problems.

Another OT objective is to have the client manage muscle tone to engage in and complete basic ADLs (BADLs) and IADLs. Positioning and movement in patterns opposite to hypertonic or synergistic patterns are important to expand the motor repertoire and develop movement that is as close to normal as possible. At times it is appropriate to facilitate synergistic movements in the client with chronic disease, or if the client does not recover beyond stage 3 of the Modified Brunnstrom's Stages of Motor Recovery (see Table 19.1 and Fig. 19.3). The synergy patterns can be facilitated to improve lateral pinch or elbow flexion function. The client should also be taught how to incorporate the affected upper extremity as much as possible into BADLs and IADLs. (See Chapter 10 for a more detailed review of traditional treatment strategies.)

Even when motor control is adequate for participation in occupation, the sensory, cognitive, and perceptual abilities of the client may affect the achievement of functional goals. Perceptual dysfunction may alter the client's abilities, requiring the therapist to focus on perceptual training concurrently.

Casting.

In some cases unilateral hypertonicity is severe enough to necessitate serial inhibitive casting or splinting. Casting in inhibitive postures has been shown to be effective in tone reduction.[44] The beneficial effect of casting on hypertonia and upper extremity contractures has been well documented in the literature.[13,33]

Casting in inhibitive postures is effective because it provides neutral warmth, maintained pressure, and constant joint positioning with static lengthening of muscle. **Serial casting** is most successful when a contracture has been present for less than 6 months. The cast may be bivalved (cut in half) and worn as a splint. This helps protect the skin and allows the therapist to work with the extremity out of the cast. However, many clinicians believe that a nonbivalved cast is more effective and actually causes less skin breakdown. A dropout cast, which can be used as part of the serial casting process, includes a cutout area, allowing movement of the joint in the desired direction. For example, for an elbow with flexor hypertonicity, the dorsal upper arm portion of a long arm cast can be cut out to allow the triceps to be facilitated to extend the arm.

Serial casting should stop when the desired position has been achieved and tone is manageable with the last cast or splint. If no evidence of increased PROM is seen after two or three casts have been removed, serial casting must stop; however, the last cast should be kept, bivalved, and used as a "retainer" splint to prevent additional contractures, similar to retainer use in orthodontics.

Many innovations have occurred in commercially available spasticity reduction splints that are used to place the wrist and hand in inhibitive postures. The client and the family need to be educated on continuing to incorporate the extremity in occupation and on bearing weight on the extremity as much as possible to retain the ROM gains achieved during casting.[43,87]

Physical Agent Modalities

Physical agent modalities, such as cold, superficial heat, ultrasound, and neuromuscular electrical stimulation, can be used as preparation for or in conjunction with purposeful activity and muscle reeducation, provided the OT practitioner has the appropriate training and meets the license criteria for his or her state or country. Ultrasound can help inhibit or reduce hypertonicity temporarily and can increase tendon and muscle extensibility. It is helpful to provide concurrent stretch during the ultrasound procedure. Even though neuromuscular electrical stimulation has been shown to strengthen paretic muscles,[20,54] more research needs to be done. Quandt and Hummel[89] reached this conclusion after completing a comprehensive review on the effect of functional electrical stimulation on hand motor recovery after a CVA.

Distal-to-Proximal Approach

The Functional Tone Management (FTM) Arm Training Program (Saebo, Charlotte, North Carolina) was developed to address the weaknesses of therapeutic interventions currently applied to the neurologically impaired upper extremity and hand. The occupational therapists who founded Saebo theorized that because grasp and release capabilities are pivotal to reintegrating the UE into daily activities, a paradigm shift for UE neurological rehabilitation was needed. Although traditional therapeutic interventions such as Bobath-based (NDT) programs are based on a proximal-to-distal recovery pattern, Saebo developed the FTM Arm Training Program on the basis of a distal activation model, which focused on the key point of early initiation of UE movements that incorporate grasp and release. To incorporate the hand into the FTM Arm Training Program, Saebo developed a dynamic orthosis for the hand and elbow, called the SaeboReach (Fig. 19.15).

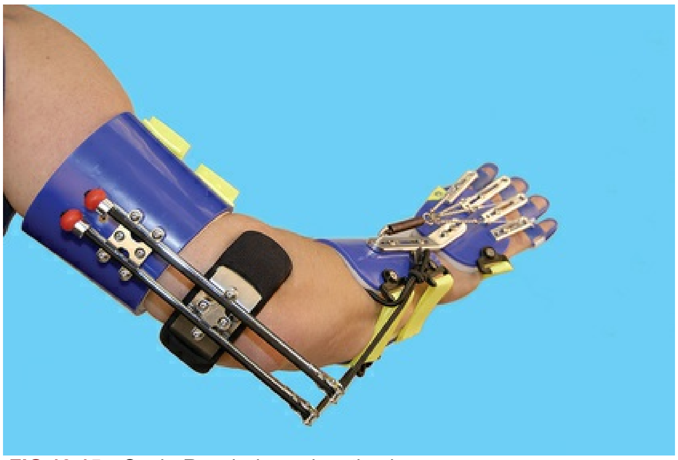

FIG 19.15 SaeboReach dynamic orthosis. (Courtesy Saebo, Charlotte, NC.)

The SaeboReach orthosis assists an individual with hypertonia in the hand to place the hand in an open, functional position. This positioning is accomplished by means of a fixed wrist support and a finger and thumb spring system of variable strength. Once the hand is open, the client can begin to retrain the finger flexors for improved motor control of the hand. While wearing the SaeboReach, the client relearns to produce a graded muscle contraction of the finger flexors to grasp an object. The finger and thumb spring system, coupled with the client's own efforts to relax muscle activation, allows the hand to open enough for the object held in the hand to be released while assisting the elbow extensors.

The SaeboGlove's lightweight, low-profile design assists with finger and thumb extension in clients with neurological or orthopedic problems. The SaeboGlove positions the wrist and fingers into extension in preparation for functional activities. The client grasps an object by voluntarily flexing the fingers. The extension system assists with reopening of the hand to release the object (Fig. 19.16).

FIG 19.16 SaeboGlove. (Courtesy Saebo, Charlotte, NC.)

Once the client is comfortable using the SaeboReach, the FTM Arm Training Program can begin. The FTM program combines high-repetition grasp and release with task-specific arm training drills to progress the client toward a functional goal. A body of research supports the FTM Arm Training Program; however, this program does not require the wrist or finger extension typically needed for participation in a constraint-induced program. Clinically observed improvements with use of the SaeboFlex (hand and wrist splint only) for 1 hour per day, 5 days per week, were improved scores on the Fugl-Meyer Assessment and the Box and Blocks test.[108] Another study of the SaeboFlex involving eight clients found that 7 of the 8 showed improved test scores on the upper limb Motricity Index after using the SaeboFlex for 12 weeks.[98]

Surgical Methods

Surgery to control hypertonicity is an option. Dynamic EMG can help orthopedic surgeons plan surgery. Orthopedic surgical intervention can improve function or release contractures. Examples of UE functional surgery include lengthening of the biceps tendon to reduce elbow flexion and to gain elbow extension; thumb-in-palm release; and transfer of the flexor carpi ulnaris tendon to the extensor carpi radialis longus or brevis tendon to reduce the deforming force of wrist flexion while simultaneously augmenting wrist extension. An example of a contracture release procedure is the flexor digitorum superficialis–to–profundus transfer to gain length in the extrinsic finger flexors.[63]

Therapists will encounter clients with severe spasticity who have undergone a neurosurgical procedure called **intrathecal baclofen pump** (ITB) implantation. This procedure enables baclofen, a spasticity-reducing medication, to enter the body at the spinal level, preventing the centrally mediated side effects of oral baclofen. The ITB dispenses the baclofen directly into the intrathecal (subarachnoid) space via a catheter attached to a subcutaneous implantable pump in the abdomen. The client must undergo a lumbar puncture test dose of intrathecal baclofen to determine candidacy before pump implantation. A 2-point lower limb spasticity reduction on the Ashworth Scale or MAS is needed for spinal spasticity, and a 1-point reduction is required for cerebral spasticity.[72]

The ITB has been shown to be very effective in reducing severe spinal spasticity and spasticity associated with multiple sclerosis, and it is also effective for cerebral spasticity. For additional details on medical and surgical treatments and their relation to occupational therapy, see Preston and Hecht's *Spasticity Management: Rehabilitation Strategies.*[87]

Pharmacological Agents

Pharmacological agents prescribed and administered by physicians include oral medications, short-term nerve blocks, and long-term blocks.

Clients with severe hypertonicity accompanied by severe pain may need evaluation to determine the cause of the pain. Drug therapy and other pain management techniques may be part of the treatment approach. The four commonly used oral medications for spasticity of UMN origin are baclofen, dantrolene sodium, tizanidine, and diazepam. These medications are generally well tolerated, but a common side effect is drowsiness. Dantrolene sodium acts at the skeletal muscle. It is preferred in cerebral spasticity because it is less apt to cause sedation, but it can cause weakness and liver damage. Tizanidine HCl is labeled for spasticity reduction in multiple sclerosis and spinal cord injury. Its side effects may include hypotension, sedation, and visual hallucinations. Side effects of diazepam include drowsiness, fatigue, and possible dependency. Neither diazepam nor baclofen can be discontinued suddenly because doing so may cause seizures.

Three antiepileptic drugs have been used off label for spasticity: pregabalin (Lyrica), topiramate (Topamax) and gabapentin (Neurontin).[77]

No matter which drug is used, it is crucial for the OT practitioner to alert the medical staff to any side effects that may interfere with the client's overall function.[77,87]

Nerve blocks and motor point blocks consist of injections of a chemical agent to diminish or obliterate tone. Short- and long-term blocks may be used. Short-term blocks are injections of an anesthetic (eg, bupivacaine) to temporarily reduce pain and muscle tone. Short-term blocks help the physician differentiate between hypertonus and contracture. Short-term blocks last 1 to 7 hours, depending on which anesthetic is used.[86]

Long-term blocks, which usually consist of injections of phenol or botulinum toxin type A (Botox) or botulinum toxin type B (Myobloc), generally last several months. Botox lasts for 2 to 5 months with spastic hypertonia. Botulinum toxin type B has been shown to diminish the negative effects of cervical dystonia for 12 to 16 weeks. Phenol blocks last 2 to 8 months, depending on whether the motor points (2 to 3 months) or the motor branch (8 months) is injected.[22,42]

Phenol and the botulinum toxins type A and type B have different mechanisms of action. Botulinum toxins type A and type B exert their effects by means of chemical denervation, whereas phenol works by means of motor point or motor branch neurolysis. All three types of blocks can be used to diminish or obliterate hypertonicity in the agonist.

Long-term blocks help prevent contractures and render the hypertonic muscle weak or flaccid. The effect and time interval of the long-term block give therapists the opportunity to increase antagonistic strength and function. A combination of long-acting blocks and casting or splinting is often used to treat hypertonicity. Long-term blocks in the upper extremities are commonly used in the subscapularis, brachioradialis, and flexor digitorum profundus.[87]

Hsu et al.[57] studied a 52-year-old client who had spastic hypertonia after a CVA. Botulinum toxin type A was injected into the elbow, wrist, and finger flexors; this treatment was combined with a 4-week program of modified constraint-induced movement therapy (CIMT) and a 5-month home exercise program. (CIMT involves constraining the sound arm to encourage use of the affected arm.) The client made functional progress, as evidenced by improved scores on the Motor Activity Log, Wolf Motor Function Test, Action Research Arm Test, and Fugl-Meyer Assessment of Motor Recovery.

Treatment of Rigidity

Decerebrate and decorticate rigidity can wax and wane. When rigidity is waning, it is recommended that the client be transferred to a wheelchair or a reclining chair because rigidity decreases in sitting. Rigidity is worse during episodes of agitation.[64] Parkinson's rigidity responds temporarily to heat, massage, stretching, and ROM exercises. Rocking back and forth before standing can aid in the transition. The Lee Silverman Voice Training BIG (LSVT BIG) program (described later in the chapter) involves exercises geared toward ameliorating rigidity. (See Chapter 35 for further discussion of Parkinson's disease and additional treatment strategies.)

Treatment of Flaccidity

Flaccidity stemming from UMN dysfunction (eg, a client recovering from spinal or cerebral shock caused by acute CNS insult or injury) is treated with facilitation techniques such as weight bearing, high-frequency vibration, tapping, quick stretch, bed positioning with weight on the flaccid side most of the time, and functional neuromuscular electrical stimulation. Splinting of the hand and wrist may be indicated for support. Therapists should closely supervise splinting because contractures can result from excessive splint wear. PROM exercises also are indicated. The arm can be passively positioned as normally as possible during ADL tasks to provide sensory and proprioceptive feedback. For example, when the client is eating, have him or her place the affected arm on the dining room table, resting on top of a piece of Dycem.[29] Client and family education on proper positioning and joint protection is important to prevent overlengthening of soft tissues and trauma (eg, the arm falls off the client's lap and bumps the wheel of the wheelchair).

Treatment of Incoordination

Treatment of incoordination is challenging. Activities graded on the basis of motor learning and control may be helpful for attaining proximal stability and then mobility. Therapy directed toward the modulation of reflexes and abnormal synergy patterns and the enhancement of postural control mechanisms, such as the righting and equilibrium reactions, can help improve coordination. Weight bearing, joint approximation, placing and holding techniques, and fixed points of stability (having the client stabilize the elbow or wrist on the tabletop) can be helpful.

It is critical that the therapist encourage the client to use his or her vision to help direct UE movements. The therapist should begin with small ranges of movement and gradually increase them as the client progresses. Initially work is done in the plane and direction of movement that are easiest for the client; it then progresses toward more difficult areas. Some of the involuntary movements of cerebellar or extrapyramidal origin, particularly primary movement disorders, are difficult to manage or change. Therapists have greater influence over movement disorders associated with TBI, stroke, and the first three stages of Parkinson's disease.

LSVT BIG, mentioned earlier, is an intensive, evidence-based treatment protocol for clients with all stages of Parkinson's disease (PD). The LSVT BIG protocol consists of 16 visits (four times per week for 4 weeks). It is delivered by occupational and/or physical therapists who have completed the LSVT BIG Training and Certification Workshop. The focus of the program is to address both the motor and sensory impairments related to PD by training larger amplitude movements and translating these movements into everyday functional activities.

Three studies have shown the efficacy of LSVT BIG in improving function in clients with PD. Ebersbach et al.[31] studied 60 clients with PD and randomly assigned them to three groups: home exercise, Nordic walking, or LSVT BIG (individual 1-hour treatment sessions, 4 days per week, for 4 weeks). The main outcome measure rated before and after treatment was the motor score of the United Parkinson's Disease Rating Scale (UPDRS). The clients in the LSVT BIG group showed a significant 5-point improvement on the UPDRS motor score, whereas the other two groups experienced mild deterioration.[31] Another study revealed that clients with PD who underwent 16 sessions of LSVT BIG had generalized transference of higher amplitude during reach and also demonstrated improved gait speed.[37] In both studies the clients were evaluated by blinded raters after treatment. A case series reported positive improvements in gait, balance, and bed mobility in three clients with PD.[59] The review article, "LSVT LOUD and LSVT BIG: Behavioral Treatment Programs for Speech and Body Movement in Parkinson Disease," by Fox et al.,[41] provides the reader with an overview of the rationale for the LSVT protocols, in addition to a description, summary of efficacy data, and discussion of limitations and future research directions.

Methods and devices to compensate for incoordination may be necessary to make BADLs and IADLs safer, more achievable, and more satisfying. The OT practitioner must obtain a thorough occupational profile to make appropriate activity and equipment choices and to determine adaptive strategies the client can carry over to the home environment. The physician may decide to use pharmacological agents or surgical intervention to try to dampen tremor or other involuntary movement patterns.

Surgical Intervention for Movement Disorders

Neurosurgical interventions for movement disorders may include stereotactic thalamotomy to reduce ballistic movement, essential tremor (multiple sclerosis), resting tremor (Parkinson Disease), and athetosis. Surgical treatment for dystonia may include ramisectomy, stereotactic thalamotomy, or ITB implantation.[32] Deep brain stimulation has been effective in tremor reduction in essential tremor and Parkinson's disease.[35]

Because of the current managed care system, occupational therapists are receiving more referrals than ever before from primary care physicians. Occupational therapists who have a basic knowledge of medical and surgical options for ameliorating motor control problems can play a triage role in suggesting referral to physician specialists.

Rehabilitation Robotics

Rehabilitation robotics is an exciting interdisciplinary field in which OT practitioners can participate. Recent rehabilitation robotics conventions have organized this field into three tracts: gerotechnology (user group characteristic), biorobotics (source of design inspiration), and neurorobotics (harness neurorecovery or neuron connectivity).[66]

Researchers at the Massachusetts Institute of Technology (MIT) invented the MIT-Manus, a device that robotically assists arms with paresis for clients who have had a CVA. The MIT study involved 96 clients, who were an average of 2 weeks post-CVA. Shoulder and elbow function improved twice as much in the experimental group (the group that used the MIT-Manus) as in the control group (the group that received conventional therapy).[103]

More information on the role of robotics in rehabilitation is available in the article by Krebs et al.[66] listed in the references.

Threaded Case Study

Daniel, Part 2

1. What performance skills or standardized assessments would you select to evaluate Daniel's motor function?

Rating Daniel's muscle tone on a mild-moderate-severe scale is a low-tech, quick way to rate the hypertonia throughout his treatment and to observe the influence it has on his movement over time. Spasticity often peaks at 3 months post-CVA and then starts to decline. This varies from client to client, depending on the level of brain damage. Active and passive range of motion (AROM and PROM) are also indicated for his shoulder through his fingers. PROM is needed to make sure he does not have any contractures that inhibit his ability to reach the steering wheel. AROM is needed to see whether he has the active range to reach the steering wheel, grasp it, and release it. Sensibility testing (eg, kinesthesia and Semmes-Weinstein monofilaments) would be useful. It is important to know whether Daniel can feel his hand position on the steering wheel. The Wolf Motor Function Test[14] or the Graded Wolf Motor Function Test[75] could be used initially and then once a month thereafter to monitor his functional progress.

2. What activities or intervention would you plan for Daniel to reduce the hypertonia in his right arm?

Weight bearing on a mat table or a kitchen counter with his right fingers, wrist, and elbow extended would serve as a good method of stretching Daniel's extrinsic finger flexors, wrist flexors, and elbow flexors. He can participate in activity with his left hand, such as putting away dishes or folding laundry one-handed.

The OT practitioner should consider fabricating a custom resting hand splint/orthotic that stretches his extrinsic finger flexors and wrist flexors. Wearing the splint/orthosis 7 hours at night is preferable so that it doesn't inhibit use of the affected extremity during the day.

Modality-certified OT practitioners can use ultrasound with concurrent stretch to lengthen tendons and muscles that have become shortened due to hypertonia/spasticity. In-clinic functional electrical stimulation can be used to strengthen antagonists to the spastic muscles (ie, triceps, wrist extensors, extrinsic finger extensors, and extensor pollicis longus to obtain thumb extension). If Daniel has good results in the clinic, a home functional electrical stimulation unit can be ordered with a physician's prescription.

3. What home exercise or activity program would you prescribe for Daniel to help him reach his goals of starting the ignition of his car and driving with his right upper extremity?

Daniel should perform passive and active stretching in any plane of motion that is needed for him to reach the steering wheel and also to turn on the ignition. This would include scapular protraction, shoulder flexion, elbow extension, forearm supination, wrist extension, finger flexion and extension, and lateral pinch. Throwing a ball forward can help him work out of the flexion synergy and speed up the release of his fingers. The hammer and inverted hammer exercises will help him gain ROM, motor control, and strength in his supinator muscles (biceps and supinator) (Figs.19.17 and 19.18). He needs both supination and lateral pinch to turn the key in the ignition. He can use therapy putty to help him acquire the strength to hold on to the car key. Home functional electrical stimulation units can be used to strengthen the triceps and the extensors of the fingers, wrist, and thumb.

FIG 19.17 Starting position for the inverted hammer exercise to strengthen the supinator muscles.

FIG 19.18 Ending position for the inverted hammer exercise to strengthen the supinator muscles. The therapist can put a cuff weight on the hammer when the client can do the exercise easily to full range.

Daniel reached his goals of driving and returning to work full duty as a salesperson 4 months after his CVA (Fig. 19.19).

FIG 19.19 Daniel's last day of therapy, driving himself to work.

Summary

From reading Daniel's case study, we can see how abnormal elements of motor control affect the quality of movement and the ability to perform in areas of occupation. The occupational therapist assesses muscle tone, upper extremity recovery, and coordination, using standardized tests and observation of movement during occupational performance. The results of the motor control assessment can help the client and the therapist collaborate on appropriate intervention. Ameliorating motor control problems can be a rewarding experience for the client and the therapist.

Review Questions

1. What is neuroplasticity?
2. Describe the circumstances in which a physician would recommend a long-term nerve block or a motor point block for a person with spastic wrist and finger flexors.
3. Describe the characteristics of rigidity.
4. Explain the major difference between spasticity and hypertonia.
5. Demonstrate how to perform an upper extremity muscle tone evaluation.
6. What is the name of the certification program that focuses on helping clients with Parkinson's disease take bigger steps and reach higher in ADLs?
7. What are equilibrium reactions?
8. Compare chorea and athetosis.
9. What is ataxia?
10. What is the most common type of tremor?

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Occupation-Based Functional Motion Assessment

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CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner[a] will be able to do the following:

1. Define occupation-based functional motion assessment.
2. Explain why it is desirable to assess motor function through observation of engagement in occupation and activity performance.
3. State two circumstances under which assessment of performance skills is indicated.
4. Define individual activity analysis, or "dynamic performance analysis."
5. Explain why it is not possible to do an accurate objective activity analysis.
6. List at least three questions that can guide the clinical observation and clinical reasoning of the occupational therapy (OT) practitioner while conducting an occupation-based functional motion assessment.
7. List factors other than range of motion (ROM), strength, and motor control that can affect motor performance.
8. Discuss how information gained from the occupation-based functional motion assessment differs from that gained during assessment of specific client factors.
9. State the minimum level of strength required throughout the lower extremities for normal stance and positioning.
10. Compare levels of muscle strength and associated endurance in the upper extremities.
11. List occupations that can be used to access functional motion in the upper extremities and in the lower extremities.

KEY TERMS

Functional motion assessment
Individual activity analysis
Objective activity analysis
Occupation-based functional motion assessment

Threaded Case Study

Raymond, Part 1

Raymond is a 60-year-old foreman of several lineman crews of the telephone company. He has been with the company for more than 40 years; although he could have moved into a more administrative position over the years, he has always enjoyed working out in the field, being a mentor to the younger workers, and dealing with emergencies. He is known throughout his neighborhood as the person to call when help is needed with home repair tasks, whether it is carpentry, plumbing, or electrical work. He is a member of a championship senior softball team and plays most weekends during the season, sometimes traveling out of town to participate in tournaments. He does quite a bit of volunteering through the outreach program at his church, participating in such activities as collecting, preparing, and delivering food to home-bound elderly and driving new immigrants to various appointments. He shares household duties with his wife and enjoys cooking for her.

Raymond was first diagnosed with rheumatoid arthritis 10 years ago, when he began experiencing pain and stiffness in his shoulders, hips, and knees. His symptoms were managed with medication and, except for occasional exacerbations, he was able to fully engage in those occupations that were meaningful to him. In the last 6 months he has experienced an exacerbation of his symptoms. The pain in his shoulders, hips, and knees has increased, and he also has begun experiencing pain in his wrist and hands. His wife began to notice Raymond's change in mood as he became increasingly reluctant to engage in occupations in which he always took the lead, such as helping his neighbors with home projects, preparing food in his church outreach program, and participating in the softball games.

Because he could not do things the way he used to, he did not want to do them at all. He stated that he did not want people seeing him fumbling as he attempted to hold tools or cooking utensils because his grip was so weak, nor did he want to let his teammates down because of the decreased power in his batting swing and speed in running the bases. At work he found himself giving more verbal instructions to his crew rather than demonstrating techniques, as he had always done before, at times speaking in a gruff, impatient tone, which was surprising to his fellow workers. His frustration with the increased amount of time it was taking him to complete activities of daily living (ADLs), such as shaving, buttoning his shirt, and putting on the boots he was required to wear at work, was making him irritable. The fatigue he was experiencing at the end of the day "just from trying to move my body around" was also adding to the depression of this client. This previously outgoing person was withdrawing and becoming more and more socially isolated.

The occupational therapist to whom he was referred began anticipating the needs of this client based on the profile she developed. Evaluating this client as he engaged in occupations in specific contexts would provide the best information for determining intervention strategies that would be most helpful, such as adaptive equipment and joint protection techniques. Getting information underlying those client factors (muscle strength, range of motion [ROM]) contributing to his decrease in function was critical. Arrangements were made to assess the client in his home and to make a job site visit. By observing the client perform occupation-based tasks and motions at work and home, the OT could obtain important information concerning his ROM, strength, and endurance and could assess his motor control.

Critical Thinking Questions

1. What is the advantage of administering an occupation-based functional motion assessment versus more specific assessments, such as joint measurement and manual muscle testing?

2. What information about the client's muscle strength and joint ROM can be determined through the occupation-based functional motion assessment? What cannot be determined?

3. What is the value of administering the occupation-based functional motion assessment in different environmental contexts?

Many physical disabilities cause limitations in motor performance skills and client factors, including joint ROM, muscle strength, and endurance or control of voluntary movement (gross and fine motor control). These physical impairments in body functions and motor skills result in movement limitations that can cause slight to substantial deficits in performance of areas of occupation and prevent pursuit of self-care, work, leisure, and educational and social activities. The **occupation-based functional motion assessment** is a way of assessing the ROM, strength, and motor control available for task performance by observing the client during performance of everyday occupations (ADLs, instrumental activities of daily living [IADLs], education, work, social participation, leisure activities, and rest and sleep) in varied contexts and environments.[1]

Because the primary responsibility of the occupational therapist is to assess occupational performance, identify performance problems, and plan intervention strategies that will improve the client's ability to fully engage in occupations, sensorimotor limitations first should be assessed through observation of functional activities. When improvement of performance skills is a goal of the intervention program, assessment of performance skills, occupation demands, and client factors in a variety of environmental contexts (eg, home, workplace, or school) may be indicated to make an objective assessment of physical limitations and gains (see Chapters 19, 21, and 22 for additional information).

Mental functions, including cognitive and perceptual abilities, such as motivation or the ability to sequence complex movement patterns, interpret incoming stimuli, or coping and behavioral regulation, can also affect motor function. These client factors must be considered in any performance evaluation (see Chapters 25 and 26). However, this chapter is limited to consideration of motor function (ie, ROM, strength, and motor control) during the occupation-based functional motion assessment.

OT Practice Notes

Except for a few diagnoses, specific assessments of ROM, muscle strength,[7] and motor control are seldom necessary. For example, performing a full ROM assessment or manual muscle test is time-consuming, can be tiring to the client, and may duplicate other services, whereas assessing these factors while the client is engaging in occupation yields the most comprehensive picture of the client's actual abilities and limitations.

Clinical Observation

It is possible to administer a gross assessment of joint mobility and muscle strength by having the client perform those motions associated with functional tasks (ie, a **functional motion assessment**). The OT practitioner could observe as the client reaches overhead, as would happen when putting dishes away in an overhead cupboard, or taking a step to the side, as when stepping into a bathtub.[11] This will give the practitioner some basic, although nonspecific, information about those factors that affect function.

OT practitioners (the OT in collaboration with the OTA) analyze the occupations of a client to assess the quality of that client's effectiveness in valued occupations, to identify the impact of contextual factors on performance, and to "determine the impact of personal factors (including health condition) on current performance."[6] With occupational analysis, client factors such as muscle strength, ROM, and motor control can be observed during the performance of ordinary ADLs, IADLs, work, and leisure tasks.[3] For example, while assessing ADLs, the therapist can observe for performance difficulties and movement patterns that may signal limited ROM, muscle weakness, muscle imbalance, poor endurance, limited motor control, and compensatory motions used for function.

An occupation-based functional motion assessment has an advantage over the functional motion assessment because, although the client will perform motions as described previously, there is the added resistance to body structures that will occur as the result of using equipment such as a sliding door, manipulating objects such as cards, or resisting fatigue and having endurance during repetitive activities such as folding clothes or bouncing a ball. Also, because the client is performing these tasks in environments and contexts that are meaningful, the client's full participation and engagement in the task may be heightened.

Essentially, when observing a client perform selected tasks, the occupational therapist is doing an **individual activity analysis** or "dynamic performance analysis"[11] to diagnose the occupational performance problems of that client. Because people perform the same task in a variety of ways and because there are so many variables in task performance, it is not possible to do an **objective activity analysis**, one that can be applied universally, and describe the sensorimotor requirements of the myriad of ADLs. The purpose of observation is to understand the client's occupational performance problems in the context of the interaction between the person, the task, and the environment.[6] This type of screening will serve the occupational therapist well in deciding a course of intervention for Raymond, who because of the current exacerbation status of his disease, is not a candidate for more specific muscle strength assessment (see Chapter 22). While observing Raymond in his home as he performs the functional tasks described later in this chapter, the therapist will not only be able to assess available ROM, but also make some determination of the client's muscle strength, endurance, and coordination.

The therapist's scientific knowledge of the particular dysfunction and an analysis of the ways in which activities are generally performed (activity demands) influence the assessment of performance problems and aid in the development of plans to remediate those problems. Analyzing the client while engaged in a specific occupation parallels activity analysis but also allows the practitioner to gain additional knowledge of the client's unique way of performing that occupation.[6]

The following are questions to guide the clinical observation and clinical reasoning processes.

1. Does the client have adequate ROM to perform the task?

   a. Where are the joint limitations?

   b. What are some possible causes of the limitations?

   c. Are there true ROM limitations, or are apparent limitations actually caused by decreased muscle strength?

2. Does the client have enough strength to perform the task?

a. In which muscle groups is there apparent weakness?

b. If strength appears inadequate to perform a task because the client cannot complete the ROM, is there truly muscle weakness, or is there actually limited ROM?

3. Does the client have enough motor control to perform the task?

a. Is the movement smooth and rhythmic?

b. Is movement slow and difficult (eg, as seen in spasticity and rigidity)?

c. Are there extraneous movements when the client performs the task (eg, tremors, athetoid, or choreiform movements)?

The observing OT practitioner must also consider the client's understanding of the instructions and perception of task importance, in addition to the possibility of sensory, perceptual, and cognitive deficits. An analysis of the results of the occupation-based functional motion assessment may indicate that formal assessment of performance skills or body functions is needed. For example, such an assessment may be needed to differentiate muscle weakness from limited ROM or to quantify (with a muscle grade) muscle weakness in specific muscle groups.

Assessing ROM, strength, and motor control by observing the client perform functional activities can aid in selecting meaningful intervention goals relative to improving occupational performance. The therapist can ask the client about his or her ability to perform the tasks of daily living but should also observe the client performing such activities as dressing, walking, standing, and sitting to make an accurate assessment.[5] Having the client perform ADLs in addition to other tasks associated with his or her habits and routines while interacting in varied environmental contexts can also add to the depth of information concerning the client's ROM and muscle strength. The occupational therapist delivering OT services to Raymond has determined that doing both a home visit and job site visit will enhance her understanding of the demands on this client. Observation of Raymond interacting with materials, equipment, tools, and products in these environments will provide information about those critical motions and complex motor patterns required for him to fully engage in those occupations most meaningful to him. Completion of the tasks by Raymond in the timely manner required in these contexts will also give information about the client's endurance, thus giving more information about his muscle strength.

Joint ROM, manual muscle testing, and motor control assessments (see Chapters 19, 21, and 22) will give the therapist specific information about the function of the musculoskeletal, neurophysiological, and sensorimotor systems. Although the tests require minimum to maximum active output by the client, the therapist will not be able to determine the client's ability to integrate these systems to perform specific goal-directed tasks based on the results of these assessments. Rather, the therapist will have information about movements of a specific limb or a combination of limbs. Under carefully controlled conditions, the therapist will know about the flexibility of the components of the joint and the strength of muscles to create movements such as flexion, abduction, and external rotation. However, the client's motor performance capabilities are not measured by these assessments. For example, the manual muscle test cannot measure muscle endurance (number of times the muscle can contract at its maximum level and resist fatigue), motor control (smooth rhythmic interaction of muscle function), or the client's ability to use the muscles for functional activities.[5]

OT Practice Notes

While observing a client performing functional activities, it would be most helpful if a therapist could also estimate the client's existing ROM, muscle strength, and motor control.

At his job site Raymond had difficulty stepping up into his truck (the cab of which was somewhat elevated due to the oversize tires), not having enough hip and knee flexion ROM. The OT also observed that if the truck was parked near a curb or if Raymond could step first on a box and then onto the step of the truck, thus requiring less flexion ROM, he had less difficulty. However, in both instances he lacked sufficient strength in hip and knee extension to launch himself into the truck without compensating with his upper extremities.

Occupation-Based Functional Motion Assessment

The activities listed in the following sections for the occupation-based functional motion assessment are suggested as a general starting place for the student or beginning practitioner (within the guidelines of the roles and responsibilities of the OT or the OTA). Only upper and lower extremity activities are included. Movements of the face, mouth, neck, and spine are beyond the scope of this chapter. Many more motions and tasks could be suggested in each category. The reader is referred to *Joint Motion and Function Assessment: A Research-Based Practical Guide,* by Clarkson,[5] for a comprehensive and detailed discussion of musculoskeletal assessment and its functional application.

Lower Extremity

Because of the somewhat stereotypical movements of the lower extremity, the arrangement of the large muscle groups, and the nature of the overall functions of weight bearing and ambulation, assumptions can be made about muscle strength during functional activities. For example, to assume a normal stance pattern, ambulate without any compensatory gait patterns, or position the lower extremities (without the assistance of the upper extremities) during dressing, a minimum of fair plus (F+) muscle strength is required in the musculature of the hips, knees, ankles, and feet. If muscle strength in the lower extremities is only F throughout the lower extremity, ambulation without aids will not be possible.[7] Good to normal muscle strength is required for the endurance to perform the small postural adjustments needed for maintained standing, repetitive movement patterns inherent in walking, and the lifting, maneuvering, and balancing on the lower limbs that usually occur during dressing.[7]

Hip Complex

The hip joints support the body weight. Each joint acts as a fulcrum when a person is standing on one leg. Hip movement makes it possible to move the body closer to or farther from the ground, bring the foot closer to the trunk, and position the lower limb in space.[5]

During functional activities, lumbar-pelvic movements accompany hip movement, which extends the functional capabilities of the hip joint. The hip is capable of flexion, extension, adduction, abduction, and internal and external rotation.[5]

Flexion and extension.

Full flexion and extension are required for many ADLs and IADLs. Standing requires full hip extension. Squatting, bending to tie a shoelace with the foot on the ground, and toenail care done with the foot on the edge of a chair all require full or nearly full hip flexion. Other activities that require moderate to full flexion and extension are donning pantyhose or socks, bathing the feet in a bathtub, ascending and descending stairs or a step stool, sitting and rising in a standard chair, and riding a stationary bicycle.[5]

Abduction and adduction.

Most ordinary ADLs and IADLs do not require full ranges of abduction and adduction. The main function of the hip abductors is to keep the pelvis level when one foot is off the ground. For ADLs, hip abduction may be used when stepping sideways into a shower or bathtub, donning trousers when sitting, squatting to pick up an object, sitting with the foot across the opposite thigh, getting on a bicycle, or, as in the case of Raymond, shifting weight from one foot to the other as he steps out when swinging the bat.[5,8]

Hip adduction brings the foot across the front of the body. An individual uses this motion when kicking a ball, moving an object on the floor with the foot, or crossing one thigh over the other for donning or removing shoes and socks.[5]

Internal and external rotation.

Internal rotation occurs when a person is pivoting medially on one foot. When a person is sitting, there is internal rotation when the person reaches to the lateral side of the foot for washing or donning socks. Internal rotators are active in walking.[5]

External rotation with hip flexion and abduction brings the foot across the opposite thigh for donning shoes or socks or examining the sole of the foot.[5,8]

Knee

The knee joint supports the body weight. With the foot fixed on the ground, knee flexion lowers the body toward the ground and knee extension raises the body. If the foot is off the ground, as in sitting, the knee and hip are used to orient the foot in space.[5]

Daily living activities that require moderate to full ranges of knee flexion and extension are standing and walking, squatting to lift an object from the floor, crossing the ankle of one foot over the thigh of the opposite leg, sitting down and rising from a chair, and dressing the feet.

Ankle and Foot

The foot is a flexible base of support when a person is on rough terrain. It functions as a rigid lever during terminal stance in the walking pattern. It absorbs shock when transmitting forces between the ground and the leg. The foot and ankle function to elevate the body from the ground when the foot is fixed. Dorsiflexion and plantar flexion occur at the ankle joint. Foot inversion and eversion occur at the subtalar joint.[5]

Plantar flexion.

Full plantar flexion is used when a person is rising on the toes to reach upward to a high shelf. Some plantar flexion is used to depress the accelerator in an automobile or the control pedal on a sewing machine and when donning socks or shoes.

Dorsiflexion.

Full range of dorsiflexion is needed to descend stairs. Dorsiflexion is used in such activities as positioning the foot to cut the toenails or tying shoelaces.[5]

Inversion and eversion.

Inversion and eversion function to provide flexibility when an individual is walking on uneven ground. Inversion is used when the foot is crossed over the opposite thigh and the sole is inspected.[5]

Threaded Case Study

Raymond, Part 2

In administering an occupation-based functional motion assessment at Raymond's home, the occupational therapist was able to observe that in his attempt to don his shoes and socks, Raymond was unable to abduct and externally rotate his hip sufficiently, in combination with full flexion of the knee, to place the ankle of one foot over the opposite thigh.

Upper Extremity

By simply observing a client engaging in functional activities, the therapist cannot make general assumptions as easily about muscle strength in the upper extremities as in the lower extremities. There are three reasons why this is the case: (1) the variety of ways in which the upper extremity can be positioned to complete any given task (ie, there is not one right way to do the task), (2) the complexity of motor patterns possible requiring gross motor and fine motor skill, and (3) the dependency of the distal joints and musculature on the more proximal joints for positioning.

If several people are observed donning shirts, it will be apparent that different techniques are used by each. One person may lift the arm out to the side, increasing shoulder abduction as the shirt is drawn onto the arm. Another person might prefer to dress with the arm more in front of the body, thus positioning the humerus in flexion. A third person might hyperextend the humerus as the shirt is pulled on. The difficulty, of course, is determining exactly how much ROM and muscle strength are minimally required at all of the joints involved when so many options are available to perform one task.

In the first two examples of donning a shirt, the musculature of the shoulder complex would certainly have to create more tension than if the humerus were in the adducted position. It would be inappropriate for the therapist to instruct the client on how to don the shirt if the therapist's goal was to attain some information regarding the client's level of independence in dressing and secondarily to make assumptions about ROM and muscle strength.

When observing a client perform occupation-based tasks and motions with the upper extremities, it is important to remember that even when it is not obvious or readily apparent, the muscles of the shoulder complex are contracting with varying degrees of tension. They may have to contract with enough force to position the hand in space and maintain it there, such as when a person is combing his or her hair. At other times the humerus must be held close to the body to provide a stable base from which the forearm, wrist, and hand can maneuver, such as when hitting the keys on a keyboard, cutting food with a knife, or writing. It would be an inaccurate assumption that the extremity is just hanging passively at the side, when in fact, the static contractions around the proximal joints make it possible for the musculature of the distal extremity to work effectively. Conversely, the shoulder complex may have to be a moving unit, as opposed to a positioning one, such as when moving groceries from a countertop to shelves in a kitchen cabinet.

General guidelines exist for assessing strength for function in the upper extremities. With good to normal endurance, the client with good (G) to normal (N) muscle strength throughout the upper extremity will be able to perform all ordinary ADLs and IADLs, work, play, and enjoy leisure and social participation occupations without undue fatigue.[7] The client with fair plus (F+) muscle strength usually will have low endurance and will fatigue more easily than a client with G to N strength. The client will be able to perform many basic ADLs and IADLs independently, but may need frequent rest periods. Work, play, and some social participation occupations may prove to be too strenuous, as in the case of Raymond attempting to hit a ball with force.

The client with muscle grades of fair (F) will be able to move parts against gravity and perform light tasks that require little or no resistance.[7] Low endurance is a significant problem and will limit the amount of activity that can be done. The client with low endurance probably will be able to eat finger foods and perform light hygiene if given the time and rest periods needed to reach the goals.

Poor (P) strength is considered below functional range, but the client with poor strength will be able to perform some ADLs with mechanical assistance and can maintain ROM independently when the range of motion is completed in gravity-eliminated planes or movement (see Chapter 30, Section 2, Mobile Arm Supports).

Clients with muscle grades of trace (T) and zero (0) will be completely dependent and unable to perform ADLs without externally powered devices. Some activities will be possible with special controls on equipment. Examples include power wheelchairs and electronic communication devices, such as voice recognition computers or environmental control systems.

Individuals use a variety of motor patterns when performing a functional task, and no one way is the right way to perform the task. These facts make it impossible for the therapist to predetermine the level of muscle strength, amount of ROM, and degree of motor control needed in the upper extremity to perform any given task. Individual styles of moving, numerous possibilities for compensatory movements when faced with loss of joint flexibility, poor endurance, lack of motor control, impaired sensation, and pain are all factors that may affect the client's ability to generate tension in a muscle or muscle group and sustain muscle activity. The pain Raymond experiences in his hands may be the primary cause of his inability to manipulate objects such as the buttons on his shirt.

Shoulder Complex

The shoulder complex is the most mobile joint complex in the body. Its function is to move the arm in space and position the hand for function.[9] The shoulder complex is composed of the acromioclavicular, sternoclavicular, scapulothoracic, and glenohumeral joints and the muscles, ligaments, and other structures that move and support these joints.[9,10] In the performance of functional activities, scapular, clavicular, and trunk motions normally accompany glenohumeral motion. These associated movements increase the range of glenohumeral motion for function. The shoulder complex functions in a coordinated manner that is accomplished through scapulothoracic and glenohumeral movement. This coordinated function is called scapulohumeral rhythm.[9,10] Thus, movements at the shoulder are actually combinations of several joint motions and are dependent on scapulohumeral rhythm in the performance of any given activity.[5]

Shoulder flexion and abduction with scapula upward rotation (overhead movements).

Activities such as placing an object (eg, book, box, or cup) on an overhead shelf or reaching overhead to pull on a light cord require these movements.

Shoulder extension and adduction with scapula downward rotation.

Activities such as reaching back for toilet hygiene, Raymond swinging his arm backward when preparing to pitch the softball, reaching backward to put an arm through the sleeve of a coat, and pulling open a refrigerator door require these movements.[5]

Horizontal adduction and abduction.

These movements allow the arm to be moved around the body. Reaching the opposite axilla or opposite ear for hygiene activities, opening and closing a sliding door, combing the hair on the opposite side of the head, and reaching the upper back while bathing are some activities that use horizontal adduction and abduction.[5]

Internal and external rotation.

Some degree of either internal or external rotation accompanies every glenohumeral motion. The ROM varies in various positions of the arm. Full range of external rotation is required for reaching the back of the head for combing or washing the hair. External rotation is often associated with supination when the elbow is extended, as when rotating a doorknob in a clockwise direction.[5]

Internal rotation is used when buttoning a shirt, eating, and drinking from a cup. Full range of internal rotation with scapulothoracic motion is used to reach into a back pocket, fasten a bra, put a belt through the belt loops on trousers, or do toilet hygiene. Internal rotation is often associated with forearm pronation, as when putting a pillow behind the low back, turning a screwdriver to unfasten a screw, rotating a doorknob in a counterclockwise direction, and pouring water from a vessel.[5]

Extension and adduction.

Extension and adduction are used to return the arm to the side of the body from shoulder flexion and abduction, as after reaching overhead. These motions are also used when quick movement or force is required, as when an individual is closing a vertically oriented window, crutch walking, or pushing off to rise from an armchair, or when stabilizing the humerus to the lateral trunk, as when carrying a basket of laundry.[5]

Flexion and adduction.

Flexion and adduction are used in activities that require reaching the same side of the body, such as washing the cheek or ear and combing the hair on the same side. Slight shoulder flexion with adduction is used for hand-to-mouth activities and putting on an earring back.

Elbow and Forearm

Elbow and forearm movements serve to place the hand for function.[9] Elbow flexion moves the hand toward the body, and elbow extension moves the hand away from the body. Forearm pronation or supination usually accompanies elbow flexion and extension. Pronation and supination position the hand precisely for the requirements of the given activity. The elbow and forearm support skilled and forceful movements of the hand that are used during performance of ADLs and work activities.[5]

Full or nearly full range of elbow flexion, usually with some humeral flexion and forearm supination, is used to bring food to the mouth, shave the face or underarms, hold a telephone receiver, place an earring on the ear, and reach the neck level of a back zipper.

Full range of elbow extension, usually with forearm pronation, is used when an individual is reaching to the feet to tie shoes, throwing a ball overhand, and using the arms to push off from a chair. Many other ADLs and IADLs require less than full range of these movements.[5]

Wrist and Hand

The wrist controls the length-tension relations of the extrinsic muscles of the hand. It positions the hand relative to the forearm for touch, grasp, or manipulation of objects.[8] Wrist extension and ulnar deviation are most important in performance of ADLs.[5] It is possible to perform some ADLs when there is a loss of wrist ROM by using compensatory movements of the proximal joints.

The primary functions of the hand are to grasp and manipulate objects and to discriminate sensory information about objects in the environment. The arches of the hand make it possible to adapt the hand to the shape of the object being manipulated.[12]

Power grip and precision grip are the bases of all hand activities. Power grip is used when force is required for grasping, such as holding a hammer handle, a full glass, or the handle of a purse or suitcase. Precision grip is used when an object is pinched and when it is being manipulated between the thumb and one or more fingers. Precision grip is used for holding a pencil, moving checkers or chess pieces, turning a key, threading a needle, and opening the cap of a medicine bottle.[12]

The occupational therapist observed Raymond in his home as he was preparing to make homemade soup. She noted that Raymond easily accessed ingredients that were on the first two shelves of above-counter cabinets, but displayed quite a bit of facial grimacing and two attempts reaching overhead to the top shelf. He was observed being able to fully open his fingers but not able to make a tight fist. When chopping vegetables, he was able to manage the less resistive ones, such as tomatoes and celery, but could not exert enough force to cut through the carrots. Although he could carry an empty pot to the sink without difficulty, he was not able to stabilize his wrists to carry a full pot of water to the stove. At his job site the occupational therapist again noted Raymond having difficulty holding some of the heavier tools in position and exerting appropriate force, such as with the large wire cutters.

Threaded Case Study

Raymond, Part 3

Due to the difficulty Raymond experienced when donning his socks and shoes, getting in and out of his truck, reaching overhead, and manipulating and applying needed force to kitchen and work tools, the occupational therapist has determined that ROM and muscle testing assessments should be administered to some of this client's specific joints and muscles.

After the occupation-based functional motion assessment, the next step in the OT process would be for the OT to plan the intervention. See Chapter 38 (Arthritis) for some ideas for interventions that could be implemented to return Raymond to participation in his customary rounds of occupation. Also, refer back to the beginning of this chapter and reflect on the three probative questions posed at the end of Raymond's case study; be able to describe the advantages of using the occupation-based functional motion assessment, the amount and type of information that was gleaned regarding Raymond from this assessment, and the value to the OT of conducting this assessment in both the home and work contexts and environments.

Summary

Many physical disabilities cause deficits in ROM, strength, and motor control that limit occupational performance. The occupational therapy practitioner (ie, the OT or the OTA under the supervision of the OT) is primarily responsible for assessing occupational performance, identifying performance problems, and planning intervention that will improve the client's occupational performance.

Because people perform the same activity in a variety of ways, the level of ROM, strength, or motor control needed to do a task is variable. Assessment of physical limitations can be made through observation of a client's performance while engaged in a variety of occupations. Therefore, as in the case of Raymond, the therapist must observe the client performing selected tasks in the person-task-environment interaction.[6]

While assessing the client's ability to perform ADLs, IADLs, work, or leisure occupations, the therapist should observe for sensorimotor problems. An analysis of the results of observation may indicate that an assessment of specific body factors or performance skills is needed.

Questions to guide clinical observation and clinical reasoning and suggested activities to assess function of the upper and lower extremities were outlined in this chapter.

Review Questions

1. Compare and contrast functional motion assessment with occupation-based task and motion assessment.
2. In occupation-based practice, how are sensorimotor functions first assessed?
3. What is meant by individual activity analysis?
4. Why is it not possible to do an objective activity analysis?
5. List three major questions that can guide the clinical observation and clinical reasoning of the OT practitioner when doing a occupation-based functional motion assessment.
6. Which factors, other than strength, ROM, and motor control, can affect the functional task-motion assessment?
7. How is the information gained from assessment of specific body factors different from that gained in an occupation-based functional motion assessment?
8. What is the minimum level of strength required throughout the lower extremities for normal stance and positioning?
9. List some activities or occupations that can be used to assess general function in the lower extremities: hip, knee, ankle, and foot.
10. Compare levels of muscle strength with endurance in the upper extremities.
11. List some activities that can be used to assess general function in the upper extremities: shoulder complex, elbow and forearm, and wrist and hand.

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[a]In this chapter, the term *occupational therapy practitioner* refers to occupational therapists (OTs) or occupational therapy assistants (OTAs) as defined in the current version (2014) of the OT Framework, the "Occupational Therapy Practice Framework: Domain and Process," third edition (OTPF-3).[1] Throughout the chapter distinctions will be made regarding which practitioner, when appropriate, depending on the job responsibilities of each in the evaluation process as defined in three important documents published by the American Occupational Therapy Association (AOTA): the Standards of Practice for Occupational Therapy,[3] the Guidelines for Supervision, Roles, and Responsibilities During the Delivery of Occupational Therapy Services,[2] and the Scope of Practice for Occupational Therapy.[4] In general, the OT is responsible for all aspects of the evaluation process, and the OTA contributes to the process under the supervision of the OT.

21

Joint Range of Motion*

Tim Shurtleff, Vicki Kaskutas

CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Define active, passive, and functional range of motion (ROM).
2. List the purposes of measuring ROM.
3. Name two methods used to screen for ROM limitations.
4. Name disabilities for which joint measurement is often an assessment tool.

5. Describe how ROM measurements are used to select intervention goals and methods.
6. Describe how to establish ROM norms for clients with unilateral involvement.
7. Describe what the therapist should do before actually measuring the joints with the goniometer.
8. Describe proper positioning of the therapist and methods to support limbs.
9. List precautions for and contraindications to joint measurement.
10. List and describe the steps in the joint measurement procedure in correct order.
11. Describe how to record results of the joint measurement.
12. Measure all the joints of a typical practice subject by using the 180-degree method and correct procedure.
13. Describe at least three intervention strategies that can be used to increase ROM.

KEY TERMS

Active range of motion

End-feel

Functional range of motion

Goniometer

Joint measurement

Palpation

Passive range of motion

Range of motion

Threaded Case Study

Evelyn, Part 1

Evelyn is an 83-year-old woman who sustained a Colles fracture when she fell on her outstretched, nondominant left hand in an attempt to break her fall after tripping on a doorstop as she exited a building. The fracture was reduced, and Evelyn was placed in a hand-to-below-elbow cast for 6 weeks. On removal of the cast, Evelyn's wrist and hand appeared swollen. She complained of pain and stiffness in the carpometacarpal and metacarpal joints of her thumb and the metacarpophalangeal and proximal interphalangeal joints of her fingers. She was unable to make a fist or oppose her thumb to her fingers.

Evelyn is a widow; her two grown children live nearby. Before her injury she was independent in all activities of daily living and the majority of instrumental activities of daily living. She used public transportation to move around her community, although her children and friends usually drove her to appointments. Evelyn volunteered at the local hospital weekly in its telecare program and called elderly, homebound persons. She is an accomplished seamstress, makes all of her own clothing, and attends a weekly sewing class, primarily for the camaraderie of the other students, although she states, “There is always something new to learn.” She also enjoys baking for her family, gardening, and generally engaging in tasks that contribute to the upkeep of her home. She attends church regularly and enjoys dining out with friends and family members.

Since her injury, her ability to participate in occupations that are meaningful to her has been curtailed. She requires moderate to maximal assistance to hold a utensil in her left hand while cutting food with her right, wash and groom her hair, put on jewelry, bathe the right side of her body, transfer out of the bathtub, and engage in home maintenance tasks (e.g., changing bed linen). At her volunteer work site, she is unable to hold the telephone with her left hand while writing with her right hand. When cooking, she has difficulty stabilizing bowls, pots, and pans with her left hand while manipulating a cooking utensil with her right. Evelyn is experiencing a great deal of frustration with her loss of independence and inability to fully engage in occupations that got her out in the community and facilitated interaction with others.

In reviewing Evelyn's occupational profile, the occupational therapist must focus on client factors that are interfering with function. Loss of range of motion (ROM) in her left upper extremity, especially the inability to flex the fingers to make a fist and oppose the thumb to the fingers, which is required for fine motor activities, is prohibiting the client from fully engaging in the physical, social, personal, cultural, and spiritual contexts that bring meaning to her life. Before determining intervention goals and strategies, the therapist must assess her ROM limitations to establish a baseline for treatment. While reading and studying this chapter, keep in mind Evelyn's ROM limitations and the restrictions they impose on her engagement in occupation.

Critical Thinking Questions

1. Why should the occupational therapist proceed with caution when assessing the ROM limitations of this client?

2. What is the appropriate sequencing of joint measurement assessment for this client? What methods should be applied first?

3. What is the advantage of joint measurement in evidence-based practice?

Joint **range of motion** (ROM) is the amount of movement that is possible at a joint.[3] It is the arc of motion at a joint within a specific plane. When the joint is moved by the muscles that act on the joint, it is called **active range of motion** (AROM). When the joint is moved by an outside force such as the therapist, it is called **passive range of motion** (PROM).[3] In normal individuals, PROM is slightly greater than AROM because of the slight elasticity of soft tissue.[3,10] The additional PROM available at the end of normal AROM helps protect joint structures because it allows the joint to give and absorb extrinsic forces. If PROM is significantly greater than AROM for the same joint motion, muscle weakness is likely to be present.[14]

Decreased ROM can cause limited function and interfere with performance in areas of occupation. Limitations in ROM may occur as a result of injury to or disease in the joint itself or the surrounding joint tissue structures, joint trauma, or joint immobilization. These limitations may restrict the client's ability to perform successfully in chosen day-to-day occupations. Inflexibility at a joint may adversely affect both speed and strength of movement. A client who constantly has to work to overcome the resistance of an inflexible joint will probably demonstrate decreased endurance and fatigue during activity. The functional motion test (see Chapter 20), screening tests, and measurement of joint ROM with a goniometer can all be used to assess ROM.

OT Practice Notes

The primary concern of the occupational therapist is whether ROM is adequate for the client to engage in meaningful occupations.

Methods used to screen limitations in ROM involve the observation of AROM and PROM. To screen for AROM, the therapist asks the client to perform all the active movements that occur at the joint.[3] To screen for PROM, the therapist moves the joint passively through all of its motions to estimate ROM, detect limitations, and observe the quality of movement, **end-feel**, and the presence of pain.[3] The therapist can then decide at which joints precise ROM measurement is indicated.

Joint Measurement

The joints of the body need to move fluidly to perform the activities and occupations that people find meaningful, such as driving, parenting, working, playing, studying, and social participation. Reaching overhead to shampoo hair, squatting to pick up a child, and operating the foot pedals in an automobile require joint movements. A wide array of personal factors will influence joint motion, such as aging, obesity, developmental conditions, injuries and illnesses, and chronic health conditions. Body structures that affect joint range of motion include the bones and joints, ligaments and cartilage, muscles and tendons, skin and fat, and nervous system. The ability to generate tension of the muscles that are performing the movement is important, as is the ability of the muscles on the opposite side of the joint to be stretched to allow movement. Restricted ROM may result from skin contracture caused by adhesions or scar tissue; arthritis, fractures, burns, and hand trauma; displacement of fibrocartilage or the presence of other foreign bodies in the joint; bony obstruction or destruction; or soft tissue contractures, such as tendon, muscle, or ligament shortening. Limited ROM may be secondary to spasticity, muscle weakness, pain, and edema.[8,14] For example, for full knee extension ROM to occur, the muscles that straighten the knee must have adequate contractibility and the muscles that flex the knee must be long enough to stretch across the backside of the knee. Lifestyle, environmental, and occupational factors can also have an effect on joint mobility. Goniometry is an evaluation tool used to assess range of motion of the joints of the body.

ROM measurements can help the therapist identify treatment goals, intervention methods, and preventive activities to restore, compensate, modify, and prevent limitations and enhance occupational performance. ROM measurement is useful to identify limitations that interfere with function or may produce deformity, additional motion needed to increase functional capacity or reduce deformity, the need for splints and assistive devices, and progression of treatment. The use of formal **joint measurement** will assist in determining the efficacy of intervention modalities and may also serve as evidence in assisting the client to see the outcome of the intervention through quantifiable data.

Tables documenting ranges for normal ROM measurements exist in the literature.[3] These may be useful guides; however, ROM varies from one person to another. It is important to avoid making assumptions about ROM limitations identified when comparing to normative values—the client may be able to function remarkably well with the ROM limitations, whereas he or she may need more ROM than is considered “normal” to perform an especially meaningful activity. The occupational history and client interview will help identify baseline ROM. If one extremity is impaired, the analogous uninvolved part can also be a useful guide.[3,4] The presence of joint and other structural limitations from previous health conditions as well as the immediate illness or injury should be considered. Joints should not be forced when resistance is met on PROM. Pain may limit ROM, and crepitus (a grinding, crackling sound or feeling) may be heard or felt with movement in some conditions. Therefore before beginning joint measurement procedures, the therapist must explain what will be done and ask the client if he or she is experiencing any joint pain and, if so, where it is located and how severe it is. To not cause undue pain, the occupational therapist further explains to the client the importance of indicating any changes in pain throughout the procedure.

Planes and Axes of Movement

It is important to understand the planes and axes of movement. Motion occurs in three cardinal planes, one that is horizontal (the transverse plane) and two of which are vertical (the frontal [coronal] and sagittal planes) (Fig. 21.1). The axes, which are perpendicular to the joint, are the pivot point for the joints. The frontal (coronal) plane divides the body into anterior (front) and posterior (back) portions. Motions that occur in the frontal plane include abduction, adduction, and spine lateral flexion to the right and left (side bending) (Fig. 21.2). The sagittal plane divides the body into right and left portions—whether it is through the center of the entire body (spine) or through an extremity (upper or lower extremity). Motions that occur in the sagittal plane are flexion and extension (Fig. 21.3). The transverse (horizontal) plane divides the body into upper and lower portions—motion occurs around a vertical axis in the transverse plane, whether it is rotation to the right and left (spine), internal and external rotation (shoulder and hip), or pronation and supination (forearm) (Fig. 21.4).

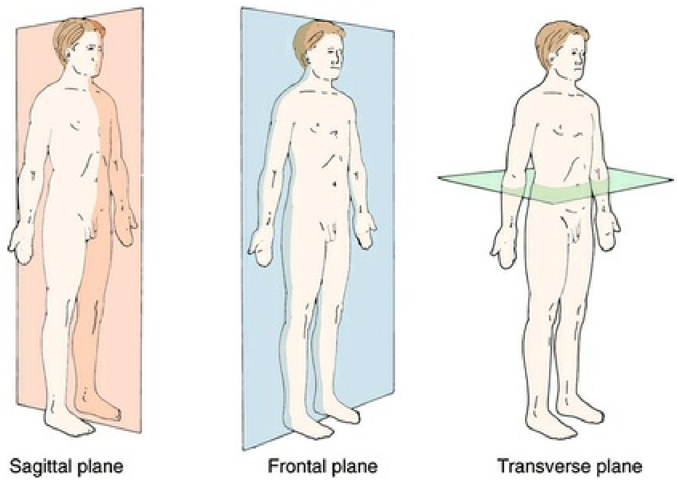


FIG 21.1 Sagittal, frontal, and transverse planes. (From Cameron MH, Monroe L: *Physical rehabilitation for the physical therapist assistant,* St. Louis, 2011, Saunders.)

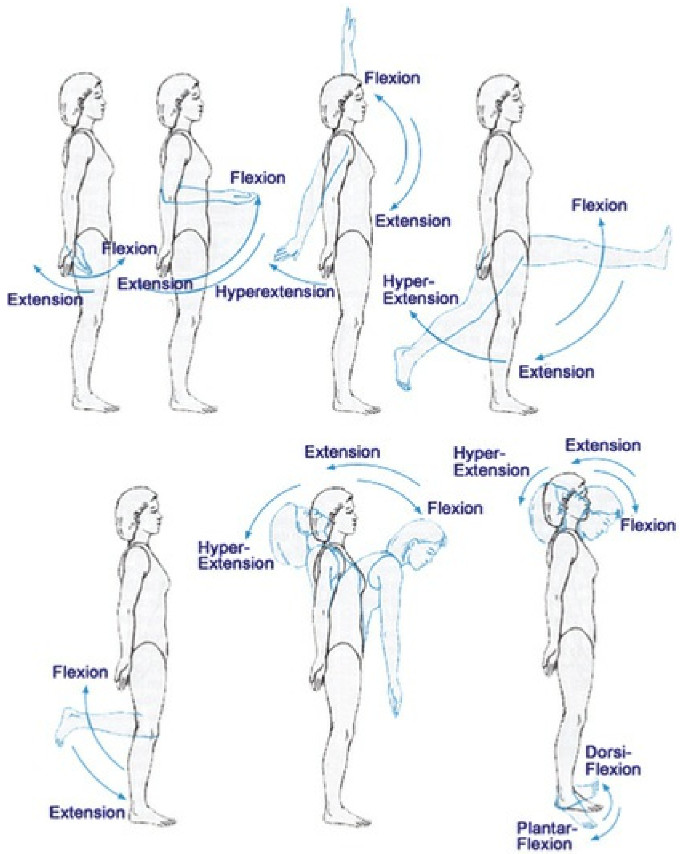


FIG 21.2 Motions that occur in the frontal plane include abduction, adduction, and spine lateral flexion to the right and left (side-bending). (Reprinted with permission from PM McGinnis: *Biomechanics of sport and exercise,* ed 3, pp. 184–185, Champaign, IL, Human Kinetics, 2013.)

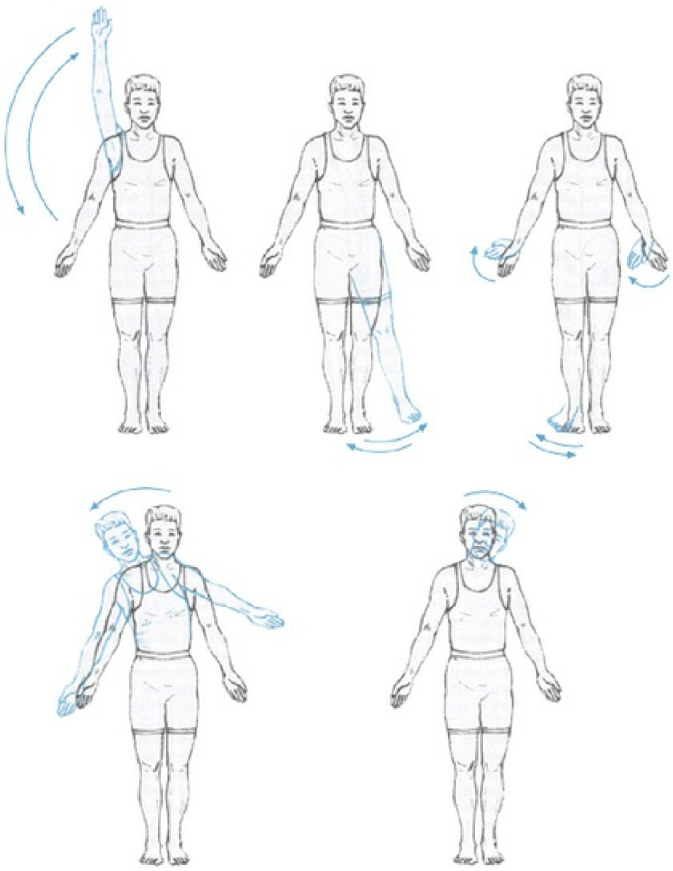


FIG 21.3 Motions that occur in the sagittal plane are flexion and extension. (Reprinted with permission from PM McGinnis: *Biomechanics of sport and exercise,* ed 3, p. 186, Champaign, IL, Human Kinetics, 2013.)

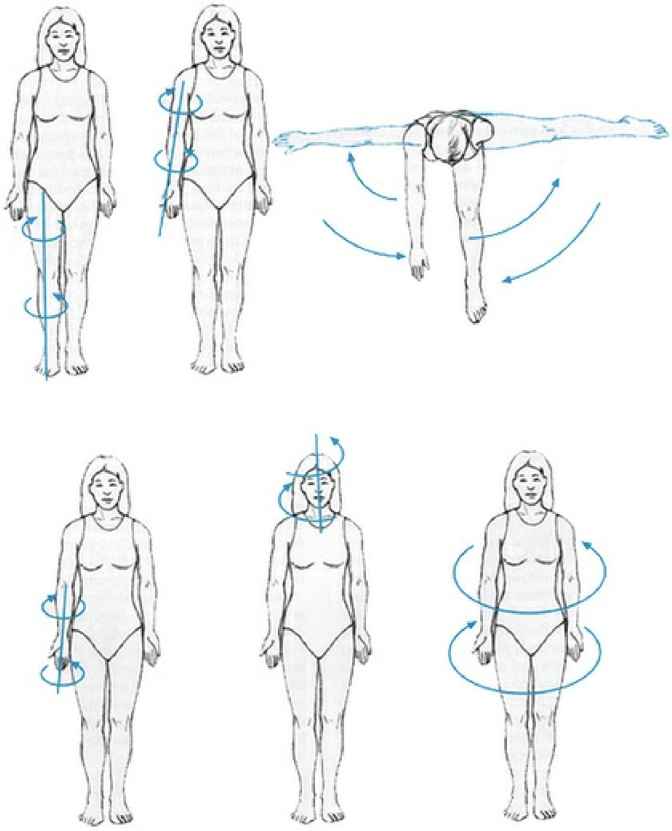


FIG 21.4 The transverse (horizontal) plane divides the body into upper and lower portions: motion occurs around a vertical axis in the transverse plane, whether it is rotation to the right and left (spine), internal and external rotation (shoulder and hip), or pronation and supination (forearm). (Reprinted with permission from PM McGinnis: *Biomechanics of sport and exercise,* ed 3, p. 188, Champaign, IL, Human Kinetics, 2013.)

Principles and Procedures in Joint Measurement

Before measuring ROM, the therapist should be familiar with average normal ROM ranges, joint structure and function, normal end-feel, safe handling methods, and bony landmarks related to each joint and joint axis.[3,4,10] The therapist should be skilled in correct positioning and stabilization for measurements, palpation, alignment and reading of the goniometer, and accurate recording of measurements.[10] For the most reliable measurements, it is best that the same therapist assesses and reassesses the client at the same time of day with the same instrument and the same measurement protocol.[3] Because that is not always feasible, when there are alternative measurement protocols and tools, the specific protocol used for measurement must be described with the measurement data to ensure test-retest and interrater reliability.

Visual Observation

The joint to be measured should be exposed, and the therapist should observe the joint and adjacent areas.[3] The therapist asks the client to move the part through the available ROM actively and independently, if muscle strength is adequate, and observes the movement.[4] The therapist should look for compensatory motions, posture, muscle contours, skin color and condition, and skin creases and compare the joint with the noninjured part, if possible.[3] The therapist should then move the part through its range to the tolerance of the client to see and feel how the joint moves and to estimate ROM.

Palpation

Feeling the bony landmarks and soft tissue around the joint is an essential skill gained with practice and experience. The pads of the index and middle fingers are used for **palpation**. The thumb is sometimes used. The therapist's fingernails should not make contact with the client's skin. Pressure is applied gently but firmly enough to detect underlying muscle, tendons, or bony structures. For joint measurement, the therapist must palpate to locate bony landmarks for placement of the goniometer.[3]

Positioning of Therapist and Support of Limbs

The therapist's position varies, depending on the joints being measured. When measuring finger or wrist joints, the therapist may sit next to or opposite the client. If sitting next to the client, the therapist should measure the wrist and finger joints on that side and then move to the other side to measure the joints on the client's opposite side. This procedure makes the client more comfortable (eliminating the need to stretch across the midline) and ensures more accurate placement of the goniometer. When measuring the larger joints of the upper or lower extremity, the therapist may stand next to the client on the side being measured. The client may be seated or lying down. The therapist needs to use good body mechanics when reaching, lifting, and moving heavy limbs. The therapist should use a broad base of support and stand with the head upright while keeping the back straight. The feet should be shoulde-width apart, with the knees slightly flexed. The therapist's stance should be in line with the direction of movement. The therapist should be positioned close to the client when lifting the limb. The limb should be supported at its center of gravity, approximately where the upper and middle thirds of the segment meet. To ensure patient comfort, the therapist's hands should be in a relaxed broad grasp that conforms to the contours of the part without pinching or allowing fingers to dig into the body part. The therapist can provide additional support by resting the part on his or her forearm.[3]

Precautions and Contraindications

In some instances, measuring joint ROM is contraindicated or should be undertaken with extreme caution. It is contraindicated if there is a joint dislocation or unhealed fracture, immediately after surgery on any soft tissue structures surrounding joints, in the presence of myositis ossificans, or when ectopic ossification is a possibility.[3]

Joint measurement must always be done carefully. The following situations call for extreme caution:

1. The client has joint inflammation or an infection.

2. The client is taking either medication for pain or muscle relaxants.

3. The client has osteoporosis, osteoarthritis or rheumatoid arthritis, hypermobility, or subluxation of a joint.

4. The client has hemophilia.

5. The client has a hematoma.

6. The client has just sustained an injury to soft tissue.

7. The client has a newly united fracture.

8. The client has undergone prolonged immobilization.

9. Bony ankyloses or excessive osteophyte formation around joint surfaces is suspected.

10. The client has carcinoma of the bone or any fragile bone condition (e.g., osteogenesis imperfecta [brittle bone disease]).[3,9]

End-Feel

PROM is normally limited by the structure and health of the joint and surrounding soft tissues. Thus ligaments, the joint capsule, muscle and tendon tension, contact of joint surfaces, and soft tissue approximation may limit the end of a particular ROM. Each of these structures has a different end-feel as the therapist moves the joint passively through its ROM. End-feel is the normal resistance to further joint motion because of stretching of soft tissue, ligamentous and joint capsule limitations, approximation of soft tissue, and contact of bone on bone. End-feel is normal when full ROM is achieved and the motion is limited by normal anatomical structures. Abnormal end-feel occurs when ROM is increased or decreased or when ROM is normal but structures other than normal anatomy stop the ROM.[3]

End-feel is normally classified as hard, soft, or firm. An example of hard end-feel is bone contacting bone when the elbow is passively extended and the olecranon process comes into contact with the olecranon fossa. Soft end-feel can be detected on elbow flexion when there is soft tissue apposition of the forearm with the elbow flexor muscles of the upper arm. A firm end-feel has a firm or springy sensation that has some give, as when the ankle is dorsiflexed with the knee in extension and ROM is limited by tension in the gastrocnemius muscle.[3]

In pathological states, end-feel is abnormal when PROM is increased or decreased significantly from the standards listed below or when PROM is normal but movement is stopped by structures other than normal anatomy.[3] For example, elbow flexion may have a hard end-feel due to a bony osteophyte or surgically implanted plate, or the end-feel may be firmer than normal due to excessively large muscle bulk. Practice and sensitivity are required for the therapist to detect different end-feels and to distinguish normal from abnormal.[3,10] The normal end-feel for each joint and directions for joint measurement are described in the following sections.

Two-Joint Muscles

Many of the deep muscles that move a joint cross only one joint; however, the more superficial muscles usually cross two or more joints. When a one-joint muscle contracts, it moves the one joint that it acts at; subsequently this muscle is stretched when the one joint that the muscle crosses is moved in the opposite direction. Because two-joint muscles act at two joints, they oppose the motion of two joints. A muscle that crosses two or more joints is not long enough to allow for full stretch when the joints that it crosses are simultaneously moved in the opposite direction. A two-joint muscle feels taut when it is at its full length over both joints that it crosses and before it reaches the limits of the normal ROM of both joints.[7] Positioning is of utmost importance as ROM at one joint may be affected by the position of the other joint due to passive insufficiency.[3] For example, the extrinsic finger flexor muscles cross anterior to the wrist and finger joints, so they have insufficient length to allow for simultaneous extension of the wrist and fingers. When joints crossed by two-joint muscles are being measured, it is necessary to place the other joint (the one not being measured) in a neutral or relaxed position to place the two-joint muscle on slack. In the finger flexor example, the wrist should be placed in a neutral position when measuring finger extension ROM to prevent passive insufficiency of the extrinsic finger flexor from restricting finger extension ROM. Similarly, when hip flexion is being measured, the knee should be flexed to place the hamstrings in the slackened position[3], and when knee flexion is measured, the hip should be flexed to relax the rectus femoris which crosses both the hip and knee joints. Avoiding passive insufficiency ensures that the measurement of a joint actually measures only the limits of the joint, and not unintended limits of the muscles.

Methods of Joint Measurement

There are two systems for measuring joint ROM: the 180-degree and the 360-degree systems. Both systems use a **goniometer**, a protractor with two arms (movable and static), to measure ROM. The goniometer is superimposed on the body in the plane in which the motion is to occur. The axis of the goniometer is placed on the moving joint, and the two arms are placed on the body parts that form the joint. When measuring the elbow joint, the axis is at the elbow, the static arm is on the proximal upper extremity, and the movable arm is on the forearm. In the 360-degree system the protractor is a full circle, whereas the protractor is a half circle in the 180-degree system. Either system can be used to measure the moving elbow joint with results easily transposed between systems. This chapter focuses on the 180-degree system; however, the 360-degree system is also briefly discussed.

180-Degree System

In the 180-degree system of joint measurement, the 0-degree position is the starting point for all joint motions. For most motions, the anatomical position (Fig. 21.5) is the starting or 0-degree position. All joint motions begin at the 0-degree position and increase toward 180 degrees.[3,5,10] Some motions cannot be related to the full circle. In these instances, a 0-degree starting position is designated (as anatomical or neutral position), and the movements are measured as increases from the 0-degree position. These motions occur in a horizontal plane around a vertical axis. They are forearm pronation and supination, hip and shoulder internal and external rotation, wrist radial and ulnar deviation, and thumb palmar and radial abduction (carpometacarpal flexion and extension).[5]

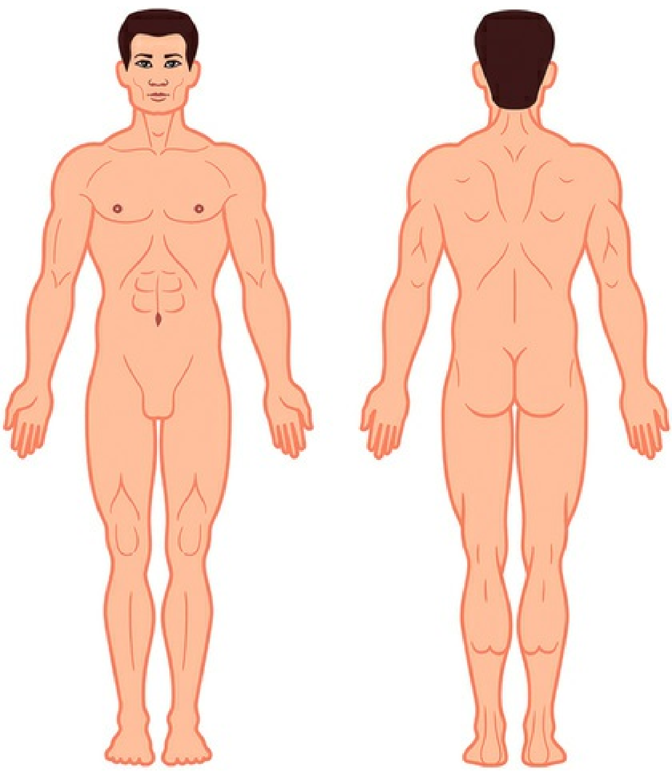


FIG 21.5 For most motions, the anatomical position is the starting or 0-degree position. (From GettyImages.com.)

360-Degree System

In this system, movements occurring in the coronal and sagittal planes are related to the full circle.

When the body is in the anatomical position, the circle is superimposed on it in the same plane in which the motion is to occur, with the goniometer axis placed on the joint center in line with the axis of movement. "The 0-degree (360-degree) position will be overhead and the 180-degree position will be toward the feet."[5] Thus, for example, shoulder flexion and abduction are movements that proceed toward the 0-degree position, and shoulder adduction and extension proceed toward the 360-degree position. The average normal ROM for shoulder flexion is 170 degrees. Therefore in the 360-degree system, the movement would start at 180 degrees and progress toward 0 to 10 degrees. The ROM recorded would be 10 degrees. On the other hand, shoulder extension that has a normal ROM of 60 degrees would begin at 180 degrees and progress toward 360 to 240 degrees, and 240 degrees would be the ROM recorded.[5] The total ROM of extension to flexion would be 240 to 10 degrees—that is, 230 degrees.[5,6]

Goniometers

Usually made of metal or plastic, goniometers come in several sizes and types and are available from medical and rehabilitation equipment companies.[5,10,11] The word *goniometer* is derived from the Greek *gonia,* which means "angle," and *metron,* which means "measure."[9,15] Thus goniometer literally means "to measure angles." The universal goniometer consists of a body attached to a stationary (proximal) bar, and a movable (distal) bar.[3,10] The stationary bar is attached to the body of the goniometer. The body is a half-circle or a full-circle protractor printed with a scale of degrees from 0 to 180 for the half-circle and 0 to 360 for the full-circle goniometer.[3,4] The movable bar is attached at the center, or axis, of the protractor and has a line or pointer on the protractor. As the movable bar rotates around the axis, the dial points to the number of degrees on the protractor scale.

Two scales of figures are printed on the half circle. Each starts at the 0-degree point and progresses toward 180 degrees, but in opposite directions, often printed in black and red. Because the starting position in the 180-degree system is always at the 0-degree point and increases toward 180 degrees, the outer row of figures is read if the bony segments being measured are end to end, as in elbow flexion. The inner row of figures is read if the bony segments being measured are alongside one another in anatomical position, as in shoulder flexion. The scale to read is the one that reads zero in the anatomically neutral position.

To ensure accuracy, it is best to use a goniometer that is long enough to allow for the stationary and movable arms to align over the majority of the length of the body parts that articulate at the joint. The grommet or rivet of the goniometer, which acts as the axis, must move freely yet be tight enough to remain where it was set when the goniometer is removed to be read after alignment with the joint.[4] For easy, accurate readings, some goniometers have a locking nut that can be tightened just before the goniometer is removed.[5] Plastic goniometers wear with age, can become loose, and are sometimes even loose when new. This makes them difficult to use because they do not stay in a final position to be read. Plastic goniometers may be tightened by gently tapping with a hammer on the rivet or grommet or squeezing it with pliers to approximate the plastic in a tightened position. The arms of the goniometer should be able to be moved with a gentle force applied with one hand, and the arms should stay in the position placed in during joint measurement.

Fig. 21.6 shows several types and styles of goniometers. The first five (labeled A-E in Fig. 21.6) are full-circle goniometers that have calibrations for both the 360-degree and the 180-degree systems printed on their face. B, C, and D have longer arms and are usually best for use on the large joints of the body. B and C are the same size, but note that one is shaded plastic and one is clear. They function the same and shading or clear may be more visible in some situations (as will become obvious with some of the pictures later in the chapter). F and H have half-circle protractors used for the 180-degree system. F is simply an inexpensive 6″ goniometer, like H, that has been cut to more easily measure the small joints of the hand and digits. The movable arms on F and H have an extension that crosses the axis and allows one to read either scale regardless of whether the convexity of the half circle is directed toward or away from the direction of motion. Thus the evaluator does not have to reverse the goniometer and thereby obscure the scale to read it. G, I, and J are special finger and hand goniometers (see Fig. 21.6). G and J have arms that are short and flattened. They are designed to lie flat over the finger joints and adjacent dorsal surfaces rather than on their lateral aspects, as is done for most of the larger joint motions. This style is also designed to be used on the hand and digits, but the protractor itself rotates and the flat side follows the dorsal surface of the joints of the hand rather than the arm rotating on the stationary protractor. Small plastic goniometers E and H are for finger measurement—these are inexpensive and easy to carry.

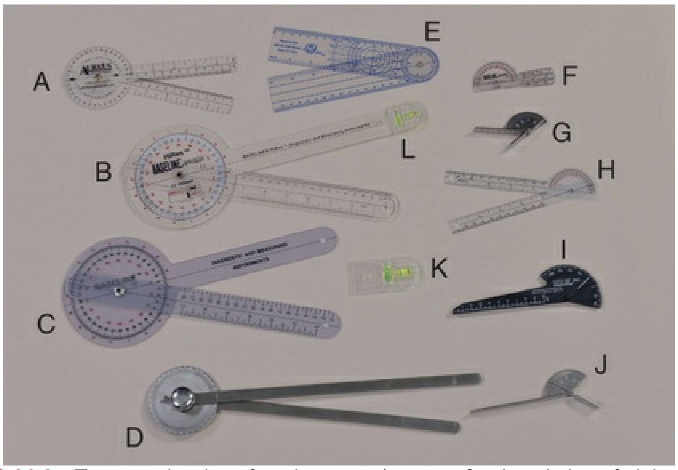


FIG 21.6 Types and styles of goniometers (see text for description of alphas).

Note that one of the larger goniometers (L) has a set of spirit levels on the end of the stationary bar. These enable correct vertical and horizontal orientation of the stationary bar and protractor for movements that are compared to the level line of the world when a patient is in anatomical or neutral position, (e.g., forearm pronation and supination, internal and external rotation of the shoulder when measured in abduction). K is a spirit level that can be slipped over the end of a large (12″) goniometer like C and removed when not needed.

Other types of goniometers are available. Some are inclinometers which have a fluid indicator that responds to gravity and provides the reading after the motion is completed but they must be read while they are on the body part.[5] Others can be attached to two body segments and have dials that register ROM electronically with digital output, but are usually only used in research settings. There are special goniometers for cervical and spine ROM measurements and for forearm rotation.[11] A tape measure or metric scale may also be used on some joints by measuring the distance between two segments; for example, the distance between the chin and chest when measuring cervical flexion, extension, and rotation (see the table dealing with the Motion Screen sequence) the distance between the center of the tips of two fingers for finger flexion or abduction (see Fig. 21.36, presented later in the chapter) and the distance between the tip of the thumb and the tip of the little finger for opposition (see Fig. 21.42, presented later in the chapter).[3]

Recording Measurements

180-Degree System

When using the 180-degree system, the evaluator should record the number of degrees at the starting position and the number of degrees at the final position after the joint has passed through the maximum arc of motion possible.[10] Normal ROM always starts at the 0-degree point in anatomical or neutral positions and increases toward 180 degrees. When it is not possible to start the motion at the 0-degree position because of limitation of motion, ROM is recorded by writing the number of degrees at the starting position followed by the number of degrees at the final position.[3] For example, elbow ROM limitations can be noted as follows:

- Normal: 0 to 140 degrees
- Extension limitation: 15 to 140 degrees
- Flexion limitation: 0 to 110 degrees
- Flexion and extension limitation: 15 to 110 degrees

Abnormal hyperextension of the elbow may be recorded by indicating the number of degrees of hyperextension below the 0-degree starting position with a minus sign, followed by the 0-degree position and then the number of degrees at the final position.[10] This may be noted as follows:

- Normal: 0 to 140 degrees
- Abnormal hyperextension: −20 to 0 to 140 degrees. A potential problem with this numbering system is that it works for an elbow but does not work well for joints like shoulders, hips, and metacarpals that naturally move past zero without indicating a potentially pathological excess ROM, which was written with the negative number previously.

An alternative that avoids this problem is the three number system. The three number system is used in joints that can move in either direction past their neutral position with zero being the typical anatomical position. No negative numbers are ever used to avoid the confusion cited earlier. For example, a shoulder may flex to 160 degrees, go through zero when hanging down in neutral (anatomical) position, and then continue in the sagittal plane to extend to 60 degrees of extension. This is written as 160/0/60. As in the preceding example, an elbow may flex to 140 degrees, straighten to zero, and go no farther with no hyperextension (140/0/0). But it may also hyperextend to 15 degrees, and the numbers would be written as 140/0/15. However, some people cannot completely extend their elbows to zero. Maybe they can only get to 12 degrees, slightly flexed. In this case their own unique neutral is 12 degrees and not the theoretical zero. This would be written as 140/12/0, indicating that they cannot go past 12 degrees of flexion (their joint's limit). The zero indicates that there is no extension or hyperextension beyond their unique neutral. Shoulder internal and external rotation is recorded similarly. Examples include pronation/0/supination of the forearm, flexion/0/extension, radial/0/ulnar deviation of the wrist and some smaller joints of the hand and analogous movements of the lower extremities. In each of these joints, it may be simpler and more efficient to write their movement with the zero (anatomical position) at a theoretical midpoint between the two extremes.

However, because there are alternative methods of recording ROM, the evaluator is advised to learn and adopt the particular method commonly and consistently used by the healthcare facility and professional peers with whom he or she works to limit any misunderstanding of AROM or PROM notation.

A sample form for recording ROM measurements is shown in Fig. 21.7. Average normal ROM for each joint motion is listed on the form and in Table 21.1. When recording ROM, there are rare instances when it is clinically important to measure every joint on the form. Every space on the form should be filled in with numbers for those joints tested. If the joint was not tested, "NT" should be entered in the space or some sections lined through to avoid confusion in the future.[3]

JOINT RANGE MEASUREMENTS

Client's name ______________________ Chart no. __________

Date of birth ______________ Age ________ Sex __________

Diagnosis ______________________ Date of onset __________

Disability ______________________________________

LEFT 3	LEFT 2	LEFT 1			RIGHT 1	RIGHT 2	RIGHT 3
			SPINE				
			Cervical spine				
			Flexion	0-45			
			Extension	0-45			
			Lateral flexion	0-45			
			Rotation	0-60			
			Thoracic and lumbar spine				
			Flexion	0-80			
			Extension	0-30			
			Lateral flexion	0-40			
			Rotation	0-45			
			SHOULDER				
			Flexion	0 to 170			
			Extension	0 to 60			
			Abduction	0 to 170			
			Horizontal abduction	0-40			
			Horizontal adduction	0-130			
			Internal rotation	0 to 70			
			External rotation	0 to 90			
			ELBOW AND FOREARM				
			Flexion	0 to 135-150			
			Supination	0 to 80-90			
			Pronation	0 to 80-90			
			WRIST				
			Flexion	0 to 80			
			Extension	0 to 70			
			Ulnar deviation	0 to 30			
			Radial deviation	0 to 20			
			THUMB				
			MP flexion	0 to 50			
			IP flexion	0 to 80-90			
			Abduction	0 to 50			
			FINGERS				
			MP flexion	0 to 90			
			MP hyperextension	0 to 15-45			
			PIP flexion	0 to 110			
			DIP flexion	0 to 80			
			Abduction	0 to 25			
			HIP				
			Flexion	0 to 120			
			Extension	0 to 30			
			Abduction	0 to 40			
			Adduction	0 to 35			
			Internal rotation	0 to 45			
			External rotation	0 to 45			
			KNEE				
			Flexion	0 to 135			
			ANKLE AND FOOT				
			Plantar flexion	0 to 50			
			Dorsiflexion	0 to 15			
			Inversion	0 to 35			
			Eversion	0 to 20			

FIG 21.7 Form for recording joint ROM measurement.

TABLE 21.1
Average Normal Range of Motion (180-Degree Method)

Joint	Range of Motion	Associated Girdle Motion
Cervical Spine		
Flexion	0 to 45 degrees	
Extension	0 to 45 degrees	
Lateral flexion	0 to 45 degrees	
Rotation	0 to 60 degrees	
Thoracic and Lumbar Spine		
Flexion	0 to 80 degrees	
Extension	0 to 30 degrees	

Lateral flexion	0 to 40 degrees	
Rotation	0 to 45 degrees	
Shoulder		
Flexion	0 to 170 degrees	Abduction, lateral tilt, slight elevation, slight upward rotation
Extension	0 to 60 degrees	Depression, adduction, upward tilt
Abduction	0 to 170 degrees	Upward rotation, elevation
Adduction	0 degrees	Depression, adduction, downward rotation
Horizontal abduction	0 to 40 degrees	Adduction, reduction of lateral tilt
Horizontal adduction	0 to 180 degrees	Abduction, lateral tilt
Internal rotation		Abduction, lateral tilt
Arm in abduction	0 to 70 degrees	
Arm in adduction	0 to 40 degrees	
External rotation		Adduction, reduction of lateral tilt
Arm in abduction	0 to 90 degrees	

When joint measurements are performed in more than one position (e.g., as in alternative shoulder internal and external rotation positions noted later), the evaluating occupational therapist should note on the record the position in which the measurement was taken. The therapist should also note the position of the joint when the client experiences any pain or discomfort, the appearance of protective muscle spasm, and whether AROM or PROM was being measured. Record the points (degrees of ROM) where tightness started, progressed to discomfort, and then were felt as pain, and any deviations from recommended testing procedures or positions.[10] This becomes important information to document recovery from injury over time or as a result of therapist intervention.

Results of Assessment as the Basis for Planning Intervention

After joint measurement, the therapist should analyze the results in relation to the client's life role requirements. The therapist's first concern should be to correct ROM that is below functional limits. Many ordinary activities of daily living (ADLs) do not require the maximum ROM listed in the table. **Functional ROM** refers to the amount of joint range necessary to perform essential ADLs and instrumental activities of daily living (IADLs) without the use of special equipment. The first concern of intervention is to attempt to increase to functional levels any ROM that is limiting performance of self-care and home maintenance tasks.[8] For example, severe limitation of elbow flexion affects eating and oral hygiene. Therefore it is important to increase elbow flexion to nearly full ROM for function. Likewise, severe limitation of forearm pronation affects eating, washing the body, telephoning, caring for children, and dressing. Because sitting comfortably requires hip ROM of at least 0 to 100 degrees, a first goal might be to increase flexion to 100 degrees if it is limited. Of course, if additional ROM can be gained, the therapist should plan the progression of intervention to increase ROM to the normal range.

Some limitations in ROM may be permanent. The role of the therapist in such cases is to work out methods to compensate for the loss of ROM. Possibilities include assistive devices—such as a long-handled comb, brush, shoehorn, and a device to apply stockings—or adapted methods of performing a particular skill. (See Chapter 10 for further suggestions for ADL techniques in those with limited ROM.)

In many conditions, such as burns and arthritis, loss of ROM can be anticipated. The goal of intervention is to prevent joint limitation with splints, positioning, exercise, activity, and application of the principles of joint protection.

Limited ROM, its causes, and the prognosis for increasing ROM will suggest intervention approaches. Some of the specific methods used to increase ROM are discussed elsewhere in this text (see Chapters 29 and 39). These methods include stretching exercises, resistive activity and exercise, strengthening of antagonistic muscle groups, activities that require active motion of the affected joints through the full available ROM, splints, and positioning. To increase ROM, the physician may perform surgery or manipulate the part while the client is under anesthesia. The occupational therapist (OT), physical therapist (PT), or certified hand therapist may use joint mobilization techniques such as manual stretching with heat and massage.[8] Some surgeries (e.g., rotator cuff repair) require long periods of restriction of AROM while the surgery site (ligament grafts to bone) heals. During these periods (often 6–8 weeks), a shoulder can develop adhesive capsulitis (frozen shoulder) if it is not moved. During this precautionary period, it is often the role of the therapist (OT or PT) to passively move the shoulder on a regular treatment schedule specified by the surgeon to maintain joint mobility while observing surgical precautions of no AROM in physician-specified planes that would pull on the grafts and repairs. Monitoring PROM during these treatments provides data about progress or maintenance of joint ROM or will indicate problems to refer back to the surgeon.

Procedure for Measuring Passive Range of Motion

Average normal ROM for each joint motion is listed in Table 21.1, in Fig. 21.7, and before each of the following procedures used for measurement. The reader should keep in mind that ROM may vary considerably among individuals and these tables contain averages of maximum ROM. Normal ROM is affected by age, gender, injury, and other factors, such as lifestyle and occupation.[10] Therefore the client (C) in the illustrations may not always demonstrate the average maximum ROM listed for the particular motion.

In the following figures, the goniometer is shown in such a way that the reader can most easily see its positioning. Therefore the occupational therapist in the pictures may not always be in the optimum position for her own body mechanics during the measurement. For the purposes of clear illustration, the therapist is necessarily shown off to one side and may have only one hand, rather than two, on the instrument and the joint. For many of the motions the OT would typically be in front of the client, or the therapist's hands may obscure the goniometer. For this reason, do not assume that the pictures indicate the *correct* position for the therapist during measurement or feel that you must follow the picture precisely. How the therapist holds the goniometer and supports the part being measured clinically is determined by factors such as the position of the client, amount of muscle weakness, presence or absence of joint pain, and whether AROM or PROM is being measured. Both the therapist and the client should be positioned for the greatest comfort, correct placement of the instrument, and adequate stabilization of the part being tested to ensure the desired motion in the correct plane.

General Procedure: 180-Degree Method of Measurement[3,10]

1. The client should be comfortable and relaxed in the appropriate position (described later) for the joint measurement.

2. Uncover the joint to be measured.

3. Explain and demonstrate to the client what you are going to do, why, and how you expect him or her to cooperate.

4. If there is unilateral involvement, assess PROM on the analogous limb to establish normal ROM for the client.

5. Establish and palpate bony landmarks, which will be used to align the axis and arms of the goniometer.

6. Stabilize joints proximal to the joint being measured.

7. Ensure that when measuring joints that are operated by two-joint muscles (e.g., finger flexors, extensors, and rectus femoris), the other joint is positioned to put those muscles in a relaxed and lengthened state avoiding passive insufficiency, which will limit ROM of the joint you are measuring.

8. Move the part passively through ROM to assess joint mobility and end-feel.

9. Return the part to the starting position.

10. To measure the starting position, place the goniometer just over the surface of the joint and in the plane of movement. Place the axis of the goniometer over the axis of the joint by using the designated bony prominence or anatomical landmark. With some joints that are embedded in soft tissue (such as the glenohumeral joint), the therapist must visualize the correct joint center based on knowledge of skeletal anatomy and adjacent surface landmarks (e.g., two fingers inferior to the acromion is a good approximation of the placement of the glenoid fossa and humeral head, which are the true joint center). Place the stationary bar on or parallel to the longitudinal axis of the proximal part (e.g., the trunk) or along the stationary/proximal bone and place the movable bar on

or parallel to the longitudinal axis of the distal or moving bone. Keep the plane of the goniometer aligned with the correct plane of movement of the joint.

11. Record the number of degrees at the starting position and follow the movement or remove (or back off) the goniometer until maximum ROM is achieved. It is acceptable but not necessary to hold the goniometer in place and follow the joint through the arc of ROM. Measurements at each end of ROM are sufficient.

12. To measure PROM, hold the part securely above and below the joint being measured and gently move the joint through ROM. Do not force the joint. Watch for signs of pain and discomfort. (Note: PROM may also be measured by asking the client to move actively through ROM. Note the degree of AROM. From the final AROM position the therapist then moves the joint passively through the final few degrees to a normal stop or to the point where the client indicates movement becomes painful and measures PROM. There is no need to force a joint past a normal maximum ROM even if it is not painful (remember that there may also be sensory damage and pain may not be felt), even if it will go farther or joint or soft tissue damage may result.

13. Reposition the goniometer and record the number of degrees at the final position. It is often necessary to stabilize the joint in its maximum PROM position with one hand, with furniture or with an assistant in difficult cases. Learning to operate the goniometer with the other hand alone becomes a very useful skill in PROM measurement.

14. Remove the goniometer and gently place the part in the resting position.

15. Record the reading at the final position and make any notes on the evaluation form about which of the alternative measurement methods you might have used or variations from standard procedure that were necessary due to client condition or position.

Motion Screen/Motion Screening Test

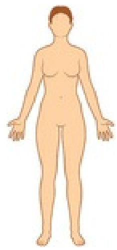
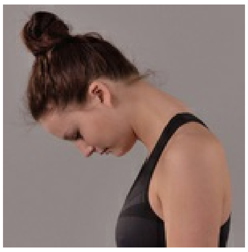
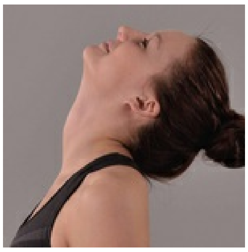
It is almost never necessary to measure the range of motion of all of the joints of the body. Most injuries, disabilities, and health conditions only affect part of the body. The first step to measuring range of motion is to conduct a quick screen of the motions of the major joints of the body. This gives the therapist a first look at movement ability and limitations. It also gives the therapist early information about which motions to measure and document in detail, which to estimate as within normal limits (WNL) or within functional limits (WFL), and which to ignore because they are not limited enough to impair the client's ADLs, IADLs, or other important occupations. There are many varieties and sequences of motion screens with different levels of completeness. A new therapist in a treatment facility would be advised to confer with colleagues to see what they use as a screen so they can be consistent in the way their screens are documented and to ensure test-retest reliability for monitoring a patient's progress in treatment notes. The following motion screen provides an illustrated example of one way to do a screening.

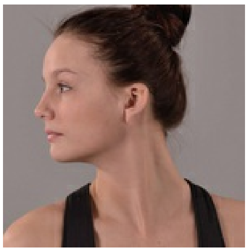
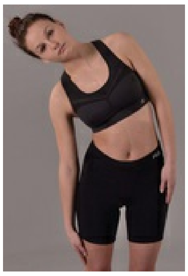
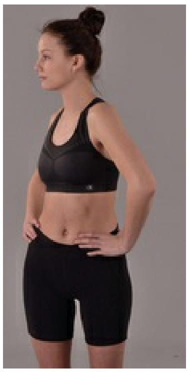
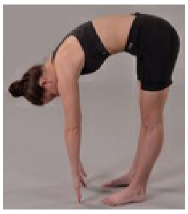
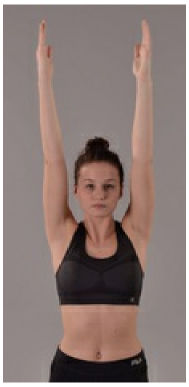
1. The therapist stands in front of the client to model each movement and performs each movement as he or she asks the client in layperson's language to perform it. Because they are facing each other, the therapist should perform his or her movements on the opposite side (mirror image) from what he or she is asking the client to do so that clients are not confused by the left-right instructions compared to what they see as the therapist models each movement.

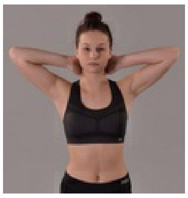
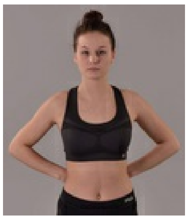
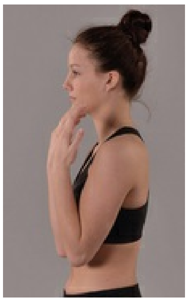
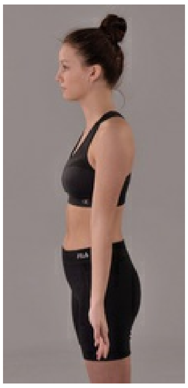
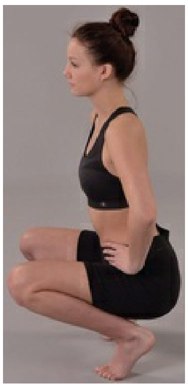
2. The screen is ideally performed standing, but if a client cannot stand unaided, it can be modified to be done from a sitting position.

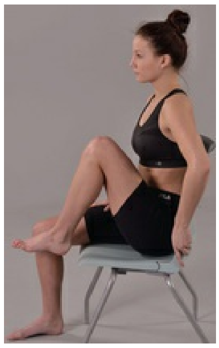
3. Because some movements are mirror images, some are only illustrated with a left or right movement when both are requested in the screen.

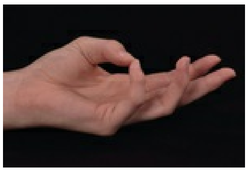
4. Motion screen sequence:

A. Starting Position "Stand straight looking forward; look at me."	
B. Cervical Flexion "Look down, bend your neck so your chin is close to your chest."	
C. Cervical Extension "Look up, bend your head back as far as you can."	

D. Cervical Horizontal Rotation "Turn your head to the right as far as you can. Now turn your head to the left."	
E. Thoracic Lateral Flexion "Bend your body as far as you can to the left. Now bend to the right."	
F. Thoracic Horizontal Rotation "Twist your body to the right as far as you can. Now twist to the left."	
G. Thoracic Flexion "Bend over and touch your toes or the floor."	
H. Shoulder Flexion With Elbow Extension "Raise both arms as high and straight as you can."	
I. Shoulder External/Lateral Rotation "Touch the back of your head with both hands."	

	
J. Shoulder Internal/Medial Rotation "Touch your back with both hands."	
K. Elbow Flexion "Bend your elbows up and touch your chin or shoulders."	
L. Elbow Extension "Straighten your elbows down with palms forward."	
M. Hip and Knee Flexion While Balancing and Weight Bearing "Squat down like this." (Therapist should stand near client to assist with balance.)	
N. Alternative Methods for Hip and Knee Flexion *Top:* "While standing, lift your right knee as high as you can. Now your left knee. You can hold onto a chair if you need to." (Therapist should stand near client to assist with balance.) Or *Bottom:* "Sit down and pick up each knee as high as you can."	

	 
O. Dorsiflexion "While sitting, point your foot up."	
P. Plantar Flexion "Now point your foot down." *The following movements can be done in either a sitting or standing position.*	
Q. Wrist Extension "Bend your elbows so both hands are out in front of you. Lift your hands at the wrist, like this."	
R. Wrist Flexion "Now bend your wrists down."	

	
S. Composite Digit Flexion "Make a fist with both hands, thumbs on top."	
T. Composite Digit Extension "Open both hands and spread your fingers."	
U. Forearm Supination "Turn your palms up."	
V. Forearm Pronation "Now turn your palms down."	
W. Thumb-Finger Opposition "Touch your thumbs to each of your fingers."	
"Thank you. Are there any other movements that you are having problems with? If there are, please show me."	

Specific Directions for Joint Measurement Using the 180-Degree System

Spine

Cervical Spine

Measurements of neck movements are the least accurate because the neck has few bony landmarks and much soft tissue overlying the bony segments. It is also composed of a series of joints and therefore does not have only one axis.[4] Radiographic examination is the best means to make an accurate measurement of the specific joints.[12] However, general measurements may be taken with a tape measure to record the distance between the chin and chest for flexion and extension, between the chin and shoulder for neck rotation, and between the mastoid process and shoulder for lateral flexion.[3]

Approximate estimates of cervical flexion, extension, rotation, and lateral flexion may be made with the goniometer or by estimating the number of degrees of motion by using a fixed landmark and axis (e.g., midline on posterior aspect of head compared to the horizontal line from C7 to acromion or vertically down spine as proximal base of movement), and then measuring the arc of motion between those two lines [1,4]

Cervical Flexion

0 to 45 degrees

Neutral Position of the Client

Sitting or standing erect with the head vertical

Measurement

The client is asked to flex the neck so that the chin moves toward the chest. If a goniometer is used, the axis is placed over the angle of the jaw. The stationary bar is held in a horizontal position to align with the starting motion of the mandible. The movable bar follows the mandible toward the point of the chin (Fig. 21.8, A).

Alternative Method

The movable arm of the goniometer can be aligned with a tongue depressor, which the client is holding between the teeth. As the client performs neck flexion, the movable bar of the goniometer is adjusted downward to align with the new position of the tongue depressor.[4,10]

Alternative Method

The number of degrees of motion may be estimated, or the therapist may measure the number of inches or centimeters from the bone at the tip of the chin to the sternal notch.[1,3,10] Recognize that when the head is flexed forward, soft tissue may bunch up around the chin. The bony tip of the chin must be found by palpation to measure this distance (Fig. 21.8, B).

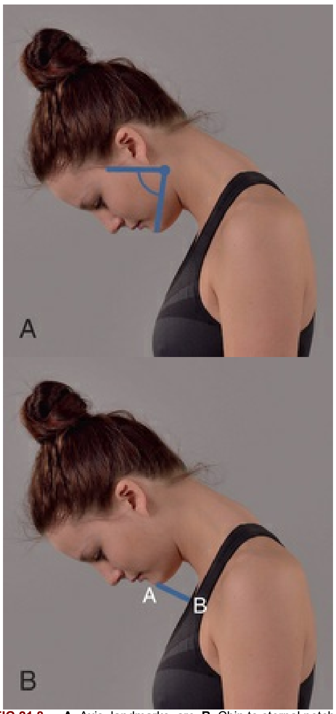


FIG 21.8 **A,** Axis, landmarks, arc. **B,** Chin to sternal notch.

Cervical Extension

0 to 45 degrees

Neutral Position of the Client

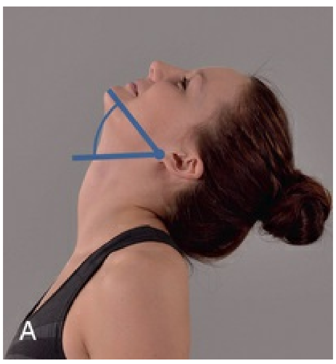
Sitting or standing erect with the head vertical

Measurement

The client is asked to extend the neck as though looking at the ceiling so that the back of the head approaches the thoracic spine. The number of degrees of motion may be estimated, or the number of inches or centimeters from the chin to the sternal notch may be measured.[3] If a goniometer is used, the axis is placed over the angle of the jaw and the stationary bar is held in a horizontal position corresponding with a theoretically level mandible. The therapist grasps the corner of the protractor and steadies his or her arm against the client's shoulder to stabilize and avoid substitution by extending the thoracic spine. The client can hold a tongue depressor in the teeth. The movable bar of the goniometer is moved upward to align with the mandible or the tongue depressor as the client extends the neck. It is important to document which method is used to ensure reliable measurements over time or between therapists (Fig. 21.9, A and B).[4,10]

Substitution

If cervical extension is inadequate, a client may attempt to achieve additional extension by extending the thoracic spine. Although this may enable the client to look upward, it does not increase cervical extension by changing the angle of the head to the trunk (see Fig. 21.9, C).



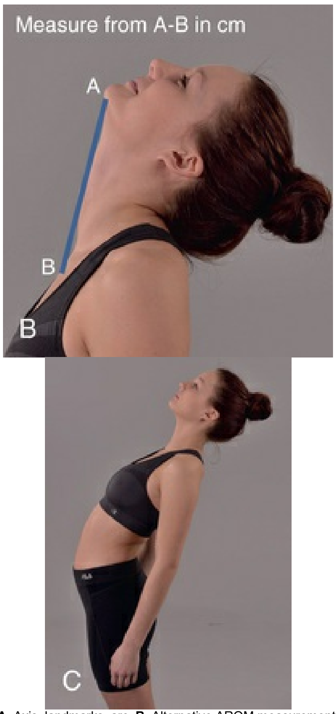


FIG 21.9 **A,** Axis, landmarks, arc. **B,** Alternative AROM measurement methods. **C,** Substitution.

Cervical Lateral Flexion

0 to 45 degrees

Neutral Position of the Client

Sitting or standing erect with the head vertical

Measurement

The client is asked to flex the neck laterally without rotation by moving the ear toward the shoulder. The number of degrees of motion may be estimated. If a goniometer is used, the axis is typically placed over the spinous process of C7 (the seventh cervical vertebra) if measured on the posterior neck, or with the axis pointed toward the larynx, if measured from the anterior side. The stationary bar may be over the shoulder toward the acromion if that yields a starting position of 0 degrees (Fig. 21.10, label 1) or parallel to the floor if the trunk is vertical so that the motion begins at 90 degrees. Or it may be aligned with the thoracic vertebra or sternum (Fig. 21.10, label 2), if the client is not positioned in a vertical position. On the posterior side, the movable bar is aligned with the midline of the external occipital protuberance or the midline of the forehead between the eyes if measured anteriorly. As an alternative method (Fig. 21.10, label 3) the therapist may measure the number of inches or centimeters between the mastoid process and the acromion process of the shoulder. Given these alternatives, and because there is no single standard method of measuring this movement, it is critical that the measurement method and landmarks be described in the notes to ensure reliability in repeat measurement.

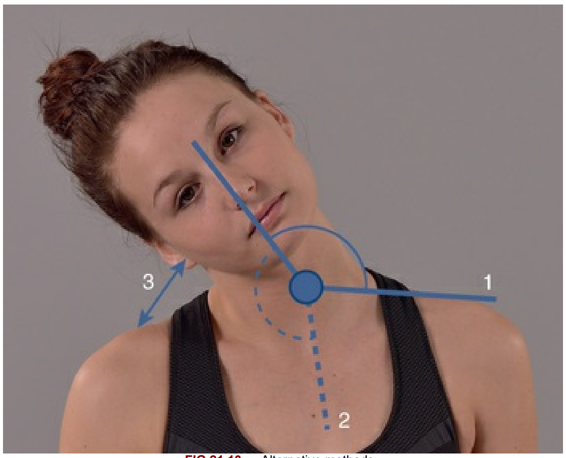


FIG 21.10 Alternative methods.

Cervical Horizontal Rotation

0 to 60 degrees

Neutral Position of the Client

Sitting or standing erect, with the head vertical, facing forward

Measurement

Sitting/Standing

The client is asked to rotate the head right or left without rotating the trunk. The therapist can provide stabilization to reduce shoulder movement due to trunk rotation. The amount of rotation may be estimated in degrees from the neutral position,[1] or a tape measure may be used to determine the distance from the tip of the chin to the acromion process of the shoulder. The measurement is taken first in the anatomical position and then again after the neck has been rotated. The difference in measurement between the two positions is the amount of rotation (Fig. 21.11).[3]

Supine

In the supine position or from a therapist position above the head with client in a seated position, a goniometer can be used. The goniometer will be set at 90 degrees with the axis placed over the vertex of the head. The stationary bar can be held in one of three positions. It can be held steady on the frontal plane relative to the trunk or aligned with the acromion process on the side being tested if sitting, or parallel to the floor in supine. The movable bar is aligned with the tip of the nose to follow the sagittal plane of the head.[4,10]

FIG 21.11 Measurement of the distance from the tip of the chin to the acromion process with neck rotated.

Thoracic and Lumbar Spine

Thoracic Flexion

0 to 80 degrees and 4 inches

Neutral Position of the Client

Standing erect, facing forward

Measurement

Four methods of estimating the range of spinal flexion are as follows:

1. Measure trunk forward flexion in relation to the longitudinal axis of the body (the therapist must hold the pelvis stable with the hands and observe any change in the client's normal lordosis), recording the level of the fingertips along the front of the client's leg.
2. Measure the number of inches or centimeters between the client's fingertips and the floor.
3. Measure the length of the spine from the seventh cervical vertebra to the first sacral vertebra when the client is erect and again after the client has flexed the spine (Fig. 21.12).[3,10]
4. The fourth is probably the most accurate of these clinical methods.[1] In a normal adult, the average increase in length in forward flexion of the spine is 4 inches (10 cm).[3] If the client bends forward at the hips with the back straight, no difference in length will occur.

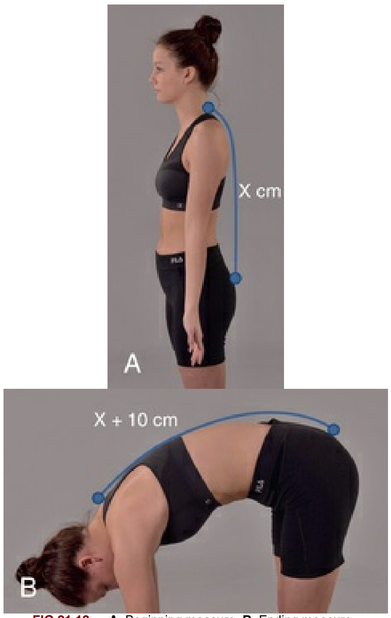


FIG 21.12 **A,** Beginning measure. **B,** Ending measure.

Thoracic Lateral Flexion

0 to 40 degrees

Neutral Position of the Client

Standing erect, facing forward

Measurement

Several methods may be used to estimate the range of lateral flexion of the trunk. A steel tape measure may be held in place during the motion and be used to estimate the number of degrees of lateral inclination of the trunk with respect to the vertical position. Other methods include estimating the position of the spinous process of C7 in relation to the pelvis; measuring the distance of the fingertips from the knee joint in lateral flexion (Fig. 21.13); measuring the distance between the tip of the third finger and the floor[3]; and with a long-arm goniometer (Fig. 21.13), placing the axis on S1 (or the mid pubic bone), the stationary bar perpendicular to the floor, and the movable bar aligned with C7 (or larynx).[1,10] Because there are several measurement method options, it is important to describe the method used in any treatment notes to ensure test-retest reliability if this movement is measured again.

FIG 21.13 Thoracic lateral flexion, ending measure. There is no beginning measurement shown.

Thoracic Extension

0 to 30 degrees (Fig. 21.14)

Neutral Position of the Client

Standing erect, facing forward

Measurement

The client is asked to bend backward while maintaining stability of the pelvis. If necessary, the therapist stabilizes the pelvis from the anterior when the measurement is taken in the standing position. The range of extension is estimated in degrees from the vertical by using the superior iliac crest as the pivotal point in relation to the spinous process of C7. With the client in the prone position, a pillow is placed under the abdomen and the client's hands are placed at shoulder level on the treatment table. The pelvis is stabilized with a strap or by an assistant, and the client extends the elbows to raise the trunk from the table. A perpendicular measurement is taken of the distance between the suprasternal notch and the supporting surface at the end of the ROM.[3]

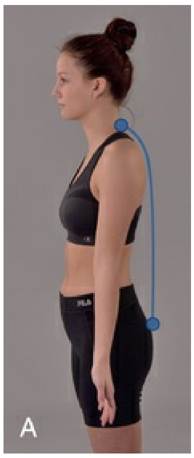
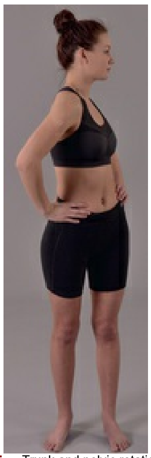


FIG 21.14 **A,** Beginning measure for thoracic extension. **B,** Ending measure for thoracic extension.

Thoracic Rotation	
0 to 45 degrees	
Neutral Position of the Client	
Standing erect, facing forward, or supine	
Measurement	
The client is asked to rotate the upper part of the trunk while maintaining a neutral position of the pelvis. It is, however, very difficult for a client to isolate trunk rotation from pelvic rotation (Fig. 21.15). The therapist may fix the pelvis firmly to maintain the neutral position and align the stationary bar on a perpendicular from a line between the left and right anterior superior iliac spine so that line projects into the sagittal plane with no rotation of the pelvis. This stabilization is especially important to isolate trunk rotation from hip and lower extremity rotation when the client is in the standing position. This motion is recorded in degrees by using the center of the crown of the head as a pivotal point and aligning the movable bar with the arc of motion made by the shoulder as it moves forward (or upward if measured in supine).	
Alternative Method	
Using the same goniometer placement, trunk rotation can also be measured in the sitting position. The seated position will stabilize the pelvis from moving with trunk rotation.	 FIG 21.15 Trunk and pelvic rotation without stabilization.

Upper Extremity[1-3,5,10,12]

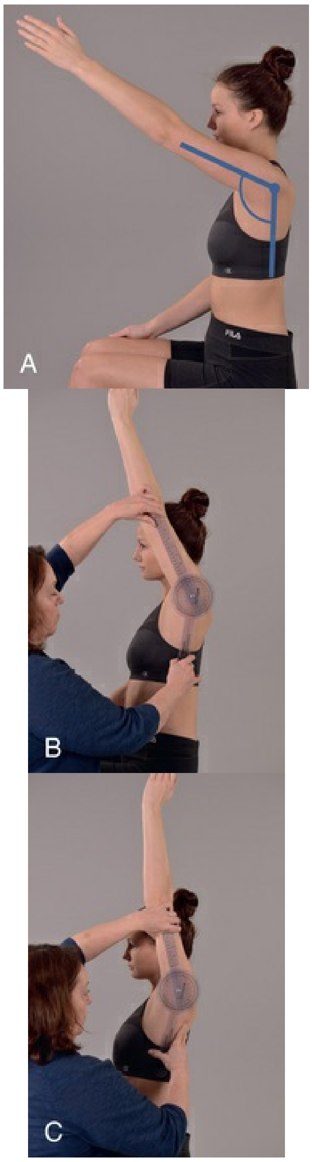
Shoulder

Glenohumeral (GH) joint movement versus total shoulder movement.

It should be noted that scapula movement accompanies total shoulder movement. The range of shoulder motion is highly dependent on scapula mobility, which adds flexibility and wide ranges of motion to the shoulder. Although it is difficult to measure scapula movement directly with the goniometer, the evaluator should assess scapula mobility by observation of active motion or passive movement before proceeding with additional shoulder joint measurements. Scapular ROM can be noted as full or restricted.[3] If scapular motion is restricted, as when the musculature is in a state of spasticity or contracture, and the shoulder joint is moved into extreme ranges of motion (for example, above 90 degrees of flexion or abduction), pain at the end of ROM stops AROM or indicates to the therapist to stop PROM measurement or glenohumeral joint damage can result.

Isolating glenohumeral joint movement.

Approximately one-third of shoulder flexion, extension, and abduction comes from movement of the humerus in the glenohumeral joint, and one-third of total shoulder movement comes from scapular movement. This is referred to as “scapular rhythm.” All of the measurement methods presented next and the ranges of ROM shown are for total shoulder movement. However, in some cases (e.g., when treating a patient after a shoulder replacement or rotator cuff repair) it may be desirable to measure glenohumeral joint movement without scapular movement because the ROM of the humerus relative to the scapula is what is important and targeted in treatment. In that situation, the hand of the therapist can be laid on the scapula with the distal palm (the metacarpophalangeal joints of digits 2–4) on the spine of the scapula and the fingers over the acromion. In that position, the therapist can feel when the angle of the scapula begins to move (rotate for abduction, protract for extension, or retract for flexion) and can stop the client at that point to measure isolated GH joint movement using the same axis and goniometer arm positions (see movements: shoulder flexion, shoulder extension, and shoulder abduction). This method is also applicable to isolate and measure internal and external rotation of the humerus relative to the scapula when measured in a position of abduction of the shoulder (see movements: shoulder internal rotation [abducted], shoulder external rotation [abducted]).

Shoulder Flexion	
0 to 170 degrees	
Position of the Client	
Seated or supine with the humerus adducted in neutral rotation	
Axis, Landmarks Arc, Position of the Goniometer	
The goniometer axis is placed over the center of the humeral head, just distal to the acromion process on the lateral aspect of the humerus. The stationary bar is parallel to the trunk, and the movable bar is parallel to the humerus aligned with the sagittal plane. If the landmarks are found before the movement into flexion, note that when the shoulder is flexed, the shape of the muscle mass changes as the shoulder flexes. The point on the skin where the initial axis is found in the neutral position moves upward and backward to the posterior surface of the shoulder and is no longer the axis of movement of the skeleton. Thus to take a measurement of the final position, the therapist should place the goniometer on the lateral surface of the shoulder by visualizing the axis through the center of the humeral head, which is just slightly superior to the crease formed by the distal end of the deltoid mass and approximately two fingers below the acromion, which can be palpated as the hollow between the proximal deltoid attachments when the shoulder is in flexion or abduction. Fig. 21.16, A, shows the landmarks for ideal placement of the axis and arms of the goniometer. Fig. 21.16, B (AROM), shows the client holding the limb herself in her maximum flexed position and the therapist's hand lightly holding the goniometer in place, with the axis aligned with the joint center and on the stationary and movable arms on the proximal and distal parts. Fig. 21.16, C (PROM), shows the therapist grasping the movable limb firmly, holding the goniometer while stabilizing the trunk with the right hand to offset her pressure on the limb toward maximum flexion and pushing the humerus to the shoulder's firm end-feel with the left hand while maintaining correct goniometer alignment.	

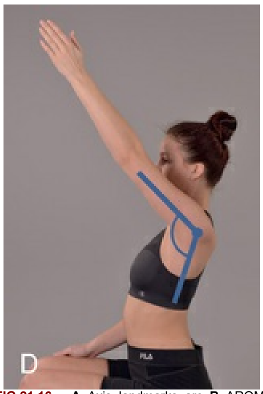


FIG 21.16 **A,** Axis, landmarks, arc. **B,** AROM. **C,** PROM. **D,** Substitution.

End-Feel

Firm[3]

Common Substitution

Sometimes a client has limitations of shoulder movement. Most clients want to please their therapist or have learned to use compensatory movements to “get the job done” so they can perform their ADLs, IADLs, or other occupations, even with limited ROM. As Fig. 21.16, D, shows, the individual may be able to reach a top shelf, but she has substituted thoracic extension for limited shoulder flexion to be able to elevate her arm and hand to reach her target. However, her shoulder AROM has not actually increased. In this illustration the arc of the model's shoulder flexion AROM is identical to that in the axis and landmark picture above (Fig. 21.16, A) where her thoracic spine is held in a neutral anatomical position and the stationary bar follows a vertical line. The evaluator must be careful to watch for substitutions and align the goniometer with the correct landmarks—that is, follow the thoracic spine, regardless of the angle of the spine, and not be tempted to follow a vertical line and incorrectly add ROM when there is no more than before.

Shoulder Extension

0 to 60 degrees (Fig. 21.17)

Neutral Position of the Client

Seated or prone, with no obstruction behind the humerus and the humerus in neutral rotation

Position of the Goniometer

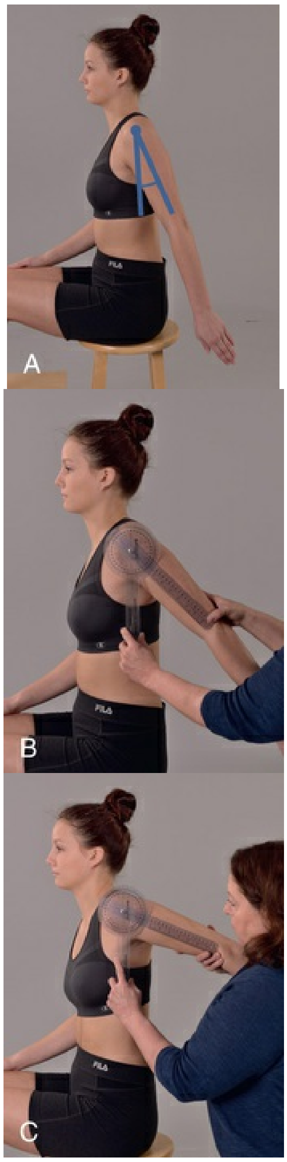
The axis for measuring shoulder extension is the same as for shoulder flexion, but the axis point appears to remain the same for the starting and final positions. Movement should be accompanied by only a slight upward tilt of the scapula. Excessive scapular motion should be avoided so only GH joint ROM is measured. Angular changes of the scapula can be seen if the shoulder is exposed, but they can also be palpated if a hand is laid on the scapula from behind with the palm over the spine of the scapula and the fingers over the acromion. During PROM the therapist must hold the goniometer while maximizing PROM, illustrated by the therapist pulling upward at the elbow in Fig. 21.17, C.

End-Feel

Firm[3]

Substitution

Just as with flexion, a substitution for limited extension may be accomplished by a client via excess anterior flexion of the trunk with no difference in actual extension of the glenohumeral joint or total shoulder ROM. If the client substitutes as in Fig. 21.17, D, the therapist can either stabilize the trunk with a firm hand on the anterior shoulder or compensate for the substitution by aligning the stationary bar with the upper trunk/thoracic spine and the movable bar still aligning with the humerus, yielding the same shoulder extension measurement as in Fig. 21.17, A.



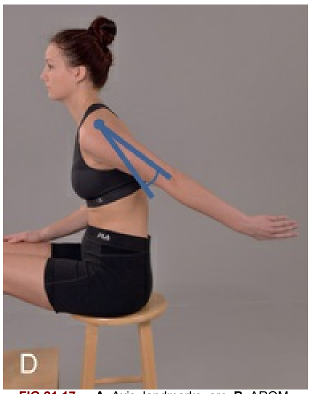
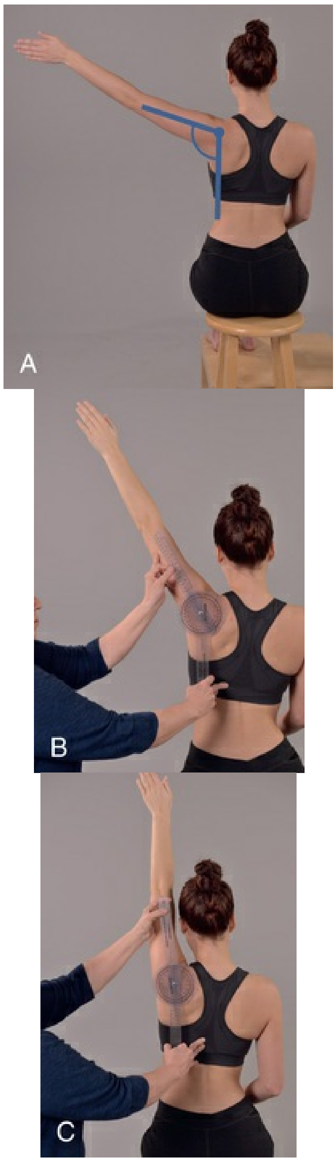


FIG 21.17 **A,** Axis, landmarks, arc. **B,** AROM. **C,** PROM. **D,** Substitution.

Shoulder Abduction
0 to 170 degrees (Fig. 21.18)
Neutral Position of the Client
Seated or lying prone, with the humerus in adduction and external rotation
Position of the Goniometer (Measure on the Posterior Surface)
The axis is below the acromion process on the posterior surface of the shoulder in line with the joint center at the head of the humerus. The therapist can visualize the joint center based on knowledge of skeletal anatomy (or approximate its position two fingers width directly below the acromion process). The stationary bar is parallel to the trunk, and the movable bar is parallel to the humerus, pointing at the lateral epicondyle. For PROM measurement those positions do not change but the therapist must find a way to hold the goniometer in position while also pushing the limb to maximum PROM. In Fig. 21.18, C, note that the therapist holds the goniometer in position with the thumb and index finger while using the palm and digits 3–5 to push the humerus to maximum PROM abduction.
End-Feel
Firm[3]
Substitution
Clients who cannot abduct to an ideal or desired level will likely substitute by leaning the trunk away from the limb thinking they are changing the angle of the joint itself when they are only raising the hand to accomplish the task at hand. This does not change the maximum AROM angle of the shoulder. When measuring ROM, the therapist follows the same landmarks and should still produce the same measurement as in Fig. 21.18, A, which shows landmarks and axis.



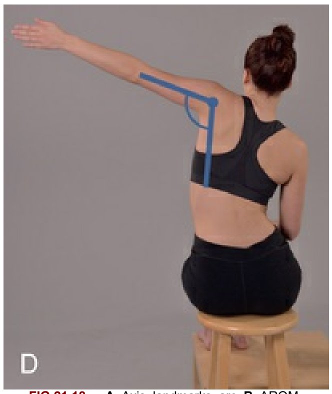


FIG 21.18 **A,** Axis, landmarks, arc. **B,** AROM. **C,** PROM. **D,** Substitution.

Shoulder Internal Rotation (Abducted)

0 to 60 degrees (Fig. 21.19)

Neutral Position of the Client

In seated or standing position, with the humerus abducted to 90 degrees, the elbow is flexed to 90 degrees, with the forearm in pronation, parallel to the floor. This position is used if there is no danger of posterior dislocation and if abduction is possible and not painful for the client.

Position of the Goniometer

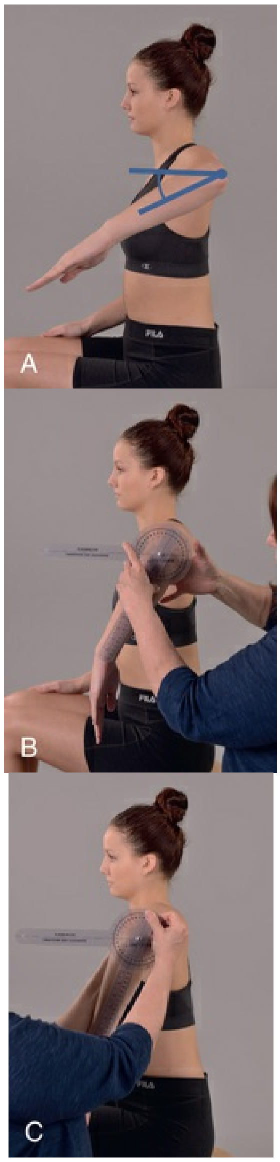
The axis is on the olecranon process of the elbow. The stationary bar is held in a horizontal position and the movable bar is parallel to the forearm, aligned with the ulna. For maximum precision, this is a measurement where the goniometer illustrated previously with the spirit level could be useful. The therapist could also sight along the stationary bar to a horizontal line in the room (e.g., a table, a line on the wall, or the joint between the wall and floor).

End-Feel

Firm[3]

Substitution

The client is substituting for inadequate internal rotation of the GH joint with excessive elevation of the scapula, which gives the illusion of increased internal rotation of the humerus and does cause the forearm to point more downward. Although the scapula is not visible in the photo (see Fig. 21.19, D), the stationary bar is still positioned perpendicular to the scapula just as it is while held horizontal in Fig. 21.19, A, relative to a neutral scapula, and should yield the same AROM measurement.



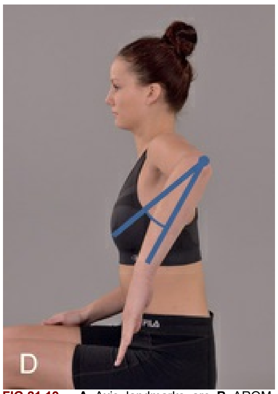


FIG 21.19 **A,** Axis, landmarks, arc. **B,** AROM. **C,** PROM. **D,** Substitution.

Shoulder Internal Rotation (Adducted–Alternative Position)

0 to 70 degrees

Neutral Position of the Client

The following position is used if abduction cannot be achieved: neutral (zero) rotation is when seated with the humerus adducted against the trunk, the elbow at 90 degrees, and the forearm at the midposition and perpendicular to the body (projected forward into the sagittal plane).[3]

Position of the Goniometer

The axis is on the olecranon process of the elbow, and the stationary bar is horizontal and pointed forward into the sagittal plane. The movable bar is parallel to the forearm and follows the arc of movement and moves in a horizontal plane. This position has a limitation in that maximum internal rotation ROM may not be achieved because the forearm's maximum arc in internal rotation stops at the abdomen.

Shoulder External Rotation (Abducted)

0 to 80 degrees (Fig. 21.20)

Neutral Position of the Client

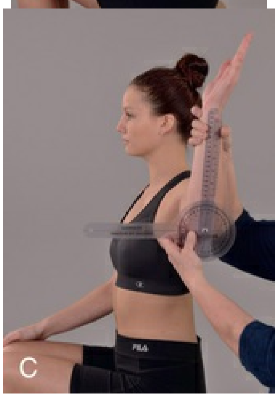
Starting in the same position as in Fig. 21.19, client seated or supine with the humerus abducted, the elbow is flexed to 90 degrees and the forearm pronated. This position is used when measuring internal rotation, if there is no danger of anterior dislocation of the humerus.[3]

Position of the Goniometer

The axis is on the olecranon process of the elbow, and the stationary bar is horizontal in neutral, parallel to the forearm (which points forward in the sagittal plane) at the beginning of the movement. The movable bar follows the forearm in a vertical arc in the sagittal plane to the end of ROM.

Substitution

When external rotation is limited, a client will often substitute thoracic extension to enable the hand to go higher. Actual external rotation of the shoulder does not change as indicated by the dotted line parallel to the upper thoracic vertebrae and the right angle symbol in Fig. 21.20, C, showing that the stationary bar is still perpendicular to the trunk. The client may develop this substitution to reach higher or might lean back to throw a ball higher and farther with some elevation rather than only be able to throw close and to the ground because of limited external rotation of the shoulder.



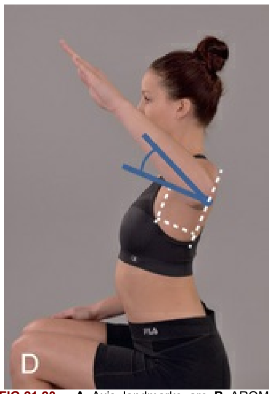


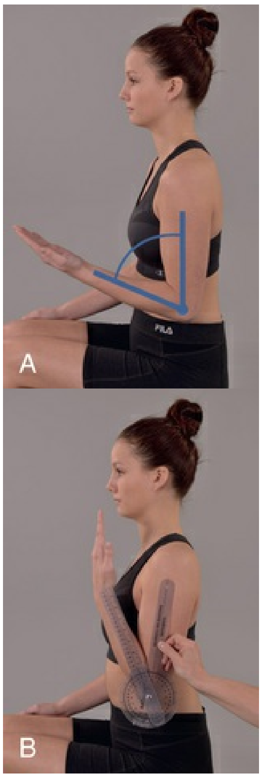
FIG 21.20 **A,** Axis, landmarks, arc. **B,** AROM. **C,** PROM. **D,** Substitution.

Shoulder External Rotation (Adducted–Alternative Position)
0 to 90 degrees
Neutral Position of the Client
This position is the same as the alternate position to measure internal rotation. The following position is used if abduction cannot be achieved: in seated or standing position the humerus is adducted, with the elbow held at the midlateral trunk with the elbow flexed to 90 degrees, the elbow is in midposition, perpendicular to the trunk, and the forearm is in neutral rotation.
Position of the Goniometer
The axis is aligned with and below the olecranon process of the elbow. In neutral, the stationary bar and movable bar are parallel to the forearm (which points forward in the sagittal plane) in zero rotation/starting position. The movable bar follows the forearm in a lateral arc in the horizontal plane to the end of AROM or PROM.
End-Feel
Firm[3]

Shoulder Horizontal Adduction
0 to 130 degrees.
Neutral Position of the Client
Seated erect with the shoulder to be tested abducted to 90 degrees, the elbow extended, and the palm facing down. The therapist may support the arm in abduction.[3]
Position of the Goniometer
The axis is over the acromion process. The stationary bar is parallel to the line between the left and right acromion, over the shoulder toward the neck, and the movable bar is parallel to the humerus on the superior aspect. The arm is rotated forward toward the opposite shoulder, past the anterior midline as far as possible in a horizontal plane.
End-Feel
Firm or soft[3]

Elbow

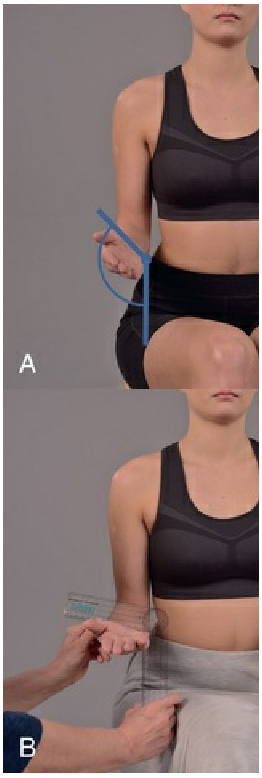
Flexion/Extension
0 to 135-150 degrees (Fig. 21.21, A-H)
Neutral Position of the Client
Standing, sitting, or supine with the humerus adducted, in neutral rotation (forearm pointed into sagittal plane) and the forearm supinated
Position of the Goniometer
The axis is placed over the lateral epicondyle of the humerus at the end of the elbow crease. The stationary bar is parallel to the midline of the humerus or aimed at the head of the humerus, and the movable bar is parallel to the radius. After the movement has been completed, the position of the elbow crease changes in relation to the lateral epicondyle because of the rise of the muscle bulk during the motion. The axis of the goniometer should be repositioned so that it is aligned with the lateral epicondyle.
End-Feel
Flexion: soft, hard, or firm. *Extension and hyperextension*: hard or firm.[3] End-feel for flexion of some joints, (elbow and knee) may depend on relaxed flexor muscle mass compared to the bulk of those muscles in flexion. Parts D and E of Fig. 21.21 illustrate the effect of muscle mass on AROM and PROM. In Fig. 21.21, D, during active flexion the muscle mass of the elbow flexors bulk up to flex the elbow and limit flexion with a firm end-feel. In Fig. 21.21, E, the elbow flexors are relaxed, allowing additional PROM flexion with a soft end-feel. Elbow extension typically starts at zero for neutral extension (Fig. 21.21, F). The elbow extends to a hard stop when the olecranon impacts the olecranon fossa. However, everybody is not typical; some cannot quite get their elbow to neutral (Fig. 21.21, G), whereas some may hyperextend a few degrees (Fig. 21.21, H). In such cases the measurement of ROM of elbow extension will use the same landmarks as noted earlier. The three-number notation system described earlier is useful to avoid confusion about the meaning of negative numbers when measuring elbow flexion/extension, especially when hyperextension or limited extension occurs.




C
D
E
F

	 FIG 21.21 **A,** Axis, landmarks, arc. **B,** AROM. **C,** PROM. **D-E,** PROM. **F,** AROM neutral extension. **G,** AROM limited extension. **H,** AROM hyperextension.

Forearm

Forearm Supination	
0 to 80 or 90 degrees (Fig. 21.22)	
Neutral Position of the Client	
Seated or standing with the humerus fully adducted, with the elbow flexed to 90 degrees, and the forearm in midposition (thumb up)	
Position of the Goniometer	
The arc to be measured is indicated in Fig. 21.22, A. The axis is at the ulnar border of the volar aspect of the wrist, just proximal to the ulnar styloid. The movable bar is resting against the volar aspect of the wrist, and the stationary bar is vertical, perpendicular to the floor (see Fig. 21.22, B). After the forearm is supinated, the goniometer should be repositioned so that the movable bar rests on a tangent across the middle of the curved center of the distal forearm, across the flexor tendons at the midpoint of the wrist between radial and ulnar styloids.	
Substitution	
The most common substitution for this movement is to slightly flex and adduct the shoulder allowing the forearm to only appear more supinated relative to the vertical line, but this does not actually change the ROM angle of forearm rotation measured at the wrist relative to the humerus (Fig. 21.22, C).	

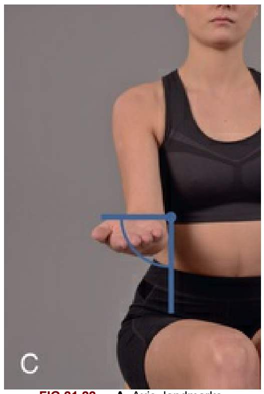


FIG 21.22 **A,** Axis, landmarks, arc. **B,** Partial AROM. **C,** Substitution.

Forearm Supination (Alternative Method)

0 to 80 or 90 degrees (Fig. 21.23)

Neutral Position of the Client

Seated or standing with the humerus adducted, the elbow at 90 degrees, and the forearm in midposition. In neutral position, place a pen or pencil in the client's hand. The client will rotate the forearm and pencil toward horizontal or beyond.

Position of the Goniometer

The axis is over the head of the third metacarpal. The stationary bar is perpendicular to the floor. The movable bar is held parallel to the pencil.

End-Feel

Firm.[3]

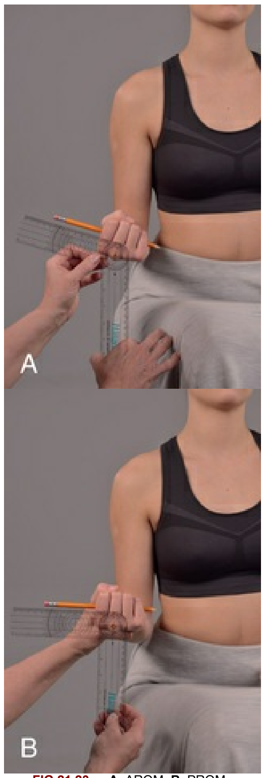


FIG 21.23 **A,** AROM. **B,** PROM.

Forearm Pronation

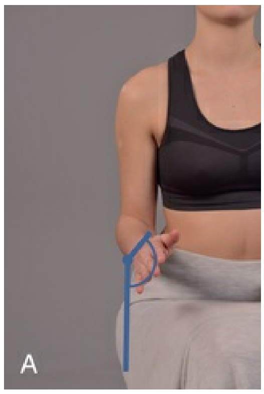
0 to 80 or 90 degrees (Fig. 21.24, A)

Position of the Client

Seated or standing with the humerus adducted, the elbow at 90 degrees, and the forearm in midposition (thumb up)

Position of the Goniometer

The axis is at the ulnar border of the dorsal aspect of the wrist, just proximal to the ulnar styloid. Place the goniometer so that the movable bar rests squarely across the center of the dorsum of the distal end of the forearm between the styloids. The stationary bar is held perpendicular to the floor with the forearm fully pronated for AROM (Fig. 21.24, A) and PROM (Fig. 21.24, B).



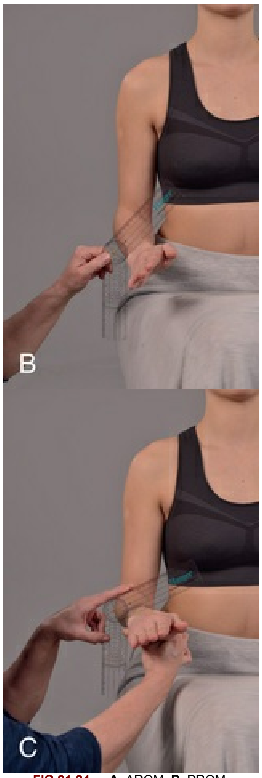


FIG 21.24 **A,** AROM. **B,** PROM. **C,** Substitution.

Forearm Pronation (Alternative Method)	
0 to 80 or 90 degrees (Fig. 21.25)	
Position of the Client	
Same as alternative method to measure supination. A pencil can be used to measure pronation. The client is seated or standing with the humerus adducted to neutral, elbow at 90 degrees, and the forearm in midposition. A pencil is placed in the hand. In neutral position (0 degrees) the pencil will be vertical, perpendicular to the floor.	
Position of the Goniometer	
When the forearm is rotated into pronation, the axis of the goniometer is over the head of the third metacarpal, the stationary bar is perpendicular to the floor, and the movable bar is parallel to the pencil.	
End-Feel	
Hard to firm[3]	
Substitution	
The most common substitution when ROM of forearm pronation is limited is to achieve the desired position of the forearm/hand using shoulder abduction (Fig. 21.25, C). This turns the wrist/hand flatter relative to the horizontal surfaces, but does not change the rotation angle of the forearm relative to the humerus. To avoid this substitution during measurement, instruct the client verbally (or stabilize) so the humerus remains in adduction (i.e., vertical or aligned with the trunk, with the elbow held close to the lateral trunk).	

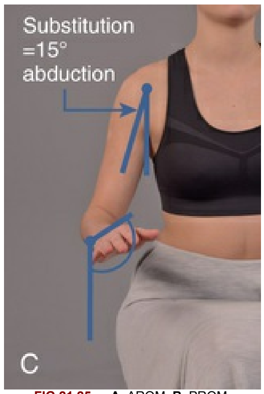


FIG 21.25 **A,** AROM. **B,** PROM. **C,** Substitution.

Wrist

Wrist Flexion

0 to 80 degrees (Fig. 21.26)

Neutral Position of the Client

Seated with the forearm in midposition and the hand and forearm resting on a table on the ulnar border with the wrist aligned with the forearm. The fingers are relaxed or extended to avoid passive insufficiency from tight extensors, which would limit wrist ROM in flexion.

Position of the Goniometer

The wrist is typically measured with the forearm in midposition, with the axis on the lateral aspect of the wrist just distal to the radial styloid in the anatomical snuffbox. The stationary bar is parallel to the radius, and the movable bar is parallel to the metacarpal of the index finger. This measurement could also be taken with the elbow partially flexed and the forearm resting on something (e.g., pillow, rolled towel, or bolster) that elevates the hand enough to clear the table and enables full ROM of the wrist while avoiding interference with the fingers on the table.[3]

End-Feel

Firm[3]

FIG 21.26 **A,** Axis, landmarks, arc. **B,** Partial AROM. **C,** PROM.

Wrist Extension

0 to 70 degrees (Fig. 21.27)

Neutral Position of the Client and Goniometer

The positions for the client and goniometer are the same as for wrist flexion, except that the wrist is extended and fingers should be relaxed in flexion instead of extended, to avoid passive insufficiency from tight flexors, which would limit wrist ROM in extension.

End-Feel

Firm or hard[3]

Measurement Error

Fig. 21.27, D, demonstrates a measurement error. Measuring passive wrist extension ROM with the fingers extended *may* result in inaccurate measurement of wrist extension PROM as the finger flexors *may* become passively insufficient, limiting the amount of wrist extension.

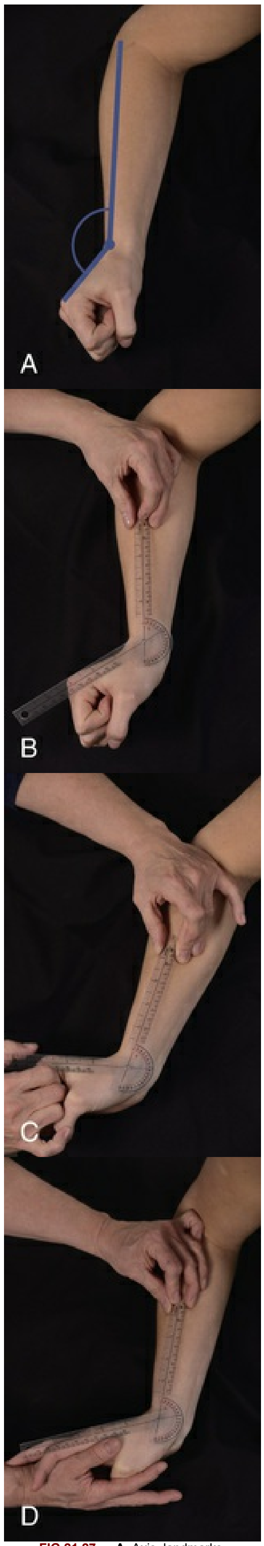


FIG 21.27 **A,** Axis, landmarks, arc. **B,** Partial AROM. **C,** PROM. **D,** Measurement error.

Wrist Radial Deviation

0 to 20 degrees (Fig. 21.28)

Neutral Position of the Client

Seated with the forearm pronated, the wrist at neutral (straight), the fingers relaxed in extension, and the palm of the hand resting flat on the table surface

Position of the Goniometer

Neutral (0 degrees) is a straight wrist and goniometer. The axis is on the dorsum of the wrist at the base of the third metacarpal, in a hollow that can be palpated over the capitate bone. The movable bar is parallel to the third metacarpal aligned with the third MCP joint and the stationary bar follows the midline of the dorsal aspect of the forearm.

End-Feel

Firm[3]

Substitution

A common substitution for limited radial deviation is to abduct the shoulder, and pronate the forearm and flex the wrist slightly, which turns the wrist/hand relative to the trunk but does not change wrist radial deviation AROM measurement relative to the forearm.

FIG 21.28 **A,** Axis, landmarks, arc. **B,** Partial AROM. **C,** PROM.

Wrist Ulnar Deviation

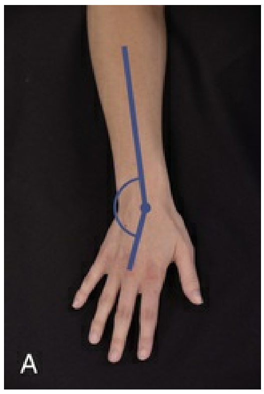
0 to 30 degrees (Fig. 21.29)

Position of the Client and Goniometer

Same client position and goniometer placement as for radial deviation. Wrist deviates toward the ulnar side.

End-Feel

Firm or hard[3]



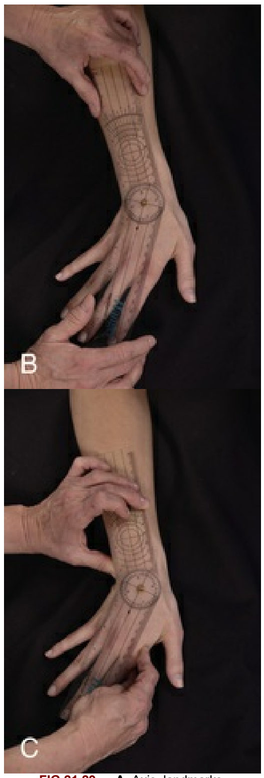


FIG 21.29 **A,** Axis, landmarks, arc. **B,** Partial AROM. **C,** PROM.

Fingers

Metacarpophalangeal (MP or MCP) Flexion
0 to 90 degrees The joint center viewed from the side is as indicated in Fig. 21.30, A. The actual axis is on the lateral side of the MP joint, but only the second digit (index finger) and the fifth digit (small finger) can be measured as in Fig. 21.30, B, on the side of the joint. So the most common method of measuring MP joints is to place the goniometer on the dorsal surface of the MP joint as in Fig. 21.30, C, on the dorsum of both the hand and proximal phalanx. The specialized goniometers illustrated are available to simplify dorsal ROM measurement. PROM is illustrated with Fig. 21.30, D-E. The MPs of digits 2–5 can all be measured in this manner.
Neutral Position of the Client
Seated with the elbow flexed. The forearm is in midposition, the wrist at 0-degree neutral position, the proximal and distal IP joints relaxed to avoid passive insufficiency, and the forearm and hand supported on a firm surface on the ulnar border.
Position of the Goniometer
Method 1
The axis is centered on the dorsal aspect of the metacarpophalangeal (MP) joint. The stationary bar lies on the dorsal surface of the hand, following the metacarpal for the MP joint being measured, and the movable bar lies on the dorsal surface of the proximal phalanx (see Fig. 21.30, B).
Method 2
The goniometer lies on the dorsal surface of the hand and digit (see Fig. 21.30, C). Or use specialized finger goniometers on the dorsal surfaces (Fig. 21.30, D-E)
End-Feel
Hard or firm[3]

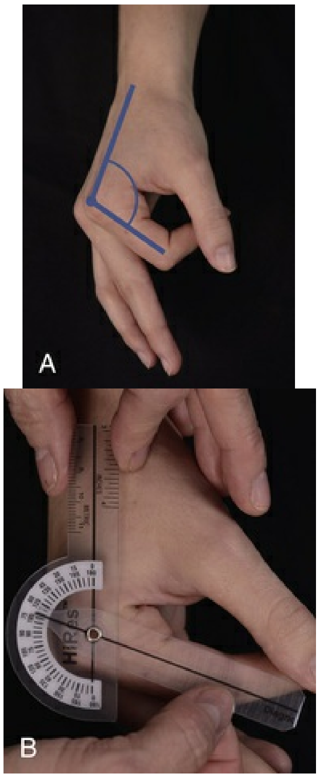


FIG 21.30 **A,** Axis, landmarks, arc. **B,** Lateral AROM. **C,** Dorsal AROM. **D-E,** Dorsal PROM with specialized goniometers.

Metacarpophalangeal Joint Extension/Hyperextension

0 to 45 degrees

Neutral Position of the Client

Seated with the forearm in midposition, the wrist at 0-degree neutral position, the interphalangeal joints relaxed or in flexion, and the forearm and hand supported on a firm surface on the ulnar border. Regardless of which way the protractor is turned on the goniometer, the extension angle being measured is illustrated in Fig. 21.31, A.

Position of the Goniometer

The axis is over the lateral aspect of the MP joint of the index finger. The stationary bar is parallel to the metacarpal, and the movable bar is parallel to the proximal phalanx. The small finger's MP joint may be measured similarly. ROM of the long and ring fingers can be estimated by comparison or specialized finger goniometers can be used on the dorsal surface of the hand and fingers.

An alternative is to place the goniometer on the volar aspect of the hand. With use of the edge of a shortened goniometer (a 6-inch goniometer can be cut to more easily measure the small joints of the hand), the axis is aligned over the MP joint being measured, the stationary bar is parallel to the metacarpal, and the movable bar is parallel to the proximal phalanx. As another alternative, these joints can be measured using specialized goniometers in the same way as illustrated under MP joint flexion (Fig. 21.31, C; see also Fig. 21.30, D-E).

End-Feel

Firm[3]

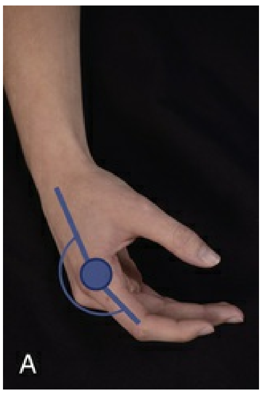


FIG 21.31 **A,** Axis, landmarks, arc. **B-C,** AROM. **D,** PROM.

Metacarpophalangeal Abduction

0 to 25 degrees (Fig. 21.32)

Neutral Position of the Client

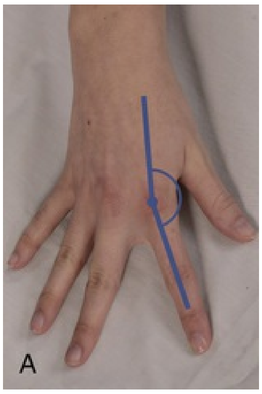
Seated with the forearm pronated, the wrist at 0-degree neutral deviation, the fingers straight, and the hand resting on a firm surface

Position of the Goniometer

The axis is centered over the MP joint being measured. The stationary bar is over the corresponding metacarpal, and the movable bar is over the proximal phalanx. The arc of the abduction angle is measured as the deviation from zero (0 = straight MP) for the MP/finger being measured. Measurements can be taken in both radial and ulnar directions for each finger.

End-Feel

Firm[3]



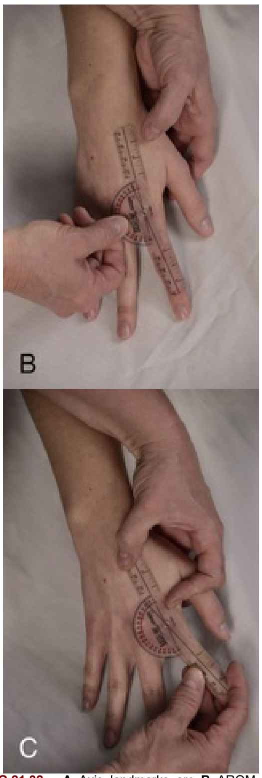
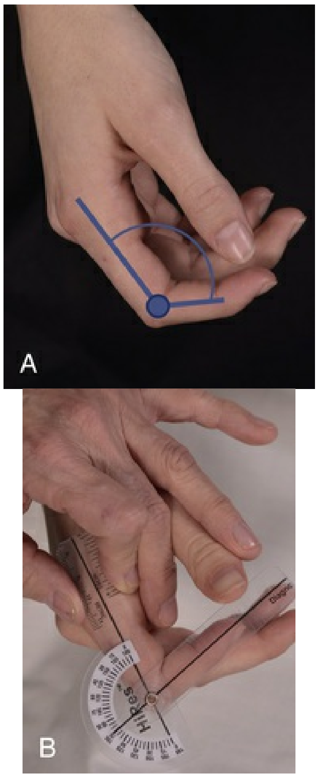


FIG 21.32 **A,** Axis, landmarks, arc. **B,** AROM. **C,** PROM.

Proximal Interphalangeal (PIP) Flexion
0 to 110 degrees
Neutral Position of the Client
Seated with the forearm in midposition, the wrist at 0-degree neutral position or relaxed and slightly extended, with the forearm and hand supported on a firm surface on the ulnar border.
Position of the Goniometer
Method 1
The axis is centered on the lateral surface of the proximal interphalangeal (PIP) joint being measured. The stationary bar is placed along the lateral side of the proximal phalanx, and the movable bar follows the middle phalanx (Fig. 21.33, A-C).
Method 2
Using a shortened goniometer or a specialized goniometer (Fig. 21.33, D), place the stationary bar on the dorsum of the proximal phalanx and the movable bar on the dorsum of the middle phalanx. When the stationary and movable bars of the goniometer are so aligned, the axis will already be aligned with the joint center.



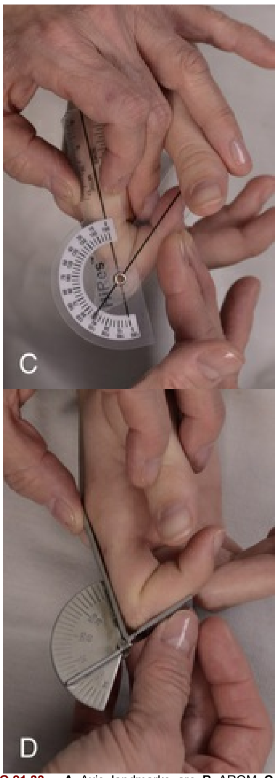


FIG 21.33 **A,** Axis, landmarks, arc. **B,** AROM. **C-D,** PROM.

Proximal Interphalangeal Flexion (Alternative Method)

This joint can also be measured with a ruler. The interphalangeal and MP joints of the fingers are flexed toward the palm. A ruler is used to measure from the midpoint of the middle phalanx of each finger to the proximal palmar crease (Fig. 21.34).[3]

End-Feel

Usually hard; may be soft or firm depending on the health of the surrounding tissues[3]

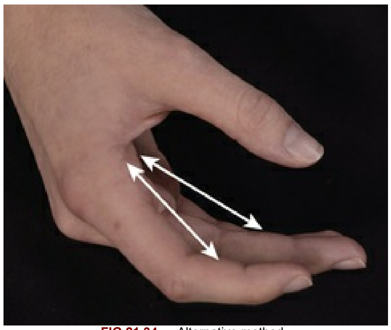


FIG 21.34 Alternative method.

Distal Interphalangeal (DIP) Flexion

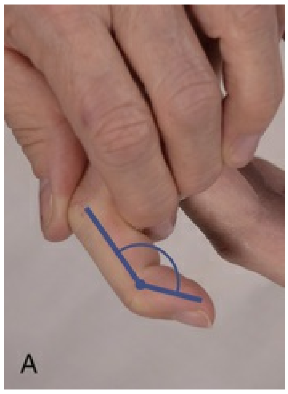
0 to 80 degrees (Fig. 21.35, A)

Neutral Position of the Client

Seated with the forearm in midposition, the wrist at 0-degree neutral deviation or relaxed with the wrist in slight extension, and the forearm and hand supported on the ulnar border on a firm surface

Position of the Goniometer

A shortened goniometer is best to measure the distal interphalangeal (DIP) flexion as a longer goniometer impacts the palm at maximum DIP flexion or interferes between the fingers. The axis is on the dorsal surface of the DIP joint. The stationary bar is over the middle phalanx, and the movable bar lies over the distal phalanx (Fig. 21.35, B). Alternative methods are to use a specialized goniometer on the dorsum of the DIP (Fig. 21.35, C). A standard long goniometer can be used (Fig. 21.35, D) on the sides of the index and small fingers, but this becomes difficult with the second and third fingers.



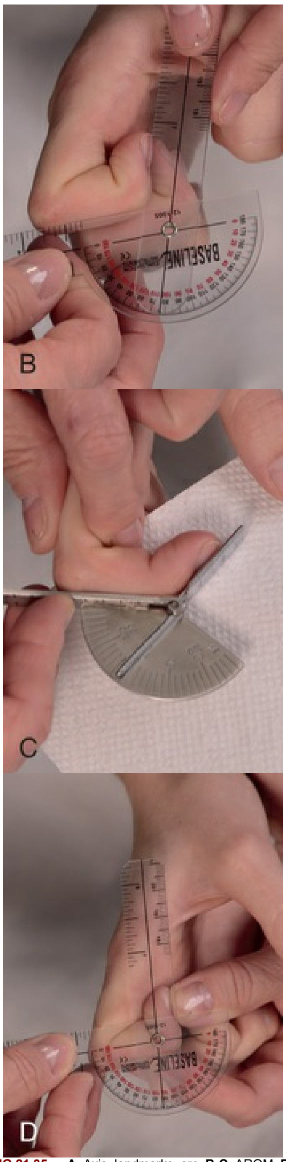


FIG 21.35 **A,** Axis, landmarks, arc. **B-C,** AROM. **D,** PROM.

PIP and DIP Composite Flexion (Alternative Method)

Some clients will have limited flexion of the fingers. In this case, isolating flexion of each digit and each joint can have limited value. Composite finger flexion can be measured if the client flexes all three finger joints (MP, PIP, and DIP) toward the palm. A measurement is then taken with a ruler from the tip of the middle finger to the proximal palmar crease. If digits 2–5 have similar flexion, this will yield a general composite measurement of finger flexion. Individual digit composite flexion can also be measured independently for each finger if the situation warrants it. Specific description of the measurement method is needed in notes to ensure the reliability of repeat measurement (Fig. 21.36).

End-Feel

Firm[3]

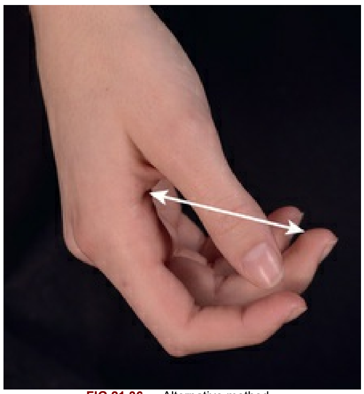


FIG 21.36 Alternative method.

Thumb

Thumb Carpometacarpal (CMC) Extension/Radial Abduction

0 to 50 degrees (Fig. 21.37)

Note: This joint may be called the trapeziometacarpal (TMC) joint by hand surgeons or hand therapists because it is the joint between the trapezium (one of the carpal bones) and the first metacarpal. It is the first of five CMC joints between the wrist and the hand and operates differently from the other CMC joints. It is a unique and mobile joint allowing more thumb flexibility than the other CMC joints provide to the metacarpals of the fingers. This joint enables the opposable thumb.

Neutral Position of the Client

Seated with the forearm pronated, wrist neutral, and the hand facing palm down, resting flat on a firm surface

Position of the Goniometer

The axis is over the dorsal surface of the thumb carpometacarpal (CMC or TMC) joint at the base of the thumb metacarpal in the anatomical snuffbox. The stationary bar is parallel to the radius, and the movable bar is aligned with the thumb metacarpal.

FIG 21.37 **A,** Axis, landmarks, arc. **B,** AROM. **C,** PROM.

Thumb CMC Extension/Radial Abduction (Alternative Method)

0 to 50 degrees

Position of the Client and Goniometer

The client is positioned the same as described in the first method. The axis is over the CMC joint at the base of the thumb metacarpal. The stationary bar is parallel to the second (index finger) metacarpal, and the movable bar is parallel to the first metacarpal and the thumb (see dotted line on Fig. 21.37, A) The axis will not be directly over the joint center but if both bars are parallel to the bones described, the axis will be correctly positioned automatically and the measurement will be correct.

End-Feel

Firm[3]

CMC Abduction/Palmar Abduction

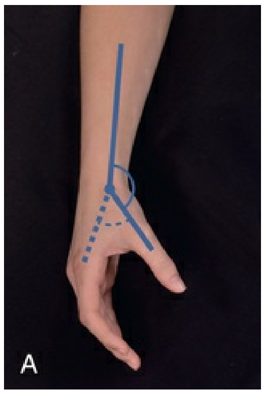
0 to 50 degrees (Fig. 21.38)

Position of the Client

Seated with the forearm in neutral, at 0-degree pronation/supination, the wrist flexion/extension at 0 degrees, and the forearm and hand resting on the ulnar border. The thumb is rotated in a plane toward a right angle from the palm of the hand.

Position of the Goniometer

The axis is at the junction of the thumb and index finger metacarpals (in the anatomical snuffbox). The stationary bar is over the radius, and the movable bar is parallel to the thumb and index finger metacarpals as illustrated in Fig. 21.38, A.



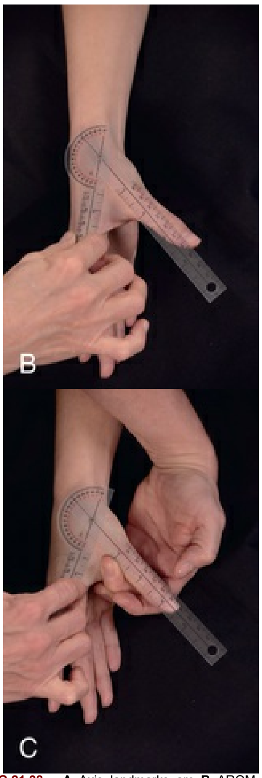


FIG 21.38 **A,** Axis, landmarks, arc. **B,** AROM. **C,** PROM.

CMC Palmar Abduction (Alternative Method)

0 to 50 degrees

Neutral Position of the Client

The client is positioned in the same way described in the first method.

Placement of the Goniometer

The axis is at the junction of the thumb and index finger metacarpals in the anatomical snuffbox. The stationary bar is parallel to the metacarpal of the index finger, and the movable bar follows the thumb metacarpal as illustrated in Fig. 21.38.

End-Feel

Firm[3]

Thumb Metacarpophalangeal (MP or MCP) Flexion

0 to 50 degrees (Fig. 21.39)

Neutral Position of the Client

Seated with the elbow flexed. The forearm is in 45 degrees of supination, the wrist at neutral deviation, the MP and interphalangeal joints relaxed in extension, and the hand and forearm supported on a firm surface.

Position of the Goniometer

The axis is on the dorsal surface of the MP joint. The stationary bar is over the thumb metacarpal, and the movable bar is over the proximal phalanx.

End-Feel

Hard or firm[3]

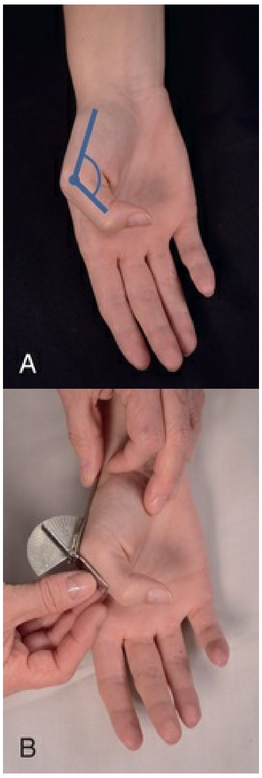


FIG 21.39 **A,** Axis, landmarks, arc. **B,** AROM. **C,** PROM.

Thumb Interphalangeal (IP) Flexion

0 to 90 degrees (Fig. 21.40)

Position of the Client

Same as described for thumb MP flexion

Position of the Goniometer

The axis is on the dorsal surface of the interphalangeal joint. The stationary bar is over the proximal phalanx, and the movable bar is over the distal phalanx. This joint can also be measured with a specialized or standard goniometer on the dorsal surface of the IP joint. Describe measurement method in clinical notes to ensure the reliability of repeat measurements.

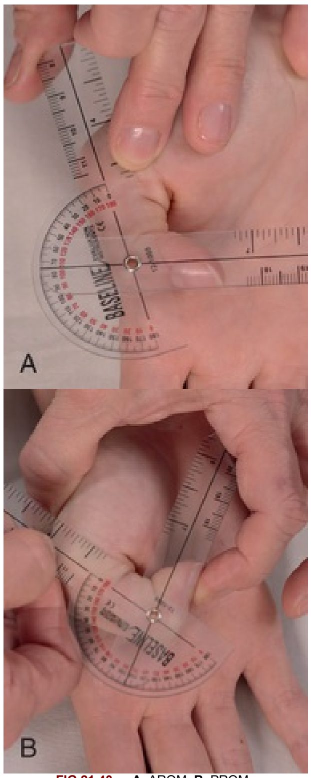


FIG 21.40 **A,** AROM. **B,** PROM.

Opposition

Deficits in opposition may be recorded by measuring the distance between the centers of the pads of the thumb and the fifth finger with a ruler (Fig. 21.41). Most goniometers have such a ruler printed on one of their long arms.

End-Feel

Soft or firm[3]

FIG 21.41 Opposition.

Lower Extremity[3,5,6,10,13]

Principles for measuring the upper extremity can easily be applied to the lower extremity (LE). We present one hip and one knee measurement in this chapter and refer readers to Reese and Bandy's

Joint Range of Motion and Muscle Length Testing for additional measurements.[13]

Hip

Hip Flexion
0 to 120 degrees (Fig. 21.42)
Neutral Position of the Client
Supine, lying with the hip and knee in 0-degree extension and rotation
Position of the Goniometer
The axis is found by palpating the lateral aspect of the hip for the greater trochanter of the femur. The stationary bar is centered over the middle of the lateral aspect of the pelvis, parallel to the trunk and to the horizontal surface upon which the client is lying. The movable bar is parallel to the long axis of the femur on the midline of the lateral aspect of the thigh, aiming at the lateral epicondyle of the knee joint. The knee is bent during the motion to relax the knee flexors and avoid passive insufficiency of the knee hamstrings at the hip.
End-Feel
Soft[3]

FIG 21.42 Hip flexion. AROM, end measure.

Knee

Knee Extension-Flexion
0 to 135 degrees (Fig. 21.43)
Position of the Client
The client should be supine, lying with the knees and hips flexed and the hip in 0-degree neutral rotation. In supine, the hip can be flexed, which relaxes the rectus femoris across the hip avoiding passive insufficiency of the hip flexor/knee extensor enabling maximal ROM in knee flexion. Knee flexion measured in prone may show less ROM due to the rectus femoris being on stretch from lying on a flat surface in prone.
Position of the Goniometer
With the client in the supine position, the axis is centered on the lateral aspect of the knee joint at the lateral epicondyle of the femur. The stationary bar is on the lateral aspect of the thigh, parallel to the longitudinal axis of the femur. The movable bar is parallel to the longitudinal axis of the fibula, aligned with the lateral malleolus, on the lateral aspect of the leg.
End-Feel
Soft[3]

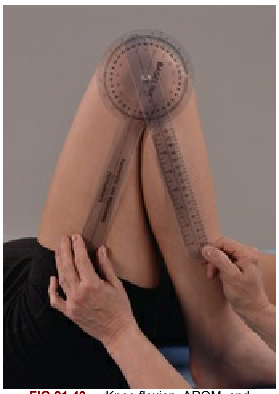


FIG 21.43 Knee flexion. AROM, end measure.

Threaded Case Study

Evelyn, Part 2

At the beginning of the chapter, Evelyn's case study was introduced. She is an active 83-year-old woman with a rich occupational life who sustained a Colles fracture in her left nondominant upper extremity, recently had her cast removed, and was experiencing residual problems (including joint ROM deficits). Readers were asked to consider three questions while studying the chapter:

Why should the therapist proceed with caution when assessing the ROM limitations of this client?

The therapist should proceed with caution with all clients; in Evelyn's case, heightened caution is necessary during joint measurement because of the edema, pain, and stiffness she is experiencing in the thumb and fingers of her recently injured left wrist. Failure to proceed with caution during measurement of ROM could exacerbate each of these symptoms.

What is the appropriate sequencing of joint measurement assessment for this client? What methods should be applied first?

It is important for the therapist to first have Evelyn actively move her joints through all available pain-free (or with tolerable pain) ROM throughout both her left affected upper extremity and her unaffected right upper extremity (for comparison purposes). Next, the therapist should passively move Evelyn's affected joints through the available pain-free (tolerable) ROM, note the end-feel, and estimate the ROM in those joints. Finally, the therapist measures the affected joints with a goniometer by following the specific sequential directions for measuring each of the joints.

What is the advantage of joint measurement in evidence-based practice?

An advantage of joint measurement in evidence-based practice is that the client's ROM baselines are recorded and the effectiveness of interventions can be determined or substantiated on the basis of the results of follow-up joint measurements. Once the therapist has collected these outcome data (along with similar data from other clients), a body of evidence regarding the effectiveness of intervention is compiled, which in turn can be used to select effective treatment of future clients with similar problems.

Summary

Joint measurement is used to evaluate ROM in persons whose physical dysfunction affects joint mobility. Measurements of ROM are used in setting intervention goals, selecting intervention methods, and making objective assessments of progress that allow the therapist to select the intervention methods most likely to target the affected joints.

Before measuring ROM, the therapist should know any precautions or contraindications concerning the client's condition that may determine how extensive the joint measurement procedure can be. The therapist should also know the principles of joint measurement. The procedure for measuring joint ROM involves correct positioning of the client and therapist, exposure of the joints to be measured, palpation, appropriate stabilization and handling of parts, and correct placement of the goniometer at the beginning and end of the ROM. To support the efficacy of intervention strategies and modalities, the therapist must also consider which method of reporting will best serve as evidence of effective intervention.

Directions and illustrations for measuring all of the major joint motions in the neck, trunk, and upper extremities are included in this chapter, as well as several major motions of the lower extremities. The content is designed for development of the fundamental techniques of joint measurement. The reader is referred to the references for more comprehensive treatment of the topic.[3,9,10,13]

Review Questions

1. Describe general rules for positioning the goniometer when measuring joint ROM.
2. With which conditions is joint measurement likely to be used?
3. List and discuss four purposes of joint measurement.
4. Is formal joint measurement necessary for every client? If not, how may ROM be assessed?
5. What is the benefit of conducting precise joint measurement with a goniometer?
6. What is meant by palpation? How is palpation done?
7. What should the therapist look for when observing joints and joint motions?
8. List at least five precautions during or contraindications to joint measurement.
9. What is meant by end-feel?
10. When measuring a joint crossed by a two-joint muscle, how should the occupational therapy practitioner position the joint not being measured?
11. List the steps in the procedure for joint measurement.
12. How is joint ROM measurement recorded on the evaluation form?
13. List the average normal ROM for elbow flexion, shoulder flexion, finger MP flexion, hip flexion, knee flexion, and ankle dorsiflexion.
14. Describe how to read the goniometer when using the 180-degree system of joint measurement.
15. What is functional ROM?
16. List three intervention methods that could be used to increase ROM.

Exercises

1. Measure all of the upper extremity joint motions of a normal client. Record the findings on the form in Fig. 21.7.
2. Repeat the first exercise, but the client should play the role of someone with several joint limitations.
3. Observe the joint motions used in ordinary ADLs/IADLs (e.g., self-care and home management). Estimate the functional ranges of motion for the following joint motions: shoulder flexion, external rotation, internal rotation, and abduction; elbow flexion; wrist extension; hip flexion and extension; knee flexion; and ankle plantar flexion.

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22

Evaluation of Muscle Strength*

Vicki Kaskutas

CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Describe screening tests for muscle strength assessment.
2. Identify what is measured by the manual muscle test (MMT).
3. List diagnoses for which the MMT is appropriate and those for which it is not appropriate, with the rationale for each.
4. List the steps of the MMT procedure in correct order.
5. Describe the limitations of the MMT.
6. Define muscle grades by name, letter, and number.
7. Administer a MMT, using the directions in this chapter, on a normal practice subject.
8. Describe how results of the muscle strength assessment are used in intervention planning.

KEY TERMS

Against gravity

Gravity minimized

Manual muscle testing

Muscle coordination

Muscle endurance

Muscle grades

Pressure

Screening tests

Substitutions

Case Study

Sharon

After a week of experiencing increasing numbness and weakness in her extremities and shortness of breath, Sharon, a 32-year-old woman, was admitted to an intensive care unit at a local hospital with acute respiratory distress, generalized musculoskeletal weakness, decreased sensory processing, and difficulty swallowing. Sharon complained of pain and tenderness in her muscles and was agitated and fearful. She was diagnosed as being in the acute phase of Guillain-Barré syndrome and was placed on a ventilator.[11] The occupational therapy (OT) practitioner fitted her with resting splints to support her weakened hands and minimize her muscle belly tenderness. When Sharon was moved from intensive care as the progression of the syndrome began to plateau, the therapist greatly reduced her fear by adapting a system that gave Sharon more control of her environmental context, allowing her to operate her call button, room lights, bed, and television.[20]

Sharon is a senior editor for a monthly food magazine. She has two children, ages 2 and 6. She has been married for 8 years; her husband is a sales representative for a computer company. They live in a two-story townhouse in an urban community. Sharon primarily works at home, going into the magazine's office once or twice a week. However, once a month, during the week the magazine is being published, her life “becomes a bit crazy,” and she may go into the office 5 days. She feels fortunate that she is able to employ a housekeeper/childcare person. In addition to caring for her home and family, Sharon is an avid photographer, exercises at a gym three times per week, and enjoys hiking and camping. She is a regular volunteer at her eldest child's school. She and her husband enjoy an active social life.

Six months after onset, Sharon is now being seen as an outpatient by an occupational therapist. Her disorder is in the recovery phase, with remyelination and axonal regeneration resulting in a generalized increase in muscle strength.[11] Sharon continues to be unable to fully engage in occupations that are meaningful to her, primarily because of residual weakness in her distal extremities and a moderate limitation in endurance. She is usually in a wheelchair but uses a walker in her home. She has an aide that comes in the morning to assist her with bathing and personal grooming and to drive her to her outpatient appointments. She states that "Although I can do things for myself, it takes so long that I end up being tired before my day even begins. I need help to safely shave my underarms and legs. Curling and blow-drying my hair can be exhausting." Sharon has also indicated that she cannot complete home maintenance tasks such as meal preparation (chopping foodstuff, managing pots and pans) and grocery shopping without assistance. She is unable to fully provide for the care and supervision of her children, especially the 2-year-old, nor can she access the second story of her home on a regular basis. She is limited in her ability to participate in outdoor and community occupations, which formerly brought her a great deal of satisfaction. She has been able to resume some of her job responsibilities at home on a limited basis with a voice-activated computer and is "grateful my employer still wants me and has been willing to make accommodations." She indicated that with all the progress she has made, she and her husband are trying to be realistic but are feeling more hopeful that she will make a full recovery.

In reviewing the above occupational profile, the therapist must focus on the client factors that are interfering with body function, namely, decreased muscle strength and endurance. Maintaining her arms at and above shoulder level without taking several rest breaks when vigorously brushing her back teeth, for example, remains a problem for Sharon. Another problem is applying enough force to open jars or perform fine motor activities, such as manipulating coins. These deficits are prohibiting the client from fully engaging in occupations for participation in the physical, social, personal, cultural, and spiritual contexts that bring meaning to her life.

Critical Thinking Questions

1. At what stage in this client's recovery should the occupational therapist first administer a muscle strength assessment?

2. Several methods are available for assessing muscle strength; what are they? What information regarding the client's status could be gained from each of these methods?

3. What is the relationship between the manual muscle test and graded activity with this client?

Many physical disabilities cause muscle weakness. Slight to substantial limitations of performance in areas of occupation—such as bringing food to one's mouth, lifting a child, removing items from a grocery store shelf, and getting into and out of bed—can result from loss of strength, depending on the degree of weakness and whether the weakness is permanent or temporary. If improvement is expected, the occupational therapist must assess the muscle weakness and plan an intervention that will enable occupational performance and increase strength.

Muscle Strength

Muscle strength is defined as "the amount of force generated by muscle contraction," and muscle contraction is the "process of development of tension in muscle tissue" (www.online-medical-dictionary.org). Muscular strength depends on a wide array of anatomical, physiological, neurological, sensory, motivational, cognitive, environmental, occupational, and habitual factors. Muscle weakness can restrict or prevent performance of occupations, including activities of daily living (ADLs), instrumental activities of daily living (IADLs), rest and sleep, education, work, play, leisure, and social participation. Muscle strength can be assessed by observing the client perform daily activities (see Chapter 20), screening tests, and manual muscle testing (MMT), when indicated.

OT practitioners must understand the components and function of the muscular system and its interaction with other systems of the body prior to performing MMT. To ensure that it is safe to evaluate muscle strength, any health conditions, injuries, or illnesses that the client may have should be known, and the OT practitioner must understand the effect that these condition(s) may have on the muscular system and contraindications to strength testing. Several factors should be screened or understood prior to assessing muscle strength, and the therapist must weigh the risks of strength testing with the benefits. Factors that may preclude a reliable and accurate assessment of strength should be considered, and muscle strength grades should never be reported unless the therapist can attest that the strength assessment is a true measure of strength and not a measure of other interfering factors such as pain, fatigue, motivation, cognition, or environmental conditions. This chapter assumes that the reader has this level of knowledge and clinical reasoning prior to participating in a strength assessment.

Causes of Muscle Weakness

Muscle strength varies greatly among individuals based on their stature, size, muscle fiber composition, occupations (work, leisure, play, and instrumental activities of daily living), age, sex, routines, roles, motivation, health, injuries, and illnesses. Obese individuals will likely sustain greater pressure during muscle testing of the limbs as they routinely lift heavy limbs to perform daily activities. Athletes will likely demonstrate better strength than sedentary workers who do not pursue occupations involving physical effort. As a result, there is wide variation in what is considered to be “normal” muscle strength.

There are many health-related causes for decreased muscle strength.

1. Health conditions affecting the muscle tissue can result in decreased strength, including injuries (muscle strain, tear, laceration, tendonitis and myositis), muscle length disorders (excessive tightness, length, or spasms), and a wide range of muscular dystrophies.

2. Because the muscular system requires messages from the nervous system to contract, strength can be affected due to conditions affecting the nervous system (brain, spinal cord, peripheral nervous system), whether due to disease, illness, or injury. This includes conditions such as stroke, traumatic brain injury, anoxia, amyotrophic lateral sclerosis, multiple sclerosis, tumor, cancer, spinal cord injury, peripheral nerve laceration or impingement, peripheral neuropathy, and nerve disease, to name a few. The nerve supply to muscle(s) can be damaged from bone fracture, osteoarthritis, or herniation of an intervertebral disk, which can result in decreased strength.

3. Autoimmune disorders and infectious disease often affect the muscular system, resulting in decreased strength. This includes syndromes such as myasthenia gravis, Guillain-Barré syndrome, rheumatoid arthritis, and systemic lupus erythematosus.

4. Endocrine and metabolic disorders can impact muscular function, such as Cushing syndrome, hyperthyroidism, and diabetes mellitus.

5. Inflammatory conditions, toxins, nutrition, and vitamin deficiencies may affect muscle strength.

6. Medical interventions can impact muscle strength due to surgery, immobilization, and medications. Clients who have been hospitalized for an extended period of time can lose a significant amount of strength. Fatigue and disuse can impact strength.

Various other factors can impact the amount of strength that a muscle demonstrates during MMT. These factors may or may not represent an actual muscle strength deficit, but they need to be considered during testing and when interpreting the results. This includes factors within the client (e.g., pain, cognition, motivation, and affect), physical environmental factors (e.g., temperature, noise, privacy, and distractions), and OT practitioner–related factors (e.g., therapeutic relationship, instructions provided, and handling techniques).

Methods to Evaluate Muscle Strength

Information regarding a client's muscle strength can be ascertained by several different methods. For many clients seen in occupational therapy, it is important to evaluate strength prior to implementing other evaluations or interventions. Depending on the specific needs, the OT practitioner should choose the most appropriate method of those listed here to evaluate strength. The OT practitioner should not assume a level of occupational performance based on strength. For example, a client with normal strength may be unable to perform his or her job, whereas a client with strength deficits may perform meaningful daily activities independently.

Screening tests are useful for observing areas of strength and weakness and for determining which areas require specific MMT.[6,10,12,19] Screening tests can help the therapist avoid unnecessary testing or duplication of services.[12] These tests are not as precise as MMT, and their purpose is to make a general evaluation of muscle strength and to determine areas of weakness, performance limitations, and the need for more precise testing. Screening may be accomplished by the following means:

1. Examining the medical record for results of previous muscle testing or daily activity performance.

2. Observing the client's movements while entering the clinic, moving about the hospital room, or getting in or out of a chair.

3. Observing the client perform functional activities, such as removing an article of clothing and shaking hands with the therapist.[6,12,13]

4. Performing an occupation-based functional motion assessment as described in Chapter 20.

5. Performing a gross check of bilateral muscle groups.[13] The client is comfortably seated in a sturdy chair or wheelchair and the OT practitioner asks the client to move both upper extremities through active range of motion. The OT practitioner applies pressure to both extremities at midrange of selected motions to obtain a gross estimation of strength.

In the case of Sharon, who during the acute stage of her illness had limited muscle strength, the OT practitioner would be able to detect changes by observing this client as she moved around her bed in an attempt to position herself. Initially Sharon might require maximal assistance for bed repositioning or for food intake. The therapist will notice a gradual increase in automatic movements of the limbs as Sharon raises her arms to her forehead to brush back her hair with her forearm, cups her hands around the water glass being held by her husband as she sips through a straw, bends and straightens her legs in an attempt to get comfortable, or momentarily lifts her trunk away from the surface of the bed. Observation of these spontaneous movements as Sharon begins to engage within the context of her environment can serve as preliminary and informal screening of this client's muscle strength.

Manual muscle testing measures the maximal contraction of a specific muscle or muscle group.[6,7] MMT is used to determine the amount of muscle power and to record gains and losses in strength. Criteria used to measure strength include evidence of muscle contraction, amount of range of motion (ROM) through which the joint passes when the muscle contracts, and amount of external pressure the muscle or muscle group can resist during contraction. Gravity is considered a form of resistance.[6,7,13] This chapter presents MMT of muscle groups, as this level of testing yields the type of data needed for most OT clinical settings. A muscle can be tested individually if a more precise measure is needed. This chapter also presents several common tests of the strength of individual muscles to help the reader envision the differences in testing procedures and discrete actions when testing individual muscles versus groups of muscles that perform a specific action. Readers requiring further details on group MMT are referred to Daniels and Worthingham,[10] Hislop and Montgomery,[12,13] and the Rancho Muscle Testing Guide.[21] Details about specific forms of MMT are available in Kendall and McCreary[14] and Cole, Furness, and Twomey.[8]

Purposes of Manual Muscle Testing

The purposes of MMT are to determine the amount of muscle power available, to discern how muscle weakness is limiting performance in meaningful occupations, to prevent deformities that can result from imbalances of strength, to determine the need for assistive devices as compensatory measures, to aid in the selection of occupations within the client's capabilities, to establish a baseline and guide intervention, and to evaluate the effectiveness of intervention strategies and modalities.[15] MMT of individual muscles can be essential for diagnosing some neuromuscular conditions, such as peripheral nerve lesions and spinal cord injury. In peripheral nerve or nerve root lesions, the pattern of muscle weakness may help determine which nerve or nerve roots are involved, whether the involvement is partial or complete, and progression over time. Careful evaluation can help determine the level(s) of spinal cord involvement and can indicate whether the cord damage is complete or incomplete.[14] Along with sensory evaluation, MMT can therefore be an important diagnostic aid in neuromuscular conditions.

Individual Differences in Manual Muscle Testing

The age, gender, body type, and lifestyle of the client; the muscle size and type and speed of contraction; the effect of previous training for the testing situation; joint position during the muscle contraction; previous training effects; and time of day, temperature, and fatigue all can affect muscle strength.[6,7] Occupations also influence the amount of pressure that a particular client can withstand during strength testing.[9,10,12-14] Strength tends to decline with age, and full resistance to the same muscle group will vary considerably from an 80-year-old man to a 25-year-old man.[7,14] One way to establish “normal” levels for individuals with one side affected is to test the unaffected extremity first. Learning about the activities, occupations, and tasks regularly performed in daily life can give the therapist a general idea; however, assumptions should be avoided. For example, a man who plays football for leisure or works as a construction worker is likely to have strength that is in the higher range of “normal.” Conversely, the strength of a female office worker should not be assumed based on her small stature, as she may bowl, play tennis, and make wood crafts in her leisure time.

Limitations of the Manual Muscle Test

When done correctly, MMT measures the strength of a muscle or group of muscles. Although information about quality of movements (speed, smoothness, rhythm, and abnormal movements such as tremors),[19] muscle tone (resistance to passive movement), and motor performance (the use of muscles for functional activities)[8] may be gathered while assessing active and passive ROM, these are not directly measured during MMT. Assessment of **muscle endurance** involves assessment of ability to repetitively contract and resist fatigue,[6] which are not measured during MMT. In fact, the therapist should limit the number of times that the muscle is maximally contracted during MMT to ensure that strength (and not muscle endurance or fatigue resistance) is being measured.

Contraindications and Precautions

MMT is contraindicated when the client has inflammation or pain in the region to be tested; a dislocation or unhealed fracture; recent surgery, particularly of musculoskeletal structures; myositis ossificans; or bone carcinoma or any fragile bone condition.[7,15] Because weak muscles fatigue easily, MMT should not be performed when the client is tired or especially fatigued for two reasons: (1) the results will not accurately reflect strength, and (2) negative ramifications can result when excessive force is applied to muscles that are compromised. Special precautions must be taken when resisted movement could aggravate the client's condition, as might occur with osteoporosis, subluxation or hypermobility of a joint, hemophilia or any type of cardiovascular risk or disease, abdominal surgery or an abdominal hernia, and fatigue that exacerbates the client's condition.[6,7] Until recently, MMT was not performed on clients with muscle spasticity, otherwise known as hypertonicity; however, recent literature notes that MMT can result in accurate results in clients with mild to moderate spasticity. Critics of MMT in clients with hypertonicity suggest that primitive reflexes and gross synergistic movement patterns make it impossible for the client to isolate joint motions, which is demanded in MMT procedures.[2,3,6,7,16] Refer to Chapters 19, 31 (Section 2), and 32 for detailed information about hypertonicity and MMT in clients with upper motor neuron disorders.

Unlike the passive range of motion (PROM) assessment discussed in Chapter 21, MMT requires the client's complete involvement in the testing procedure. MMT should not be compromised as a result of cognitive and language barriers, or the client's inability to perform the motor skills required for the test.[13] Screening of clients' ability to understand and follow directions and their willingness and ability to expend maximal effort should be ascertained prior to MMT. If the OT practitioner suspects that the results of an MMT may be compromised, MMT should not be performed. Likewise, if the therapist has any reason to believe that results of an MMT that was administered do not accurately measure muscle strength, the results should not be recorded in the client's record.

Role of Joint Range of Motion When Performing Manual Muscle Testing

The amount of motion through which a muscle group can move the body part is the first criterion used to evaluate MMT. As a result, it is common to perform MMT after evaluating ROM (see Chapters 20 and 21). The amount of ROM actively performed when the client contracts the muscle group (active range of motion [AROM]), is compared to the amount of ROM through which the OT practitioner can passively move the client's body part (PROM). It is important to note that PROM deficits do not affect the assignment of muscle strength grades. Despite a PROM limitation, muscle strength within the available AROM may be normal. ROM and the actions being muscle tested should be screened prior to assessing strength; if AROM is within functional limits, further ROM evaluation is not necessary as PROM will also be within functional limits. However, if AROM is limited, the therapist must take the joint through PROM to identify the available amount of joint mobility prior to assigning a muscle grade.

Let's consider a client who has elbow flexion ROM limitations of 120 degrees both passively and actively due to joint changes from an old fracture. Strength is not the factor limiting AROM, so the OT practitioner proceeds with the next step of MMT, placing the joint in midrange and applying pressure. It is important to record the PROM limitation along with the muscle grade noted during pressure application.[10] Conversely, if the client's PROM for elbow flexion is 160 degrees and AROM is only 120 degrees, pressure would not be applied, as the muscle group is only capable of moving the joint through partial ROM **against gravity**. Using a client's “actual” ROM rather than published ROM norms is preferred, as it is more specific and accurate. When assessing Sharon's muscle strength during the recovery phase of her illness, the OT practitioner most likely will find less active ROM than passive ROM due to muscle strength deficits. The discrepancy will decrease and strength will begin to recover as remyelination and axonal regeneration occur.

Role of Gravity When Performing Manual Muscle Testing

Gravity is a resistance force that the muscular system must overcome in order to move the body through ROM. Movement against gravity is one criterion used to assess muscle strength.[14] Movement of a body part against gravity in a vertical plane (i.e., away from the floor or toward the ceiling) through the joint's full available PROM signifies a certain level of muscle strength. If a client is not able to perform a movement against gravity (plane that is vertical), the effect of gravity on the body part is minimized to determine the amount of movement possible. This involves placing the body part in a position that allows motion to occur in a horizontal plane (i.e., parallel to the floor). This position has been referred to as the gravity-eliminated, gravity-minimized, or gravity-lessened test position.[10,14,16,19] Because the effect of gravity cannot be eliminated, *gravity minimized* or *gravity lessened* are more accurate terms. The term **gravity minimized**[10,14] is used in this chapter.

When the body part being moved has a substantial mass (and hence weight), the effect of gravity on muscle power must be considered when muscle testing. Such is the case when moving the trunk or head, lifting an entire extremity at the hip or shoulder, and performing knee, elbow, ankle, and wrist movements. In these cases, motion must occur in the vertical plane to account for gravity's effect, and when strength is inadequate to move the body part in the vertical plane, the body must be repositioned to measure movement in the horizontal or gravity-minimized plane. It is of lesser importance to position the body part with the motion occurring against gravity (in the vertical plane) when the moving body part is lightweight, such as the fingers and toes, and when rotating the forearm.[10,14] Therefore when assessing strength of the muscle group that moves the forearm, fingers, or toes, testing can occur in either the horizontal or vertical plane. For some actions, positioning in the against-gravity or gravity-minimized position is not feasible. For example, when testing scapula depression, the against-gravity position would require the client to assume an inverted position. In individual cases, positioning for movement in the correct plane may not be possible because of confinement to bed, generalized weakness, trunk instability, immobilization devices, medical devices, and precautions. In these instances, the OT practitioner must adapt the positioning to the client's needs and use clinical judgment in modifying the grading. The therapist should note modifications in positioning and grading when recording the results of the muscle test.

For consistency in procedure and grading, gravity-minimized positions and against-gravity positions are used in the manual muscle tests for all motions described later, except in cases in which the positioning is not feasible or would be awkward or uncomfortable for the client. Modifications in positioning and grading have been cited with the individual tests.

Application of Pressure During Manual Muscle Testing

Application of pressure (previously referred to as resistance in prior editions of this chapter) by the therapist is an additional external force used when assessing muscle strength. The amount of pressure a group of muscles performing an action can tolerate depends on a wide range of factors. Larger muscles have greater strength,[7,10] which relates to the diameter or cross section of the fibers that make up a muscle. The number of muscles responsible for an action (the agonists) also affects the strength of an action. For example, the three muscles primarily responsible for wrist flexion are larger, have more power, and can withstand more resistance than the one muscle that adducts each finger. As a result, the OT practitioner must consider the size and relative power of the muscles and modify the amount of pressure applied accordingly. The amount of pressure that can be applied to grade a particular muscle group varies among individual clients.[9,10,12-14]

Many other principles must be followed during the application of pressure. Pressure is applied opposite to the direction of the action being tested, and it should be applied directly opposite to the line of pull of the muscle or muscle group being tested. This means that the pressure is applied completely perpendicular to the long axis of the bony structure that is moving (Figure 22.1). Application of pressure in this manner allows for all of the therapist's force to be applied to “un-rotate” the joint and not to compress or distract the joint. Pressure is normally applied as distal as possible on the body part that is moving (avoiding crossing the next joint), which gives the therapist a longer moment arm. Application of pressure in a perpendicular manner to the moving body part and ensuring that pressure is applied as far distal as possible without crossing the next joint increase the therapist's biomechanical advantage, resulting in the need to use less force when applying pressure. The therapist should tell the client when the pressure is going to be applied, which allows the client to “set” the muscle. Pressure should be applied gradually and be adjusted to the client's abilities.[12] The body part proximal to the joint being tested should be well stabilized to ensure that pressure is directed only to the moving body part. To prevent interference with muscle contraction, pressure should not be applied directly over the muscle belly or tendon of the muscles that are contracting. In some cases, all of these principles regarding pressure application cannot be observed at the same time; the therapist considers the ramifications of breaking a principle, erring on the side of safety.

FIG 22.1 Application of pressure during MMT. The red arrow denotes pressure application by OT; the blue dotted line is the longitudinal axis of the moving body part. Note that pressure is applied perpendicular to the moving body part.

The break test should not evoke pain, and pressure should be released immediately if pain or discomfort occurs.[10] After applying pressure, the therapist grades the muscle strength according to the preceding standard definitions of **muscle grades**. This procedure is used for tests of strength of grades Fair+ (3+) and above. Pressure is not applied for tests of muscles from Fair (3) to Zero (0). Slight resistance is sometimes applied to a muscle that has completed the full ROM in the gravity-minimized plane to determine whether the grade is Poor+. Figure 22.2 shows a sample form for recording muscle grades.

MUSCLE EXAMINATION

Client's name ______________________________ Chart no.

Date of birth ______________ Name of institution ______________________

Date of onset ______________ Attending physician ______________________ MD

Diagnosis:

LEFT							RIGHT			
					Examiner's initials					
					Date					
				NECK	Flexors	Sternocleidomastoid				
					Extensor group					
				TRUNK	Flexors	Rectus abdominis				
					Rt. ext. obl. / Lt. int. obl. — Rotators	{ Lt. ext. obl. / Rt. int. obl.				
					Extensors	{ Thoracic group / Lumbar group				
					Pelvic elev.	Quadratus lumb.				
				HIP	Flexors	Iliopsoas				
					Extensors	Gluteus maximus				
					Abductors	Gluteus medius				
					Adductor group					
					External rotator group					
					Internal rotator group					
					Sartorius					
					Tensor fasciae latae					
				KNEE	Flexors	{ Biceps femoris / Inner hamstrings				
					Extensors	Quadriceps				
				ANKLE	Plantar flexors	{ Gastrocnemius / Soleus				
				FOOT	Invertors	{ Tibialis anterior / Tibialis posterior				
					Evertors	{ Peroneus brevis / Peroneus longus				
				TOES	MP flexors	Lumbricales				
					IP flexors (first)	Flex. digit. br.				
					IP flexors (second)	Flex. digit. l.				
					MP extensors	{ Ext. digit. l. / Ext. digit. br.				
				HALLUX	MP flexor	Flex. hall. br.				
					IP flexor	Flex. hall. l.				
					MP extensor	Ext. hall. br.				
					IP extensor	Ext. hall. l.				

Measurements:

Cannot walk	Date	Speech
Stands	Date	Swallowing
Walks unaided	Date	Diaphragm
Walks with apparatus	Date	Intercostals

KEY

5	N	Normal	Complete range of motion against gravity with full resistance.
4	G	Good*	Complete range of motion against gravity with some resistance.
3	F	Fair*	Complete range of motion against gravity.
2	P	Poor*	Complete range of motion with gravity eliminated.
1	T	Trace	Evidence of slight contractility. No joint motion.
0	0	Zero	No evidence of contractility.
S or SS			Spasm or severe spasm.
C or CC			Contracture or severe contracture.

*Muscle spasm or contracture may limit range of motion. A question mark should be placed after the grading of a movement that is incomplete from this cause.

LEFT							RIGHT			
					Examiner's initials					
					Date					
				SCAPULA	Abductor	Serratus anterior				
					Elevator Depressor	Upper trapezius Lower trapezius				
					Adductors	Middle trapezius Rhomboids				
				SHOULDER	Flexor	Anterior deltoid				
					Extensors	Latissimus dorsi Teres major				
					Abductor	Middle deltoid				
					Horiz. abd.	Posterior deltoid				
					Horiz. add.	Pectoralis major				
					External rotator group					
					Internal rotator group					
				ELBOW	Flexors	Biceps brachii Brachioradialis				
					Extensor	Triceps				
				FOREARM	Supinator group					
					Pronator group					
				WRIST	Flexors	Flex. carpi rad. Flex. carpi uln.				
					Extensors	Ext. carpi rad. l. & br. Ext. carpi uln.				
				FINGERS	MP flexors	Lumbricales				
					IP flexors (first)	Flex. digit. sub.				
					IP flexors (second)	Flex. digit. prof.				
					MP extensor	Ext. digit. com.				
					Adductors	Palmar interossei				
					Abductors	Dorsal interossei				
					Abductor digiti quinti					
					Opponens digiti quinti					
				THUMB	MP flexor	Flex. poll. br.				
					IP flexor	Flex. poll. l.				
					MP extensor	Ext. poll. br.				
					IP extensor	Ext. poll. l.				
					Abductors	Abd. poll. br. Abd. poll. l.				
					Adductor pollicis					
					Opponens pollicis					
				FACE						

Additional data:

FIG 22.2 Sample form for recording the muscle examination. (Adapted from March of Dimes Birth Defects Foundation.)

Because weak muscles fatigue easily, the results of MMT may not be accurate if the client is tired. There should be no more than three repetitions of the test movement because fatigue can result in grading errors if the muscle becomes tired as a result of low endurance.[7,8] Pain, swelling, or muscle spasm in the area being tested may also interfere with the testing procedure and accurate grading. Such problems should be recorded on the evaluation form.[19] Psychological factors must be considered in interpreting muscle strength grades. When interpreting strength, the therapist must assess motivation, cooperation, and the effort put forth by the client.[10]

Palpation of Muscle Contraction

If there is no visible action when a muscle group is tested on a horizontal plane, the therapist must ascertain if the muscles are able to generate any tension; this is done via palpation. The therapist places his or her fingers (typically the tips of the index and long fingers) over the muscle belly or tendon of the muscles that perform the action being tested and moves the body part into the target position several times while instructing the client to attempt to move the joint in this manner. Palpating over the exact position of each muscle belly/tendon that performs is preferred; however, placement over the general area of the muscle group performing the action is acceptable. Because shoulder abduction occurs in the frontal (coronal) plane, the muscles performing abduction are palpable lateral to the glenohumeral joint (Figure 22.3, A). Similarly, knee flexion occurs in the sagittal plane and the distal lower extremity rotated into neutral; the muscles performing knee flexion are palpable posterior to the knee joint, with their muscle bellies lying superior and others inferior to the knee (Figure 22.3, B).

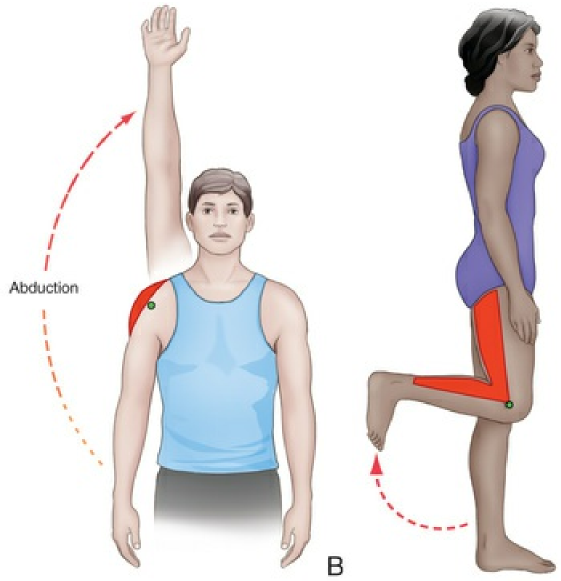


FIG 22.3 **A,** Muscles performing shoulder abduction. The green dot denotes general axis of motion and the red shape represents position of the shoulder abductor muscle group. **B,** Muscles performing knee flexion. The green dot denotes general axis of motion and the red shape represents position of the knee flexor muscle group.

When palpating for contraction, it is important to tell the client that although the muscles can be too weak to physically move the joint, there can still be muscular activity that the OT practitioner can feel when the client attempts to perform the motion. The client should be given several opportunities to generate tension. It is also important for the OT practitioner to know the location of the target muscles and their tendinous attachments to discern them from other muscles in the vicinity that may be attempting to substitute for the test action.

Substitutions

The OT practitioner must observe the client closely to ensure that the action that he or she performs is the exact motion that the muscle group that is being tested performs. The brain thinks in terms of movement and not in terms of contraction of individual muscles.[10] Thus a muscle or muscle group may attempt to compensate for the function of a weaker muscle to accomplish a movement. These movements are called **substitutions**.[6,7,14] The therapist must give careful instructions; provide correct positioning, stabilization, and palpation; and ensure that the test motion occurs without extraneous movements. To prevent substitutions, the correct position of the body should be maintained and movement of the part performed without shifting the body or turning the part.[6,7,14] Undetected trick movements can mask the client's problems, resulting in inaccurate treatment planning.[6] Palpation of the contractile tissue ensures that tension is being generated by the muscle under examination.[6,10] The technique for muscle testing described in this chapter does not use palpation when testing grades Normal, Good, and Fair. The muscles that work in concert to perform a joint action often originate in different locations, making palpation of the contractile tissue impossible. For example, the muscle bellies of the elbow flexors lie in the midarm, lateral forearm, and deep anterior elbow joint. In addition, one of the OT practitioner's hands is stabilizing the proximal body part and the other is applying pressure to the moving body part, leaving no hand free for palpation. This chapter describes body and joint positioning in detail, placement of the body part in a specific position, and subtle substitutions to help the OT practitioner identify substitutions. Palpation is utilized when the muscle grade is below Fair. Detecting substitutions is a skill that OT practitioners gain with time and experience.

Knowledge and Skill of the Occupational Therapist

The safety, reliability, and validity of MMT depends on the knowledge, abilities, and skills of the OT practitioner. This begins with detailed understanding of the muscular system (muscle anatomy, innervation, origin, and insertion), kinesiology (muscle action and function, direction of muscle fibers, the role of muscles in fixation and substitution), and skeletal system (joints, motions, end-feels, and normal range of motion). The therapist must be able to observe the contour of a muscle to determine if it is normal, atrophied, or hypertrophied. He or she must be able to detect abnormal movements, postures, and positions. The therapist must be able to position his or her body as well as the client's body and body part and apply stabilization and pressure adequately, or he or she must be able to instruct and closely supervise a proxy to help perform these physical skills. The ability to locate and feel contracting muscles is required. The OT practitioner must know and be competent using consistent methods in the application of test procedures. Careful observation of movement, careful and accurate palpation, correct positioning, consistency of procedure, and the experience of the therapist are critical factors in accurate testing.[10,12-14] Knowledge and experience are necessary to detect substitutions and interpret strength grades with accuracy.[12-14]

It is necessary for the OT practitioner to acquire skill and experience in testing and grading the muscles of a wide range of typical individuals of both genders and of all ages before determining how “normal” presents in the clinical setting. Although definitions of muscle grades are standardized, conducting a manual muscle test consists of both subjective and objective components. Subjective components relate to the OT practitioner's perception of how much pressure/resistance was applied, relative to expectations based on experience of what is typical strength for a person of that size, age, history, and so on. Objective factors primarily relate to the clients' range of motion in a specific plane. Collectively, the objective and subjective components inform the therapist's clinical reasoning to assign a specific muscle grade. Because many factors affect muscle strength, experience is required to help therapists differentiate among strength grades.[19]

Principles of Manual Muscle Testing

Preparation for Testing

After performing necessary screening tests, the client is positioned on a stable chair or table per directions outlined in specific testing procedures. If several tests are to be administered, they are sequenced to avoid frequent repositioning of the client.[12,13,21] Clothing is arranged or removed to avoid interference with motion, contraction, or application of pressure, and to allow for observation of muscle contour (symmetry between sides, hypertrophy, or atrophy). The OT practitioner is positioned close to the client's body part being tested to minimize upward and outward reaching. This allows for support of a weakened extremity on the OT practitioner's body, decreases the amount of force that must be generated when applying pressure, protects the OT practitioner's joint structures, and prevents overall fatigue.

Specific Procedure for Testing

To ensure accuracy and consistency, MMT must always be performed according to standardized procedures. If modifications are performed, they must be described and documented. The procedure for MMT of the extremities is described in Table 22.1. Procedures for testing the face, neck, and trunk are document elsewhere.[6,8,10,12-14]

TABLE 22.1

Manual Muscle Test Procedure

1. *Body position:* The client is placed in a stable position that allows the muscle group to perform the action against gravity (vertical plane).
2. *Action:* After being shown the motion to be tested, the client actively performs the action against gravity through the maximal available range of motion.*
3. *Test position.* The joint is positioned midway through the available range of motion.
4. *Stabilize.* The OT practitioner stabilizes the body part just proximal to the joint that is moving while simultaneously observing the motion.
5. *Pressure.* The OT practitioner applies pressure opposite to the direction of muscle contraction and movement.

*Depending on the results in step 2, the following procedures are followed:

(a) If the client demonstrates active ROM through the available PROM, the OT practitioner positions the joint in midrange (approximately 50% of full available PROM), stabilizes the body part proximal to the joint being tested (to isolate the muscle group, ensure the correct test motion, and prevent substitutions), and applies pressure perpendicular to the moving body part in a direction that is opposite to the motion being tested. Pressure is applied as distal as possible on the moving body part without crossing the next joint. For example, when elbow flexion is tested, the therapist applies pressure in the direction of extension. The client should be prepared to establish a maximal contraction when the OT practitioner applies pressure.[10,15]

(b) If AROM is less than the available PROM, the OT practitioner positions the client's body part in a manner that limits the effect of gravity (body part supported by the OT practitioner in a horizontal plane that is parallel to the ground) and the client is asked to perform the action in the gravity-minimized (horizontal) plane.

(i) If the client performs the motion through full available PROM on the gravity-lessened plane, the body part is placed at midrange and the therapist attempts to move the body part out of the position using slight pressure.

(ii) If the client is unable to perform the motion through full available PROM, no pressure is applied.

(iii) If no motion is noted in the horizontal plane, the therapist palpates over the muscle belly or tendon of the muscles being tested and asks the client to attempt the motion while palpating for muscle contraction.

Grading of Muscle Strength

The criteria for grading of muscle strength are listed in Table 22.2.[6,10,12,13,21]. The highest grade that can be assigned is grade 5, or Normal. For a client to be assigned this muscle grade, the client must demonstrate full AROM against gravity and tolerate maximal pressure. If a muscle group is able to complete full range against gravity but is unable to withstand the maximal pressure, it is assigned a grade 4, Good. The therapist will assign a grade 4 when the muscle “yields” or “gives” when it is no longer able to withstand maximal pressure. A muscle or muscle group is deemed a grade 3, Fair, if it can move through the full ROM against gravity but cannot tolerate additional pressure from the OT practitioner. The muscle group will easily yield if the therapist provides only slight pressure. If a muscle group is assigned a muscle grade of 2, Poor, the muscle group is able to complete full ROM in a gravity-minimized plane. If the muscle group is unable to move the body through any ROM of motion in a gravity-minimized plane but the therapist can feel tension or contraction in the muscle group upon palpation, the muscle is a grade 1, Trace. The client does not need to be placed in a gravity-minimized plane to palpate the muscle contraction. When the therapist is unable to feel the contraction, the muscle is assigned a grade 0, Zero. The decision tree in Figure 22.4 is a useful guide.

TABLE 22.2

Muscle Grades

Grade (Number)	Grade (Name)		Gravity	AROM	Pressure
5	Normal	N	Against	Full	Maximal
4	Good	G	Against	Full	Moderate
3+	Fair plus	F+	Against	Full	Slight
3	Fair	F	Against	Full	None
3–	Fair minus	F–	Against	More than 50%	None
			Against	Less than 50%	None
2+	Poor plus	P+	Gravity minimized	Full	Slight
2	Poor	P	Gravity minimized	Full	None
2–	Poor minus	P–	Gravity minimized	Partial	None
1	Trace	T	Against or gravity minimized	No motion	Contraction observed/felt
0	Zero	0	Against or gravity minimized	No motion	No movement

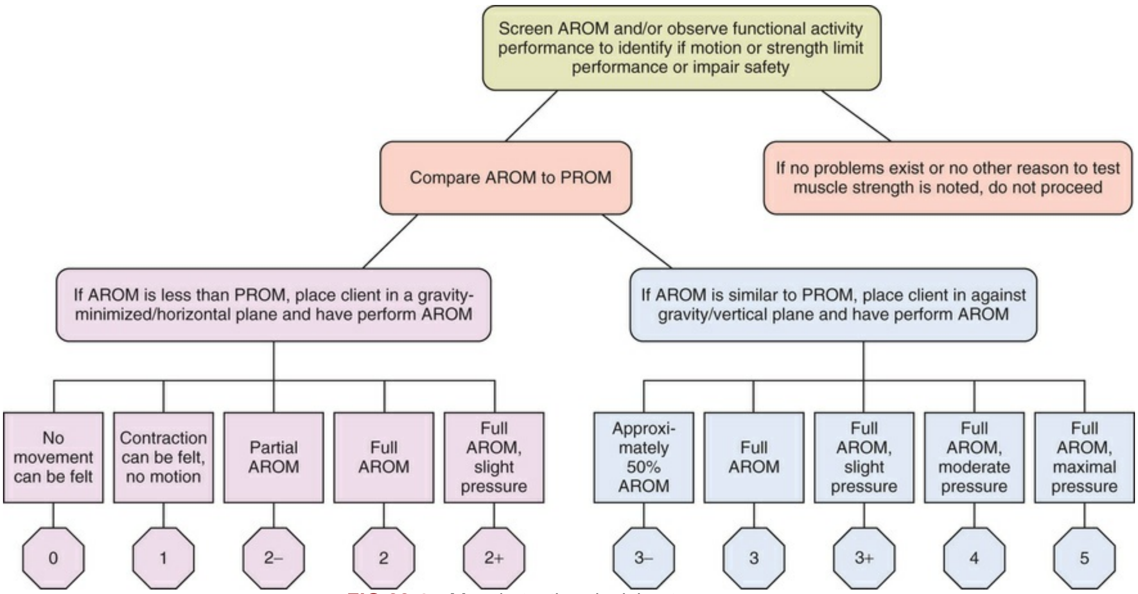


FIG 22.4 Muscle testing decision tree.

The purpose of using "plus" or "minus" designations with muscle grades is to "fine grade" muscle strength. These designations are likely to be used by the experienced OT practitioner. The results of two OT practitioners testing the same individual may vary up to a half grade, but there should not be a whole grade difference.[19] Practice among a work group of OT practitioners can standardize techniques and calibrate muscle grading to improve interrater reliability.

If tests of the forearm, fingers, and toes are performed against gravity rather than in the gravity-minimized plane, the standard definitions of muscle grades can be modified when muscle grades are recorded. Partial ROM against gravity is graded Poor (2), and full ROM against gravity is graded Fair (3).[10]

If the client cannot be placed in the correct position for the test, the OT practitioner must adapt the test and use clinical judgment in approximating strength grades.[19] In addition to correct positioning, test reliability and validity depend on careful stabilization, palpation of the muscles, and observation of movement.[10]

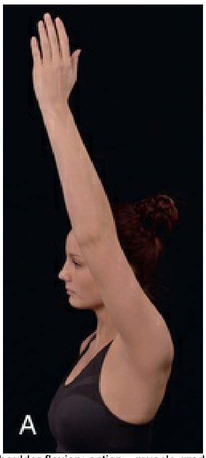
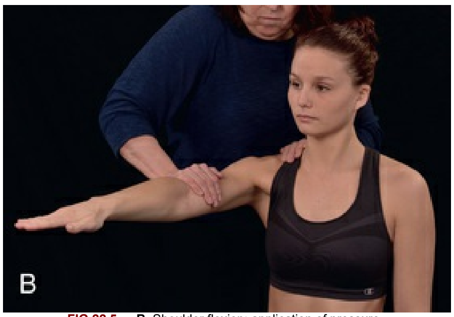
Manual Muscle Testing of the Upper Extremity

The muscles performing each action, their innervation, and the specific procedures for testing are described in the following sections. The practitioner is positioned to allow for optimal viewing of client positioning, which may not be the most mechanically advantageous position for the OT practitioner. The evaluator should stand as close as possible to the body part that is being tested. Pressure should always be applied perpendicular to the distal body part, which may not always be demonstrated in order to maintain optimal viewing of the client's positioning.

Shoulder Flexion (Fig. 22.5)

Muscles[10,18,22]	Innervation[6,10,18,22]
Anterior deltoid	Axillary nerve, C5, C6
Coracobrachialis	Musculocutaneous nerve, C5–7
Bicep brachii (short head)	Musculocutaneous, C5, C6
Pectoralis major (clavicular head)	Lateral and medial pectoral nerves, C5, C6

Procedure for Testing Grades Normal (5), Good (4), and Fair (3)

1. Body position	The client is seated on a supportive chair or mat—if trunk stability or balance is impaired, the trunk is externally supported. The therapist stands on the side being tested.	
2. Action	While demonstrating movement from neutral to full shoulder flexion, the therapist says, "Move your arm like I did." Observe the client actively performing the movement. Allow client's scapula and clavicle to move along with the humerus.	 FIG 22.5 **A,** Shoulder flexion: action—muscle grades 3 and above.
3. Test position	If client performs through available PROM, place shoulder at 90 degrees of flexion and proceed. If not, follow procedure for testing grades Poor, Trace, and Zero.	
4. Stabilize	Therapist stabilizes the scapula and clavicle by placing hand over superior shoulder girdle just proximal to glenohumeral joint. Client is stabilized in chair if needed.	
5. Pressure	Tell the client, "Don't let me move you." Apply pressure perpendicular to the distal humerus in downward fashion (toward shoulder extension), adjusting pressure to client's abilities. (a) Maximal pressure = Normal (b) Moderate pressure = Good (c) Minimal pressure = Good− (d) Slight pressure = Fair+ (e) No pressure = Fair	 FIG 22.5 **B,** Shoulder flexion: application of pressure.

Procedure for Testing Grades Poor (2), Trace (1), and Zero (0)

1. Body position	The client is side-lying on the side that is not being tested. If the client cannot maintain the weight of the upper extremity (UE) against gravity, the therapist supports it.[6,12] If the side-lying position is not feasible, the client may remain seated, and the test procedure is performed with grading modified.[10]	

		 FIG 22.5 **C,** Shoulder flexion: palpation—for muscle grades 2 and below.
2. Action	Beginning in midposition, move client's shoulder through partial flexion ROM twice while stating, "Move your arm like I did." (a) If client performs full ROM, place in 90 degrees of shoulder flexion and apply slight pressure perpendicular to the distal humerus toward shoulder extension. (i) If tolerates pressure = Poor+ (ii) No pressure = Poor (b) If client performs through partial ROM, do not apply pressure = Poor− (c) If client is unable to perform motion, place in 90 degrees of shoulder flexion and state, "Try to move your arm like I did." Palpate over anterior glenohumeral joint to feel for contraction in shoulder flexor muscle(s). (i) If muscle contraction palpable = Trace. (ii) If no contraction palpable = Zero.	

Substitution(s): Observe for flexion accompanied by horizontal adduction, external rotation, or scapula elevation.[10,15,21] Also look for hyperextension of the trunk.

FIG 22.5 **D,** Shoulder flexion: substitutions.

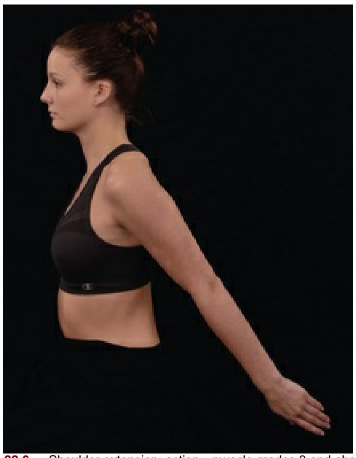
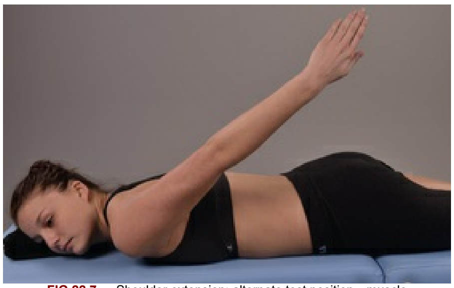
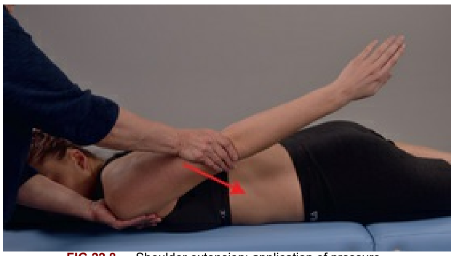
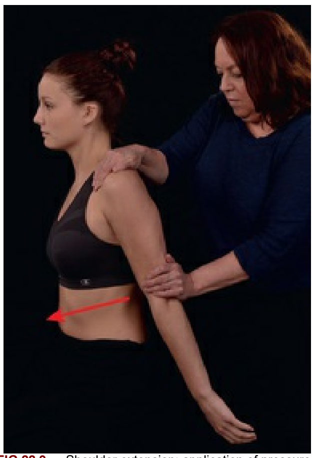
Note: Arm elevation in the plane of the scapula, about halfway between shoulder flexion and abduction, is called scaption. This movement is used for function more commonly than shoulder flexion or abduction. Scaption is performed by the deltoid and supraspinatus muscles. It is tested in a way similar to that used for shoulder flexion, except the arm is in a position 30 to 45 degrees anterior to the frontal plane.[6,12]

Shoulder Extension (Figs. 22.6 to 22.11)

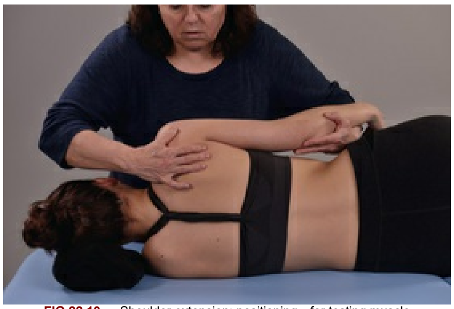
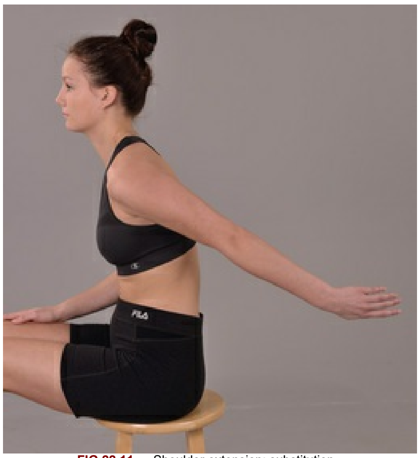
Muscles[4,10,14,18,22]	**Innervation**[6,10,18,22]
Latissimus dorsi	Thoracodorsal nerve, C6–8
Teres major	Lower subscapular nerve, C5–7
Posterior deltoid	Axillary nerve, C5, C6
Infraspinatus	Suprascapular, C4–6
Teres minor	Axillary nerve, C5, C6
Triceps brachii (long head)	Radial nerve, C6–8
Pectoralis major (sternal head)	Lateral and medial pectoral nerves, C7, C8, T1

Procedure for Testing Grades Normal (5), Good (4), and Fair (3)

1. Body position	The client is sitting on chair without back or lying prone on mat. If trunk stability or balance is impaired, the trunk is externally supported. Shoulder is at side in neutral position.[6,7,12] The therapist stands behind the side being tested.	
2. Action	While passively moving the client's shoulder from neutral to shoulder extension, the therapist says, "Move your arm like I did." Observe the client actively performing the movement.	
3. Test position	If client performs through available PROM, place shoulder at 30 degrees extension and proceed. If not, follow procedure for testing grades Poor, Trace, and Zero.	

		 FIG 22.6 Shoulder extension: action—muscle grades 3 and above.  FIG 22.7 Shoulder extension: alternate test position—muscle grades 3 and above.
4. Stabilize	Therapist stabilizes scapula and clavicle by placing hand over superior shoulder girdle just proximal to glenohumeral joint. If sitting, client is stabilized in chair if needed.	
5. Pressure	Tell the client, "Don't let me move you." Apply pressure perpendicular to the distal humerus in downward fashion, adjusting pressure to client's abilities. (a) Maximal pressure = Normal (b) Moderate pressure = Good (c) Minimal pressure = Good− (d) Slight pressure = Fair+ (e) No pressure = Fair	 FIG 22.8 Shoulder extension: application of pressure.  FIG 22.9 Shoulder extension: application of pressure.

Procedure for Testing Grades Poor (2), Trace (1), and Zero (0)

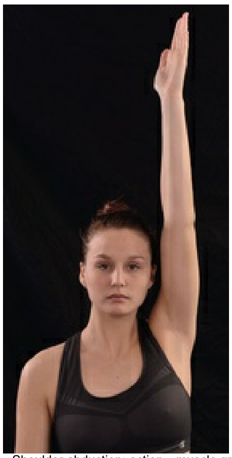
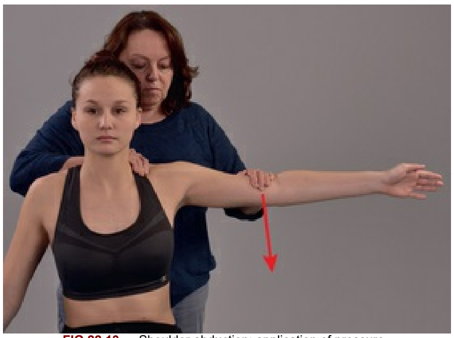
1. Body position	The client is placed side-lying on side that is not being tested. If the client cannot maintain the weight of the UE against gravity, the therapist supports it.[6,12] If the side-lying position is not feasible, the client may remain seated or in prone, and the test procedure is performed with the grading modified.[10]	 FIG 22.10 Shoulder extension: positioning—for testing muscle grades 2 and below.
2. Action	Beginning in midposition, move the client's shoulder through partial extension ROM twice while stating, "Move your arm like I did" (see FIG 22.10). (a) If client performs full ROM, place in 30 degrees of shoulder extension and apply slight pressure perpendicular to the distal humerus. (i) If tolerates pressure = Poor+ (ii) No pressure = Poor (b) If client performs through partial ROM, do not apply pressure. (i) = Poor− (c) If client is unable to perform motion, place in 90 degrees of shoulder flexion and state, "Try to move your arm like I did." Palpate over posterior glenohumeral joint to feel for contraction in shoulder extensor muscle(s). (i) If muscle contraction palpable = Trace (ii) If no contraction palpable = Zero	
Substitution(s): If sitting, trunk flexion or scapular anterior tilting.  FIG 22.11 Shoulder extension: substitution.		

Shoulder Abduction (Figs. 22.12 to 22.14)

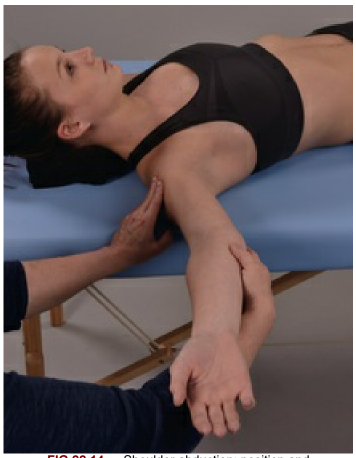
Muscles[10,14]	**Innervation**[10]
Middle deltoid	Axillary nerve, C5,6
Supraspinatus	Suprascapular nerve, C4, C5, C6

Procedure for Testing Grades Normal (5), Good (4), and Fair (3)

1. Body position	The client is seated on a supportive chair or mat. If trunk stability or balance is impaired, the trunk is externally supported. The therapist stands behind the client.[6,7,12]	
2. Action	While demonstrating movement from neutral to full shoulder abduction, the therapist says, "Move your arm like I did." Observe the client actively performing the movement. Allow client's scapula and clavicle to move along with the humerus.	

		 FIG 22.12 Shoulder abduction: action—muscle grades 3 and above.
3. Test position	If client performs through available PROM, place shoulder at 90 degrees of abduction and proceed. If not, follow procedure for testing grades Poor, Trace, and Zero.	
4. Stabilize	Therapist stabilizes scapula and clavicle by placing hand over superior shoulder girdle proximal to glenohumeral joint. Client is stabilized in chair if needed.	
5. Pressure	Tell the client, "Don't let me move you." Apply pressure perpendicular to the distal humerus in downward fashion toward adduction, adjusting pressure to client's abilities. If pressure is maximal = Normal, moderate = Good, minimal = Good−, slight = Fair+, and no pressure = Fair.	 FIG 22.13 Shoulder abduction: application of pressure.

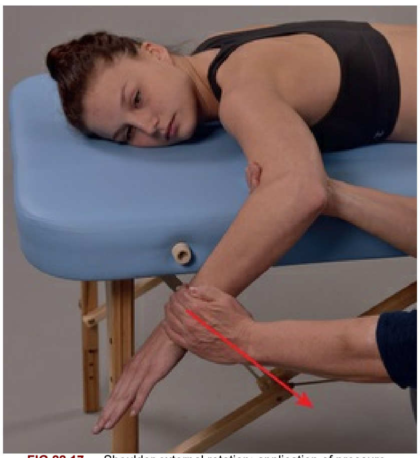
Procedure for Testing Grades Poor (2), Trace (1), and Zero (0)

1. Body position	The client is in the supine position, lying with the arm to be tested resting at the side of the body. The therapist stands on the side to be tested,[10,12] providing UE support if needed.	
2. Action	(a) Beginning in midposition, move client's shoulder through partial abduction ROM twice while stating, "Move your arm like I did." a. If client performs full ROM, place in 90 degrees of shoulder abduction and apply slight pressure perpendicular to the distal humerus. (i) If tolerates pressure = Poor+. (ii) No pressure = Poor. (b) If client performs through partial ROM, do not apply pressure = Poor−. If client is unable to perform motion, place in 90 degrees of shoulder abduction and state, "Try to move your arm like I did." Palpate superior to glenohumeral joint to feel for contraction in shoulder abductor muscle(s). (i) If muscle contraction palpable = Trace. (ii) If no contraction palpable = Zero.	 FIG 22.14 Shoulder abduction: position and palpation—muscle grades 2 and below.
Substitutions: The long head of the biceps may attempt to substitute. Observe for elbow flexion and external rotation accompanying the movement.[12] The anterior and posterior deltoids can act together to effect abduction. The upper trapezius may attempt to assist. Observe for scapula elevation preceding movement.[7,15,21]		

Shoulder External Rotation (Figs. 22.15 to 22.19)

Muscles[4,10,14]	Innervation[4,10,14]
Infraspinatus	Suprascapular nerve, C5, C6
Teres minor	Axillary nerve, C5, C6
Posterior deltoid	Axillary nerve, C5, C6

Procedure for Testing Grades Normal (5), Good (4), and Fair (3)

1. Body position	The client is prone (or sitting), with the shoulder abducted to 90 degrees and the humerus in neutral rotation, elbow flexed to 90 degrees. The forearm is in neutral rotation, hanging over the edge of the table, perpendicular to the floor.[6-8,12] A rolled towel under distal humerus will elevate the humerus to full abduction and may increase comfort. The therapist stands in front of the supporting surface, toward the side to be tested.[10,14]	
2. Action	The therapist demonstrates the movement from neutral to full shoulder external rotation. The therapist then says, "Move your arm like I did."	 FIG 22.15 Shoulder external rotation: test position—muscle grades 3 and above.  FIG 22.16 Shoulder external rotation: alternate test position—muscle grades 3 and above.
3. Test position	If client performs through available PROM, place shoulder in midexternal rotation ROM (approximately 40 degrees) and proceed. If not, follow the procedure for testing grades Poor, Trace, and Zero.	
4. Stabilize	The therapist provides stabilization at the distal end of the humerus by placing a hand under the distal humerus on supporting table.[7,14]	
5. Pressure	The therapist tells the client, "Don't let me move you." Apply pressure perpendicular to the distal end of the forearm toward the direction of internal rotation, adjusting pressure to the client's abilities. If pressure is maximal = Normal, moderate = Good, minimal = Good−, slight = Fair+, and no pressure = Fair.	 FIG 22.17 Shoulder external rotation: application of pressure.

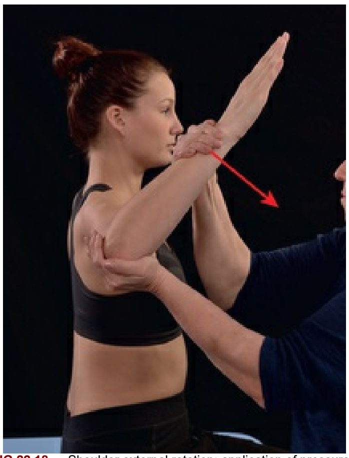
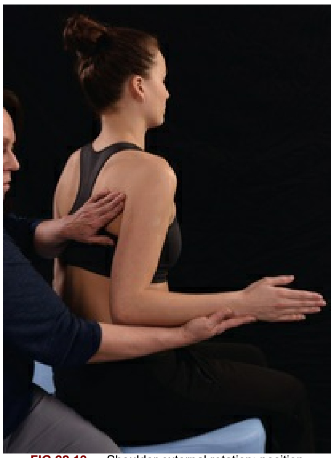


FIG 22.18 Shoulder external rotation: application of pressure.

Procedure for Testing Grades Poor (2), Trace (1), and Zero (0)

1. Body position	The client is seated, with arm adducted and in neutral rotation at the shoulder. The elbow is flexed to 90 degrees, with the forearm in neutral rotation. The therapist stands in front of the client toward the side to be tested.[6,7]	
2. Action	Move client's shoulder through partial external rotation ROM twice while stating, "Move your arm like I did." (a) If client performs full ROM, place in 40 degrees of external rotation and apply slight pressure to the distal forearm toward internal rotation. (i) If tolerates pressure = Poor+. (ii) No pressure = Poor. (b) If client performs through partial ROM do not apply pressure = Poor−. (c) If client is unable to perform motion, place in 40 degrees of external rotation and state, "Try to move your arm like I did." Palpate over posterior shoulder and scapula to feel for contraction in external rotators (see FIG 22.19). (i) If muscle contraction palpable = Trace. (ii) If no contraction palpable = Zero.	 FIG 22.19 Shoulder external rotation: position and palpation—muscle grades 2 and below.
Substitutions: If the elbow is extended and the client supinates the forearm, the momentum could aid external rotation of the humerus. Scapular adduction can pull the humerus backward and into some external rotation. The therapist should observe for scapula adduction and initiation of movement with forearm supination.[15,21]		

Shoulder Internal Rotation (Figs. 22.20 to 22.22)

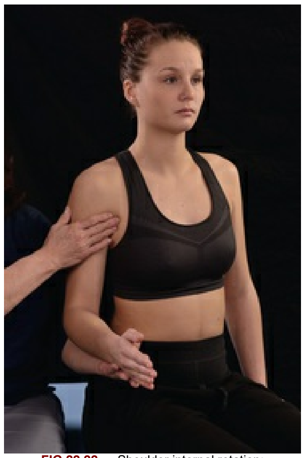
Muscles[10,14,15]	Innervation[4,5,10]
Subscapularis	Subscapular nerve, C5–7
Pectoralis major	Medial and lateral pectoral nerves, C5–T1
Latissimus dorsi	Thoracodorsal nerve, C6–8
Teres major	Lower subscapular nerve, C5–6
Anterior deltoid	Axillary nerve, C5–6

Procedure for Testing Grades Normal (5), Good (4), and Fair (3)

1. Body position	The client is prone, with the shoulder abducted to 90 degrees, the humerus in neutral rotation, and the elbow flexed to 90 degrees. A rolled towel may be placed under the distal humerus (FIG 22.20). The forearm is perpendicular to the floor. The therapist stands on the side to be tested, just in front of the client's arm.[6-8,12]	

		 FIG 22.20 Shoulder internal rotation: test position—muscle grades 3 and above.
2. Action	While demonstrating movement from neutral to full internal rotation, the therapist says, “Move your arm like I did.” Observe the client actively performing the movement (FIG 22.21).	 FIG 22.21 Shoulder internal rotation: application of pressure.
3. Test position	If client performs through available PROM, place shoulder into midrange of internal rotation (approximately 40 degrees) and proceed.	
4. Stabilize	The therapist provides stabilization at the distal end of the humerus by placing a hand under the arm and on the supporting surface, as for external rotation.[6,7,10,14]	
5. Pressure	The therapist tells the client, “Don't let me move you,” then applies pressure at the distal end of the volar surface of the forearm anteriorly toward external rotation, adjusting pressure to the client's abilities (see FIG 22.21).	

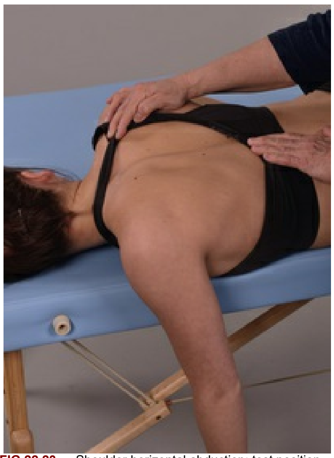
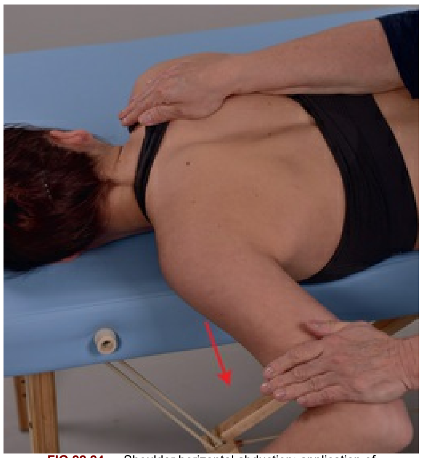
Procedure for Testing Grades Poor (2), Trace (1), and Zero (0)

1. Body position	The client is seated, with the shoulder adducted and in neutral rotation, elbow flexed to 90 degrees with the forearm in neutral rotation. The therapist stands on the side to be tested[6,21] and supports forearm (FIG 22.22).	 FIG 22.22 Shoulder internal rotation: position and palpation—muscle grades 2 and below.
2. Action	Beginning in midposition, move client's shoulder through partial internal rotation ROM twice while stating, “Move your arm like I did.” (a) If client performs full ROM, place in midshoulder internal rotation (approximately 40 degrees) and apply slight pressure to distal forearm into internal rotation. (i) If tolerates pressure = Poor+. (ii) No pressure = Poor. (b) If client performs through partial ROM, do not apply pressure = Poor−. (c) If client is unable to perform motion, place in midrange of internal rotation (approximately 40 degrees) and state, “Try to move your arm like I did.” Palpate over anterior glenohumeral joint to feel for contraction in internal rotators (see FIG 22.22). (i) If muscle contraction palpable = Trace. (ii) If no contraction palpable = Zero.	
Substitutions: If the trunk is rotated, gravity will act on the humerus, rotating it internally.[6] The therapist should observe for trunk rotation. When the elbow is in extension, pronation of the forearm can substitute.[10,15,21]		

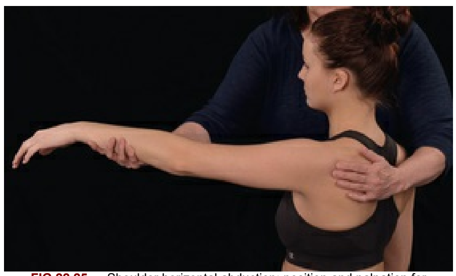
Shoulder Horizontal Abduction (Figs. 22.23 to 22.26)

Muscles[4,10,15]	Innervation[10,13]
Posterior deltoid	Axillary nerve, C5,6
Infraspinatus	Suprascapular nerve, C5,6

Procedure for Testing Grades Normal (5), Good (4), and Fair (3)

1. Body position	The client is prone, with the UE hanging over the edge of the mat, shoulder in about 90 degrees of scaption and neutral rotation, and elbow extended. The therapist stands on the side being tested[14,15] (FIG 22.23).	 FIG 22.23 Shoulder horizontal abduction: test position—muscle grades 3 and above.
2. Action	The therapist moves the client's UE from a position above into full horizontal abduction and says, "Move your arm like I did." Observe the client actively performing the movement (FIG 22.24).	 FIG 22.24 Shoulder horizontal abduction: application of pressure.
3. Test position	If client performs through available PROM, place shoulder into 90 degrees horizontal abduction (UE will be parallel to the floor) and proceed. If not, follow procedure for testing grades Poor, Trace, and Zero.	
4. Stabilize	The therapist provides stabilization over the scapula.[6,10] If needed, stabilization can move to the opposite scapula to stabilize the client's trunk (see FIG 22.24).	
5. Pressure	Tell the client, "Don't let me move you," then apply pressure over the distal humerus downward toward horizontal adduction. Be sure the table does not restrict motion (see FIG 22.24).	

Procedure for Testing Grades Poor (2), Trace (1), and Zero (0)

1. Body position	The client is seated, with the arm in 90-degree abduction and the palm down, supported on a high table or by the therapist.[6,12] (FIG 22.25). If a table is used to support the weight of the upper extremity, powder may be sprinkled on the surface or the limb can be placed on a rolling support (similar to a small skateboard) to reduce friction.	 FIG 22.25 Shoulder horizontal abduction: position and palpation for muscle grades 2 and below.
2. Action	Beginning in midposition, move client's shoulder through partial horizontal abduction ROM twice while stating, "Move your arm like I did."	

	(a) If client performs full ROM, place in 90 degrees of horizontal abduction and apply slight pressure to distal humerus toward horizontal adduction. (i) If tolerates pressure = Poor+. (ii) No pressure = Poor. (b) If client performs through partial ROM, do not apply pressure = Poor−. (c) If client is unable to perform motion, place in 90 degrees of horizontal abduction and state, “Try to move your arm like I did.” Palpate over posterior glenohumeral joint to feel for contraction in horizontal abductors. (i) If muscle contraction palpable = Trace. (ii) If no contraction palpable = Zero.	

Specific Muscle Testing: The posterior deltoid can be isolated by positioning the client in the sitting position, with the shoulder in 90 degrees abduction and approximately 35 degrees of internal rotation. The trunk is stabilized and pressure is applied over the distal humerus toward horizontal adduction and extension (FIG 22.26).[14]

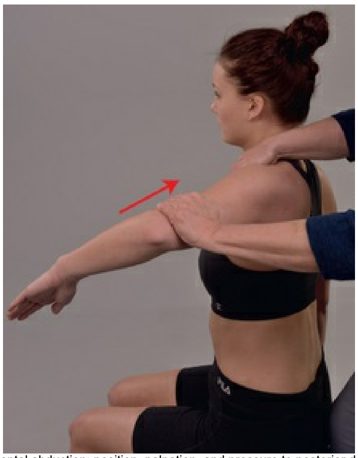


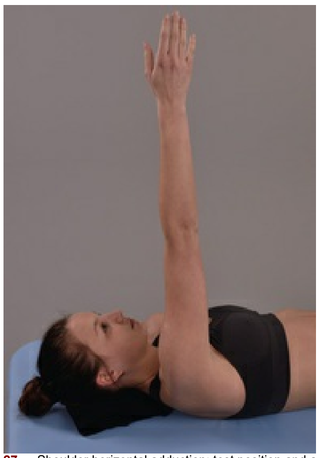
FIG 22.26 Shoulder horizontal abduction: position, palpation, and pressure to posterior deltoid for muscle grades 2+.

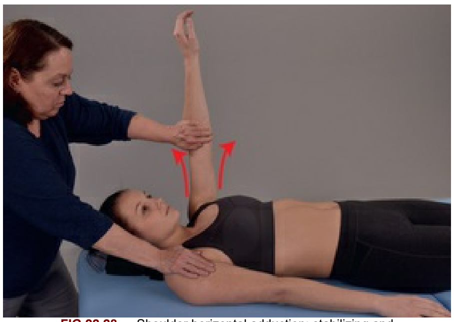
Substitutions: Latissimus dorsi and teres major may assist movement if the posterior deltoid is very weak. Movement will occur with more shoulder extension rather than at the horizontal level. Scapula adduction may produce slight horizontal abduction of the humerus, but trunk rotation and shoulder retraction would occur.[6,15,21] The long head of the triceps may substitute. Maintain some flexion at the elbow to prevent this.[12]

Shoulder Horizontal Adduction (Figs. 22.27 to 22.29B)

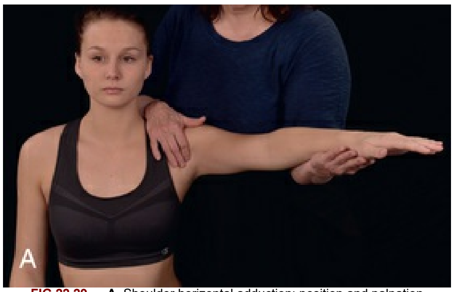
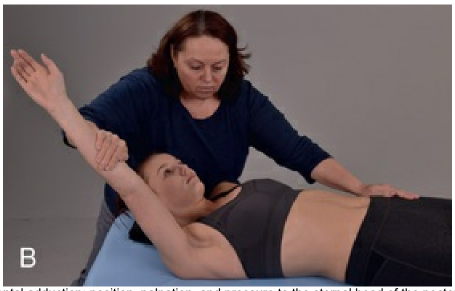
Muscles[4,12-14]	Innervation[4,10,12,13]
Pectoralis major	Medial and lateral pectoral nerves, C5-T1
Anterior deltoid	Axillary nerve, C5, C6
Coracobrachialis	Musculocutaneous nerve, C6, C7
Biceps brachii (short head)	Musculocutaneous nerve, C5, C6

Procedure for Testing Grades Normal (5), Good (4), and Fair (3)

1. Body position	The client is supine, with the shoulder abducted to 90 degrees, elbow flexed or extended. The therapist stands next to the client on the side being tested or behind the client's head.[4,6,7,10,12]	
2. Action	The therapist moves the client into horizontal adduction and says, “Move your arm like I did.” Observe the client actively performing the movement (FIG 22.27).	 FIG 22.27 Shoulder horizontal adduction: test position and action—muscle grades 3 and above.
3. Test position	If client performs through available PROM, place shoulder into midhorizontal adduction (approximately 80 degrees) (see FIG 22.27) and proceed. If not, follow procedure for testing grades Poor, Trace, and Zero.	
4. Stabilize	The therapist stabilizes the trunk by placing one hand over the anterior shoulder on the side opposite to that being tested to stabilize the trunk (FIG 22.28).	

		 FIG 22.28 Shoulder horizontal adduction: stabilizing and application of pressure.
5. Pressure	Tell the client, "Don't let me move you," then apply pressure over the distal humerus in outward direction toward horizontal abduction (see FIG 22.28).	

Procedure for Testing Grades Poor (2), Trace (1), and Zero (0)

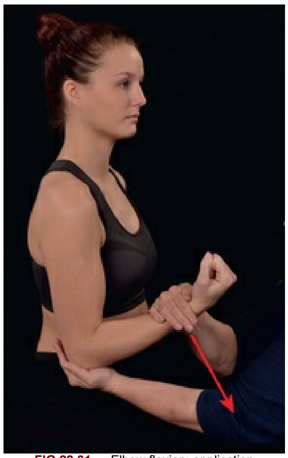
1. Body position	The client is seated with shoulder in 90 degrees of shoulder abduction with arm supported on high table[4,12,21] or by therapist (FIG 22.29, A). If a table is used to support the weight of the upper extremity, powder may be sprinkled on the surface or the limb can be placed on a rolling support (similar to a small skateboard) to reduce friction.	 FIG 22.29 A, Shoulder horizontal adduction: position and palpation for muscle testing the clavicular portion grades 2 and below.
2. Action	Move client's shoulder into horizontal adduction twice while stating, "Move your arm like I did." (a) If client performs full ROM, place in slight horizontal adduction and apply slight pressure toward horizontal abduction. (i) If tolerates pressure = Poor+. (ii) No pressure = Poor. (b) If client performs through partial ROM, do not apply pressure = Poor−. (c) If client is unable to perform motion, place shoulder in slight horizontal abduction and state, "Try to move your arm like I did." Palpate over anterior shoulder girdle for muscle contraction. (i) If muscle contraction palpable = Trace. (ii) If no contraction palpable = Zero.	
Specific muscle testing: The sternal and clavicular heads of the pectoralis major can be tested individually. The above-described procedure tests the clavicular head (however, the thumb must point toward the opposite shoulder), whereas bringing the hand from the position demonstrated in FIG 22.29, B, toward the opposite hip (with the thumb pointing toward opposite hip) isolates the sternal head. Stabilization of the opposite hip is provided, and pressure is toward horizontal abduction and abduction.[14]  FIG 22.29 B, Shoulder horizontal adduction: position, palpation, and pressure to the sternal head of the pectoralis major—muscle grades 2+.		
Substitutions: If the pectoralis major is not functioning, strength will decline significantly.[15] Contralateral trunk rotation can substitute if trunk is not adequately stabilized.[6]		

Elbow Flexion (Figs. 22.30 to 22.32)

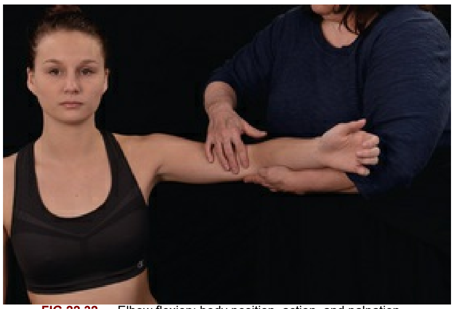
Muscles[10,12-14]	Innervation[12-14]
Biceps brachii	Musculocutaneous nerve C5, C6
Brachialis	Musculocutaneous nerve C5, C6
Brachioradialis	Radial nerve C5–7
Pronator teres	Median nerve C5, C6

Procedure for Testing Grades Normal (5), Good (4), and Fair (3)

1. Body position	Client is seated on a supportive chair or mat—if trunk stability or balance is impaired the trunk is externally supported. Shoulder and elbow in neutral. Therapist stands on side being tested.	

2. Action	While demonstrating movement from neutral to full elbow flexion with forearm supinated, the therapist says, "Move your arm like I did." Observe the client actively performing the movement (FIG 22.30).	 FIG 22.30 Elbow flexion: action.
3. Test position	If client performs through available PROM, place elbow at 90 degrees of flexion with forearm supinated and proceed. If not, follow procedure for testing grades Poor, Trace, and Zero.	
4. Stabilize	The therapist provides stabilization under the elbow joint.	
5. Pressure	Tell the client, "Don't let me move you." Apply pressure over the distal volar forearm in a downward fashion toward elbow extension, adjusting pressure to client's abilities (FIG 22.31). If pressure is maximal = Normal, moderate = Good, minimal = Good−, slight = Fair+, and no pressure = Fair.	 FIG 22.31 Elbow flexion: application of pressure.

Procedure for Testing Grades Poor (2), Trace (1), and Zero (0)

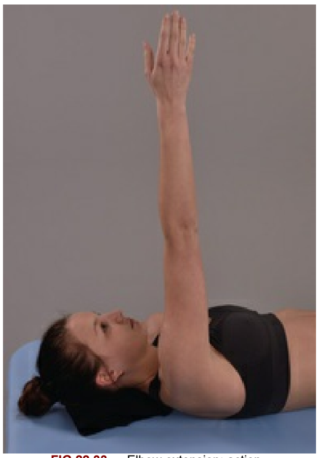
1. Body position	The client is sitting or supine with shoulder abducted to 90 degrees. UE can be supported on a high table with powder sprinkled on top to prevent friction. Therapist stands on side being tested and supports arm and forearm as needed (FIG 22.32).	 FIG 22.32 Elbow flexion: body position, action, and palpation—muscle grades 2 and below.
2. Action	Beginning in midposition, move client's elbow through partial extension ROM twice while stating, "Move your arm like I did." (a) If client performs full ROM, place in 90 degrees of elbow flexion and apply slight pressure over distal volar wrist perpendicular to forearm. (i) If tolerates pressure = Poor+. (ii) No pressure = Poor. (b) If client performs through partial ROM, do not apply pressure = Poor−. (c) If client is unable to perform motion, place in 90 degrees of elbow flexion and state, "Try to move your arm like I did." Palpate over anterior arm and forearm to feel for contraction in elbow flexor muscle(s). (i) If muscle contraction palpable = Trace. (ii) If no contraction palpable = Zero.	

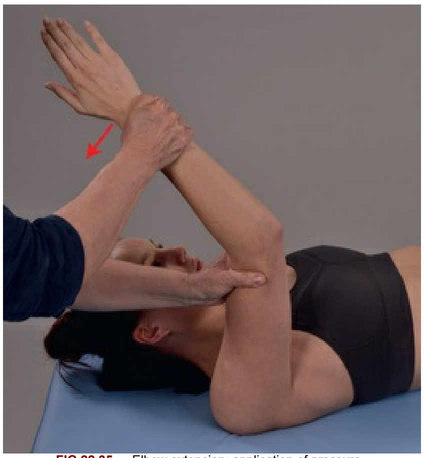
Specific muscle testing: A supinated forearm position tests primarily the biceps brachii, whereas pronated position tests brachialis and pronator teres[15]; neutral forearm position tests brachioradialis.[10,12,13]
Substitution: Wrist and extrinsic finger flexors may assist elbow flexion, which will be preceded by finger and wrist flexion.[10,12,13,15]

Elbow Extension (Figs. 22.33 to 22.38)

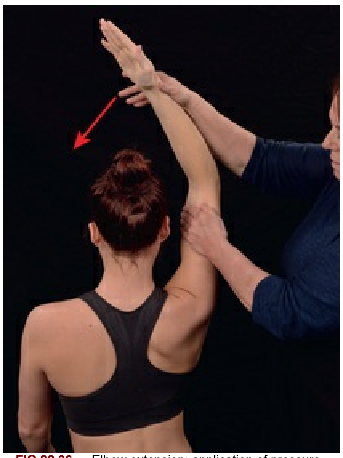
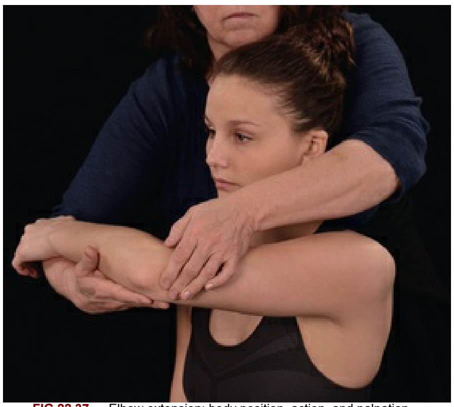
Muscles[6,10,12]	Innervation[10,12-14]
Triceps	Radial nerve, C6–8
Anconeus	Radial nerve, C7, C8, T1

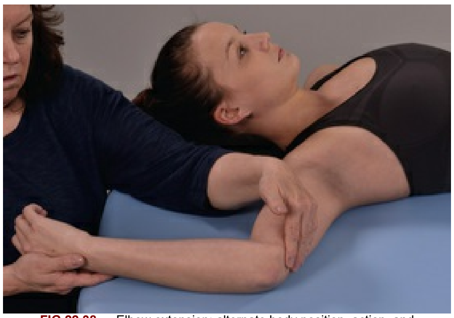
Procedure for Testing Grades Normal (5), Good (4), and Fair (3)

1. Body position	The client is supine with shoulder in 90 degrees flexion, sitting with shoulder in full flexion, or prone with humerus abducted to 90 degrees. The elbow is flexed. The therapist stands next to the client, just behind the extremity to be tested.[7,14,21]	
2. Action	While demonstrating movement from elbow flexion to full extension, the therapist says, “Move your arm like I did.” Observe the client actively performing the movement (FIGS 22.33 and 22.34).	 FIG 22.33 Elbow extension: action.  FIG 22.34 Elbow extension: action—alternate action method.
3. Test position	If client performs through available PROM, place elbow in 45 degrees of flexion and proceed. If not, follow procedure for testing grades Poor, Trace, and Zero.	
4. Stabilize	The therapist provides stabilization at the humerus, avoiding the contracting fibers on posterior humerus.	
5. Pressure	The therapist tells the client, “Don't let me move you,” then applies pressure at the distal end of the forearm into elbow flexion, adjusting pressure to the client's abilities[3] (FIG 22.35) The elbow should not be locked in full extension, as this can cause joint injury.[6,10]	

		 FIG 22.35 Elbow extension: application of pressure.

Procedure for Testing Grades Poor (2), Trace (1), and Zero (0)

1. Body position	The client is sitting with shoulder in 90 degrees flexion, scaption, or abduction.[7,10,12] Shoulder and forearm are in neutral rotation. The therapist supports the weight of the arm while standing next to the client's arm being tested[10] (FIG 22.36).	 FIG 22.36 Elbow extension: application of pressure.
2. Action	Beginning in midposition, move client's elbow through partial extension ROM twice while stating, "Move your arm like I did" (FIG 22.37). (a) If client performs full ROM, place in 90 degrees of elbow flexion and apply slight pressure perpendicular to the forearm. (i) If tolerates pressure = Poor+. (ii) No pressure = Poor. (b) If client performs through partial ROM, do not apply pressure = Poor−. (c) If client is unable to perform motion, place in 90 degrees of shoulder flexion and state, "Try to move your arm like I did." Palpate just superior to the dorsal elbow over the tendon (FIG 22.38), or over the middorsal humerus over the muscle belly to feel for contraction in elbow extensor muscle(s). (i) If muscle contraction palpable = Trace. (ii) If no contraction palpable = Zero.	 FIG 22.37 Elbow extension: body position, action, and palpation—muscle grades 2 and below.

		 FIG 22.38 Elbow extension: alternate body position, action, and palpation—muscle grades 2 and below.
Substitutions: Extrinsic finger and wrist extensors may substitute for weak elbow extensors, as their proximal attachment crosses the elbow joint in a posterior manner. Observe for the presence of finger and wrist extension preceding elbow extension. When the client is upright, gravity and eccentric contraction of the biceps will effect elbow extension from the flexed position.[15] Scapula depression with shoulder external rotation aided by gravity may result in elbow extension.[6] The elbow will assume an extended position when a client who is sitting with the hand fixed on the bed or mat (closed chair) performs scapular protraction and contracts the shoulder flexors to move the proximal attachment. Once the elbow is "locked" in hyperextension, the client's body weight maintains elbow extension.		

Forearm Supination (Figs. 22.39 to 22.42)

Muscles[4,10,13]	Innervation[6,10,13]
Biceps brachii	Musculocutaneous nerve, C5, C6
Supinator	Radial nerve, C7–C8

Procedure for Testing Grades Normal (5), Good (4), and Fair (3)

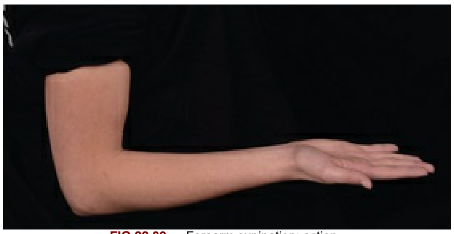
1. Body position	The client is seated, with the humerus adducted, the elbow flexed to 90 degrees, and the forearm pronated. The therapist stands in front of the client or next to the client on the side to be tested.[6,7,10,12,13]	
2. Action	While demonstrating movement from neutral to full forearm supination, the therapist says, "Move your arm like I did." Observe the client actively performing the movement (FIG 22.39).	 FIG 22.39 Forearm supination: action.
3. Test position	If client performs through available PROM, place forearm in neutral position and proceed. If not, follow procedure for testing grades Poor, Trace, and Zero.	
4. Stabilize	If client is able to stabilize humerus next to side, therapist can use both hands to comfortably apply pressure to client. If not, therapist stabilizes humerus just proximal to elbow.[6,10]	
5. Pressure	Tell the client, "Don't let me move you." Therapist can "sandwich" the forearm between both hands on midforearm, applying pressure into pronation (FIG 22.40). Therapist can also grasp around the dorsal aspect of the distal forearm with the fingers and heel of the hand, while turning the arm toward pronation. Adjust pressure to client's abilities (FIG 22.41).	 FIG 22.40 Forearm supination: application of pressure.

		 FIG 22.41 Forearm supination: application of pressure—alternate method.

Procedure for Testing Grades Poor (2), Trace (1), and Zero (0)

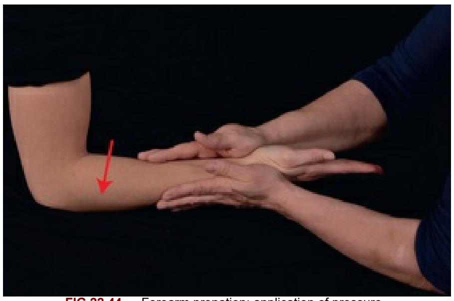
1. Body position	The client is seated with shoulder and elbow flexed to 90 degrees and the upper arm resting on table or supported by the therapist (FIG 22.42). Can test lying supine with shoulder in neutral and elbow flexed to 90 degrees, or prone with shoulder in 90 degrees abduction and forearm lying over edge of table in a position perpendicular to the floor.[6,7,21] The therapist stands next to client on the side to be tested.	 FIG 22.42 Forearm supination: body position, action, and palpation—muscle grades 2 and below.
2. Action	Beginning in midposition, move client's forearm into supination twice while stating, "Move your forearm like I did." (a) If client performs full ROM, place in midposition and apply slight pressure toward pronation. (i) If tolerates pressure = Poor+. (ii) No pressure = Poor. (b) If client performs through partial ROM, do not apply pressure = Poor−. (c) If client is unable to perform motion, place forearm in midposition and state, "Try to move your forearm like I did." Palpate over anterior dorsal forearm just distal to lateral epicondyle to feel supinator contraction or over volar elbow for biceps brachii. (i) If muscle contraction palpable = Trace. (ii) If no contraction palpable = Zero.	
Specific muscle testing: To test only the supinator muscle, the elbow and shoulder are fully flexed to make the biceps actively insufficient. In this position it is hard to tell if the forearm is pronated or supinated, resulting in pressure applied into pronation. The therapist should orient to forearm position when the elbow is flexed. **Substitutions**: With the elbow flexed, external rotation and horizontal adduction of the humerus will effect forearm supination. With the elbow extended, shoulder external rotation will place the forearm in supination. The brachioradialis can bring the forearm from full pronation to midposition. Wrist and thumb extensors, assisted by gravity, can initiate supination. The therapist should note any external rotation of the humerus, supination to midline only, and initiation of motion by wrist and thumb extension.[10,13,15,21]		

Forearm Pronation (Figs. 22.43 to 22.46)

Muscles[4,12,13,15]	**Innervation**[12,14]
Pronator teres	Median nerve, C6,7
Pronator quadratus	Median nerve, C8, T1

Procedure for Testing Grades Normal (5), Good (4), and Fair (3)

1. Body position	The client is seated, with the shoulder and elbow flexed to 90 degrees, and the forearm supinated (FIG 22.43). The therapist stands beside client on the side to be tested.[6,7,10,13]	

		 FIG 22.43 Forearm pronation: action.
2. Action	While demonstrating movement from neutral to full forearm pronation, the therapist says, “Move your forearm like I did.” Observe the client actively performing the movement.	
3. Test position	If client performs through available PROM, place forearm in neutral position and proceed. If not, follow procedure for testing grades Poor, Trace, and Zero.	
4. Stabilize	If client is able to stabilize humerus next to side, therapist can use both hands to comfortably apply pressure to client. If not, therapist stabilizes humerus just proximal to elbow to prevent shoulder abduction.[6,7,10,14]	
5. Pressure	Tell the client, “Don't let me move you.” Therapist can “sandwich” the forearm between both hands on midforearm, applying pressure into supination (FIG 22.44). Therapist can also grasp around the dorsal aspect of the distal forearm with the fingers and heel of the hand, while turning the arm toward supination (FIG 22.45). Adjust pressure to client's abilities.	 FIG 22.44 Forearm pronation: application of pressure.  FIG 22.45 Forearm pronation: application of pressure—alternate method.

Procedure for Testing Grades Poor (2), Trace (1), and Zero (0)

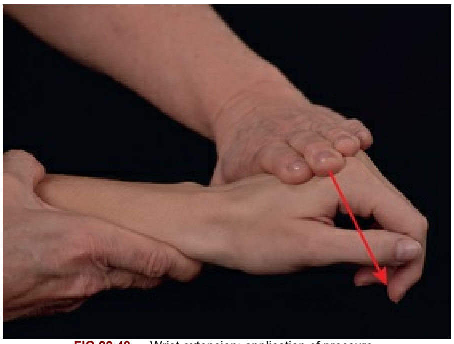
1. Body position	The client is seated with shoulder and elbow flexed to 90 degrees and upper arm resting on table or supported by therapist. Can test with client in side-lying or supine with shoulder in neutral and elbow flexed to 90 degrees, or prone with shoulder in 90 degrees abduction and forearm lying over edge of table in a position perpendicular to the floor.[21] The therapist stands next to client on the side to be tested.	
2. Action	Beginning in midposition, move client's forearm into supination twice while stating, “Move your forearm like I did.” (a) If client performs full ROM, place in midposition and apply slight pressure toward supination. (i) If tolerates pressure = Poor+. (ii) No pressure = Poor. (b) If client performs through partial ROM do not apply pressure = Poor−. (c) If client is unable to perform motion, place forearm in midposition and state, “Try to move your forearm like I did.” Palpate over anterior volar forearm just distal to elbow and the volar distal forearm for muscle contraction (FIG 22.46). (i) If muscle contraction palpable = Trace. (ii) If no contraction palpable = Zero.	

		 FIG 22.46 Forearm pronation: body position, action, and palpation—muscle grades 2 and below.
Specific Muscle Testing: To isolate the pronator quadratus only, the elbow is fully flexed to render the pronator teres actively insufficient.[14] **Substitutions**: With the elbow flexed, internal rotation and abduction of the humerus will produce apparent forearm pronation. With the elbow extended, internal rotation can place the forearm in a pronated position. Brachioradialis can bring the fully supinated forearm to midposition. Wrist flexion, aided by gravity, can effect pronation.[6,7,10,12,13,15,21]		

Wrist Extension (Figs. 22.47 to 22.49)

Muscles[10,12,14]	Innervation[6,12]
Extensor carpi radialis longus	Radial nerve, C6, C7
Extensor carpi radialis brevis	Deep branch of radial nerve, C7, C8
Extensor carpi ulnaris	Posterior interosseous nerve off radial nerve, C7, C8

Procedure for Testing Grades Normal (5), Good (4), and Fair (3)

1. Body position	The client is seated or supine with the forearm resting on the supporting surface in pronation, and the fingers and thumb relaxed. The therapist sits opposite to or next to the client on the side to be tested.[10,14]	
2. Action	While demonstrating movement from neutral to full wrist extension, the therapist says, “Move your wrist like I did” (FIG 22.47). Observe the client actively performing the movement.	 FIG 22.47 Wrist extension: action.
3. Test position	If client performs through available PROM, place the wrist in slight extension and proceed. If not, follow procedure for testing grades Poor, Trace, and Zero.	
4. Stabilize	The therapist stabilizes over the volar or dorsal aspect of the distal forearm.[6,10,14]	
5. Pressure	Tell the client, “Don't let me move you.” Apply pressure dorsally over distal metacarpals in perpendicular fashion toward flexion, adjusting pressure to client's abilities (FIG 22.48). If pressure is maximal = Normal, moderate = Good, minimal = Good−, slight = Fair+, and no pressure = Fair.	 FIG 22.48 Wrist extension: application of pressure.

Procedure for Testing Grades Poor (2), Trace (1), and Zero (0)

1. Body position	Client is seated or supine with forearm resting in midposition on its ulnar border,[10,21] and fingers and thumb relaxed.	
2. Action	Move client's wrist into extension twice while stating, “Move your wrist like I did.” (a) If client performs full ROM, place in slight wrist extension and apply slight pressure toward wrist flexion. (i) If tolerates pressure = Poor+. (ii) No pressure = Poor. (b) If client performs through partial ROM do not apply pressure = Poor−. (c) If client is unable to perform motion, place forearm in midposition and state, “Try to move your wrist like I did.” Palpate over posterior dorsal forearm and dorsal wrist for muscle contraction (FIG 22.49). (i) If muscle contraction palpable = Trace. (ii) If no contraction palpable = Zero.	 FIG 22.49 Wrist extension: body position, action, and palpation—muscle grades 2 and below.

Specific muscle testing: Each wrist extensor muscle can be tested individually by combining wrist extension with radial deviation (extensor carpi radialis longus and brevis) or wrist extension with ulnar deviation (extensor carpi ulnaris). Pressure is performed opposite to the action.

Substitution: The extensor digitorum and extensor pollicis longus can initiate wrist extension, but finger or thumb extension will precede wrist extension.[6,7,12,13,15,21]

Wrist Flexion (Figs. 22.50 to 22.52)

Muscles[10,13]	**Innervation**[5,10,13]
Flexor carpi ulnaris	Ulnar nerve, C7–T1
Palmaris longus	Median nerve, C7–T1
Flexor carpi radialis	Median nerve, C6–8

Procedure for Testing Grades Normal (5), Good (4), and Fair (3)

1. Body position	The client is seated or supine with the forearm resting in nearly full supination on the supporting surface, fingers and thumb relaxed. The therapist is seated opposite or next to the client on the side to be tested.[10,14]	
2. Action	While demonstrating movement from neutral to full wrist flexion, the therapist says, “Move your wrist like I did” (FIG 22.50). Observe the client actively performing the movement.	 FIG 22.50 Wrist flexion: action.
3. Test position	If client performs through available PROM, the therapist places the wrist in slight wrist flexion and proceeds. If not, follow procedure for testing grades Poor, Trace, and Zero.	
4. Stabilize	The therapist stabilizes the forearm,[10,14] therapist's hand under dorsal forearm increases client comfort.	
5. Pressure	Tell the client, “Don't let me move you.” Apply pressure dorsally over distal volar palm toward extension, adjusting pressure to client's abilities (FIG 22.51). If pressure is maximal = Normal, moderate = Good, minimal = Good−, slight = Fair+, and no pressure = Fair.	 FIG 22.51 Wrist flexion: application of pressure.

Procedure for Testing Grades Poor (2), Trace (1), and Zero (0)

1. Body position	Client is seated or supine with forearm resting in midposition on its ulnar border[10,21] and fingers and thumb relaxed.[10] The therapist sits opposite or next to the client on the side being tested.	
2. Action	Move client's wrist into flexion twice while stating, “Move your wrist like I did.”	

	(a) If client performs full ROM, place in slight wrist flexion and apply slight pressure toward wrist flexion. (i) If tolerates pressure = Poor+. (ii) No pressure = Poor. (b) If client performs through partial ROM do not apply pressure = Poor−. (c) If client is unable to perform motion, place forearm in midposition and state, “Try to move your wrist like I did.” Palpate over volar forearm and wrist for muscle contraction (FIG 22.52). (i) If muscle contraction palpable = Trace. (ii) If no contraction palpable = Zero.	 FIG 22.52 Wrist flexion: body position, action, and palpation—muscle grades 2 and below.
Specific muscle testing: Each wrist flexor muscle can be tested individually by combining wrist flexion with radial deviation (flexor carpi radialis) or wrist flexion with ulnar deviation (flexor carpi ulnaris). The palmaris longus is tested by having the client oppose the thumb and small finger while flexing the wrist.[14] Pressure is applied to un-oppose (reposition) the thumb and extend the wrist. **Substitution**: The extrinsic finger flexors can also assist wrist flexion, but the motion will be preceded by flexion of the fingers.[6,15,21]		

Wrist Radial Deviation (Figs. 22.53 to 22.55)

Muscles[10,13]	Innervation[5,10,13]
Flexor carpi radialis	Median nerve, C6–8
Extensor carpi radialis longus	Radial nerve, C6, 7
Extensor carpi radialis brevis	Deep branch of radial nerve, C7, C8

Procedure for Testing Grades Normal (5), Good (4), and Fair (3)

1. Body position	The client is seated or supine with forearm in neutral rotation and wrist in slight extension and neutral deviation. Thumb will be pointing up. The therapist is seated or standing next to the client on the side to be tested.	
2. Action	While demonstrating movement from neutral to full wrist radial deviation, the therapist says, “Move your wrist like I did” (FIG 22.53). Observe the client actively performing the movement.	 FIG 22.53 Wrist radial deviation: action.
3. Test position	If client performs through available PROM, place the wrist in midradial deviation and proceed. If not, follow procedure for testing grades Poor, Trace, and Zero.	
4. Stabilize	The therapist stabilizes the forearm; therapist's hand under dorsal ulnar forearm increases client comfort.	
5. Pressure	Tell the client, “Don't let me move you.” Apply pressure radially over the distal second metacarpal or through the entire hand (not fingers) toward ulnar deviation, adjusting pressure to client's abilities (FIG 22.54). If pressure is maximal = Normal, moderate = Good, minimal = Good−, slight = Fair+, and no pressure = Fair.	 FIG 22.54 Wrist radial deviation: application of pressure.

Procedure for Testing Grades Poor (2), Trace (1), and Zero (0)

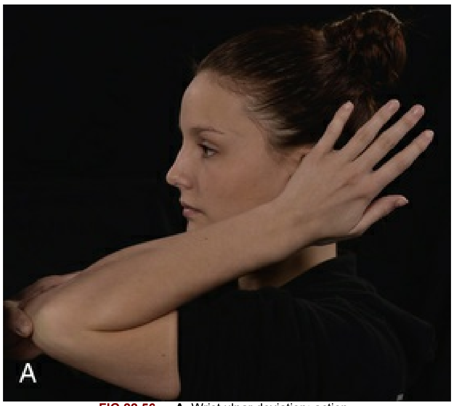
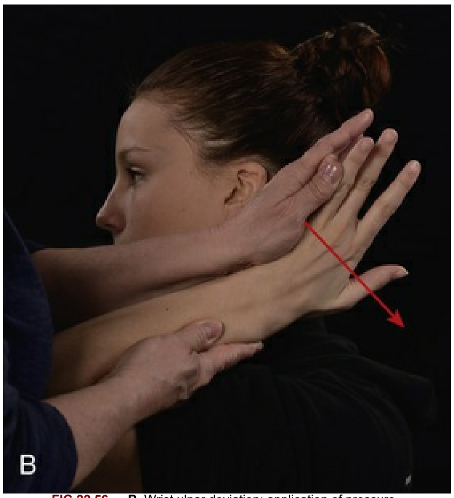
1. Body position	Client is seated or supine with volar surface of forearm resting on table, bed, or supported by therapist. The therapist sits opposite or next to the client on the side being tested.	
2. Action	Move client's wrist into radial deviation twice while stating, “Move your wrist	

	like I did." (a) If client performs full ROM, place in midradial deviation and apply slight pressure through distal second metacarpal or entire hand toward ulnar deviation. (i) If tolerates pressure = Poor+. (ii) No pressure = Poor. (b) If client performs through partial ROM, do not apply pressure = Poor−. (c) If client is unable to perform motion, place forearm in midposition and state, "Try to move your wrist like I did." Palpate over distal radial wrist for muscle contraction (FIG 22.55). (i) If muscle contraction palpable = Trace. (ii) If no contraction palpable = Zero.	 FIG 22.55 Wrist radial deviation: body position, action, and palpation—muscle grades 2 and below.
Substitution: The thumb extrinsic muscles (abductor and extensor pollicis longus) can radially deviate the wrist, but wrist motion will be preceded by thumb movement.		

Wrist Ulnar Deviation (Figs. 22.56A to 22.57)

Muscles[10,12,14]	**Innervation**[6,12]
Extensor carpi ulnaris	Posterior interosseous nerve off radial nerve, C7, C8
Flexor carpi ulnaris	Ulnar nerve, C7–T1

Procedure for Testing Grades Normal (5), Good (4), and Fair (3)

1. Body position	The client is seated or supine with forearm in neutral rotation and wrist in slight extension and neutral deviation. To get the action against gravity, the client's elbow and shoulder must be flexed. The therapist is seated or standing next to the client on the side to be tested.	
2. Action	While demonstrating movement from neutral to full ulnar deviation, the therapist says, "Move your wrist like I did." Observe as the client actively performs the movement (FIG 22.56, A).	 FIG 22.56 **A,** Wrist ulnar deviation: action.
3. Test position	If client performs through available PROM, place the wrist in midulnar deviation and proceed. If not, follow procedure for testing grades Poor, Trace, and Zero.	
4. Stabilize	The therapist stabilizes the distal forearm; therapist's hand under the distal radial forearm.	
5. Pressure	Tell the client, "Don't let me move you." Apply pressure radially over distal fifth metacarpal or through the entire hand (not fingers) toward radial deviation, adjusting pressure to the client's abilities (FIG 22.56, B). If pressure is maximal = Normal, moderate = Good, minimal = Good−, slight = Fair+, and no pressure = Fair.	 FIG 22.56 **B,** Wrist ulnar deviation: application of pressure.

Procedure for Testing Grades Poor (2), Trace (1), and Zero (0)

1. Body position	Client is seated or supine with volar surface of forearm resting on table, bed, or supported by therapist. The therapist sits opposite or next to the client on the side being tested.	
2. Action	Move client's wrist into ulnar deviation twice while stating, “Move your wrist like I did.” (a) If client performs full ROM, place in midulnar deviation and apply slight pressure on ulnar border of hand (not fingers) toward radial deviation. (i) If tolerates pressure = Poor+. (ii) No pressure = Poor. (b) If client performs through partial ROM, do not apply pressure = Poor−. (c) If client is unable to perform motion, place wrist in midposition and move toward ulnar deviation while stating, “Try to move your wrist like I did.” Palpate over the ulnar wrist and distal forearm for muscle contraction (FIG 22.57). (i) If muscle contraction palpable = Trace. (ii) If no contraction palpable = Zero.	 FIG 22.57 Wrist ulnar deviation: body position, action, and palpation—muscle grades 2 and below.

Metacarpophalangeal Flexion (Figs. 22.58 to 22.63)

Muscles[1,4,18,22]	Innervation[10,12,18,22]
Lumbricals 1 and 2 (index and long)	Median nerve, C8, T1
Lumbricals 3 and 4 (ring and small)	Ulnar nerve, C8, T1
Dorsal interossei (index, long, and ring)	Deep branch of ulnar nerve, C8, T1
Palmar interossei (index, ring, and small)	Deep branch of ulnar nerve, C8, T1
Flexor digitorum superficialis	
Flexor digitorum profundus	
Flexor digiti minimi (small)	

Procedure for Testing Grades Normal (5), Good (4), and Fair (3)

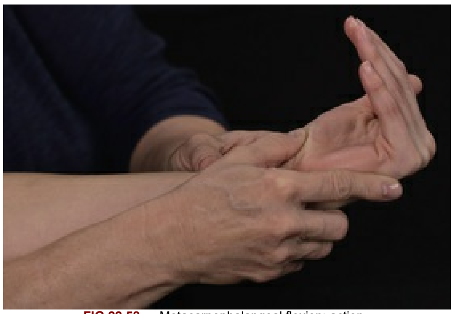
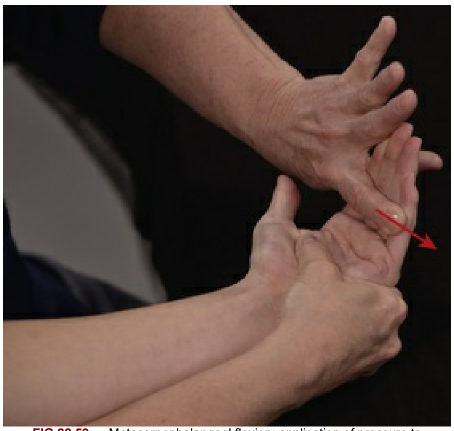
1. Body position	The client is seated or supine with forearm fully supinated and wrist stabilized in neutral resting on a supporting surface.[8] The therapist sits next to the client on the side being tested.	
2. Action	While demonstrating movement from neutral to full metacarpophalangeal (MP) flexion, the therapist says, “Move your finger(s) like I did” (FIG 22.58). Observe the client actively performing the movement.	 FIG 22.58 Metacarpophalangeal flexion: action.
3. Test position	If client performs through available PROM, place the MP joint(s) in midflexion and proceed (see FIG 22.58). If not, follow procedure for testing grades Poor, Trace, and Zero.	
4. Stabilize	The therapist stabilizes the metacarpal of digit being tested. If digits 2–5 are tested simultaneously, metacarpals 2–5 are stabilized.	
5. Pressure	Tell the client, “Don't let me move you.” Apply pressure over the volar proximal phalange(s) toward MP extension, adjusting pressure to client's abilities. If pressure is maximal = Normal, moderate = Good, minimal = Good−, slight = Fair+, and no pressure = Fair. FIG 22.59 depicts simultaneous testing of digits 2–5, with the intrinsic muscles that flex the MP joints targeted (as the interphalangeal [IP] joints are in extension), whereas FIG 22.60 depicts index finger testing only, allowing the extrinsic finger flexors to assist as the PIP joint is flexed.	 FIG 22.59 Metacarpophalangeal flexion: application of pressure to all digits.

FIG 22.60 Metacarpophalangeal flexion: application of pressure to index finger.

Procedure for Testing Grades Poor (2), Trace (1), and Zero (0)

1. Body position	Client's hand is resting on table or bed on the ulnar side of forearm and hand. The therapist is opposite or next to the client on the side being tested.	
2. Action	Move client's MP joint(s) into flexion twice while stating, "Move your finger(s) like I did." Digits can be tested simultaneously or individually depending on the need. (a) If client performs full ROM, place in mid-MP flexion and apply slight pressure toward MP extension. (i) If tolerates pressure = Poor+. (ii) No pressure = Poor. (b) If client performs through partial ROM, do not apply pressure = Poor−. (c) If client is unable to perform motion, place MP joints in midposition and state, "Try to move your finger(s) like I did." Palpate over the volar palm for muscle contraction (FIG 22.61); however, the intrinsics are very deep and contraction may not be palpable.[15,21] The first dorsal interossei is palpable over the distal web space. Contraction of the extrinsic finger flexors is palpable over the volar wrist (FIG 22.62). (i) If muscle contraction palpable = Trace. (ii) If no contraction palpable = Zero.	 FIG 22.61 Metacarpophalangeal flexion: body position, action, and palpation—muscle grades 2 and below. Palpation over volar surface of the palm.  FIG 22.62 Metacarpophalangeal flexion: body position, action, and palpation—muscle grades 2 and below. Alternate palpation method over volar surface of the wrist.

Specific muscle testing: To isolate the intrinsic muscles that flex the MP joints, MP flexion must be performed with the IP joints in full extension as the intrinsics perform IP extension concomitantly with MP flexion. When testing the extrinsic finger flexor muscles, the IP joints are flexed along with the MP joints; however, the extrinsic flexors are best isolated by testing their actions at the proximal interphalangeal (PIP) joints (flexor digitorum superficialis) or distal interphalangeal (DIP) joints (flexor digitorum profundus).[15,21] These tests are described in PIP and DIP sections.

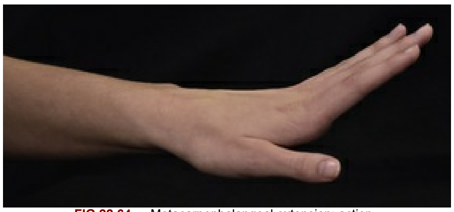
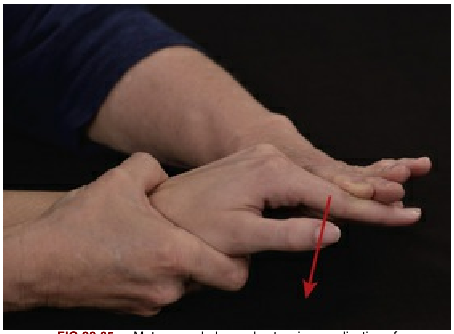
Substitution: The joints of the fingers will move into a flexed position when the wrist is moved into extension; however, the motion is not due to active contraction of any muscles that flex the fingers. Because the extrinsic finger flexors pass volar to the wrist joint, they are of insufficient length to allow the fingers to stay extended when the wrist is actively or passively moved into extension; this is known as tenodesis, as insufficient tendon excursion pulls the fingers into flexion (FIG 22.63). To prevent tenodesis action, the wrist should be stabilized while testing the muscles that flex the fingers so the client cannot actively extend the wrist.

FIG 22.63 Metacarpophalangeal flexion: substitution—tenodesis action.

Metacarpophalangeal Extension (Figs. 22.64 to 22.67)

Muscles[10,13]	Innervation[10,13,18]
Extensor digitorum (ED)	Radial nerve, C7, C8
Extensor indicis	Posterior interosseous nerve, C7, C8
Extensor digiti minimi (EDM)	Posterior interosseous nerve, C7, C8
Lumbricals 1 and 2 (index and long)	Median nerve, C8, T1
Lumbricals 3 and 4 (ring and small)	Ulnar nerve, C8, T1
Dorsal interossei (index, long, and ring)	Deep branch of ulnar nerve, C8, T1
Palmar interossei (index, ring, and small)	Deep branch of ulnar nerve, C8, T1

Procedure for Testing Grades Normal (5), Good (4), and Fair (3)

1. Body position	The client is seated, with the forearm pronated and the wrist in neutral to slight extension, MP and IP joints relaxed in partial flexion.[7,10,12] The therapist sits opposite or next to the client on the side to be tested.	
2. Action	While demonstrating movement from neutral to full MP extension, the therapist says, “Move your finger(s) like I did” (FIG 22.64). Observe the client actively performing the movement.	 FIG 22.64 Metacarpophalangeal extension: action.
3. Test position	If client performs through available PROM, place the MP joint in midextension and proceed. If not, follow procedure for testing grades Poor, Trace, and Zero.	
4. Stabilize	The therapist stabilizes the wrist and metacarpals slightly above the supporting surface.[10,12-14] If testing fingers individually, the metacarpal corresponding to the finger being tested is stabilized.	
5. Pressure	Tell the client, “Don't let me move you.” Provide pressure to each finger individually on the dorsum of the proximal phalanx toward MP flexion (FIG 22.65).[6,10,14] Digits 2–5 can be tested simultaneously. If pressure is maximal = Normal, moderate = Good, minimal = Good−, slight = Fair+, and no pressure = Fair.	 FIG 22.65 Metacarpophalangeal extension: application of pressure.

Procedure for Testing Grades Poor (2), Trace (1), and Zero (0)

1. Body position	Client's hand is resting on table or bed on the ulnar side of forearm and hand.[10,12] The therapist is opposite or next to the client on the side being tested.	
2. Action	Move client's fingers into MP extension twice while stating, “Move your fingers like I did.” Digits can be tested simultaneously or individually depending on the need. (a) If client performs full ROM, place in mid-MP extension and apply slight pressure over distal proximal phalange(s) toward MP flexion. (i) If tolerates pressure = Poor+. (ii) No pressure = Poor. (b) If client performs through partial ROM do not apply pressure = Poor−. (c) If client is unable to perform motion, place MP joint in midposition and state, “Try to move your finger(s) like I did.” Palpate the ED tendons where they course over the dorsum of the hand[6,7,10] (FIGS 22.66 and 22.67). In some	

	individuals, the EDM tendon can be palpated or visualized just lateral to the ED tendon to the fifth finger. The extensor indicis tendon can be palpated or visualized just medial to the ED tendon to the first finger.[6] The intrinsic MP extensors are small and deep, making palpation difficult for anything besides the first dorsal interossei. (i) If muscle contraction palpable = Trace. (ii) If no contraction palpable = Zero.	 FIG 22.66 Metacarpophalangeal extension: body position, action, and palpation—muscle grades 2 and below. Palpation of the individual tendons of the ED.  FIG 22.67 Metacarpophalangeal extension: body position, action, and palpation—muscle grades 2 and below. Simultaneous palpation of all of the tendons of the ED.

Specific muscle testing: To isolate the extrinsic MP extensors, the IP joints should remain in some flexion,[6,12] as the ED becomes actively insufficient if the IP joints are concurrently in IP extension.
Substitutions: With the wrist stabilized, no substitutions are possible. When the wrist is not stabilized, passive insufficiency of the ED can produce MP extension through tenodesis action.[6,7,10,13,15,21]

Proximal Interphalangeal Flexion, Second Through Fifth Fingers (Figs. 22.68 to 22.70)

Muscles[10,14]	Innervation[6,10,12]
Flexor digitorum superficialis (FDS)	Median nerve, C7, C8, T1
Flexor digitorum profundus (FDP)	Median and ulnar nerves, C8, T1

Procedure for Testing Grades Normal (5), Good (4), and Fair (3)

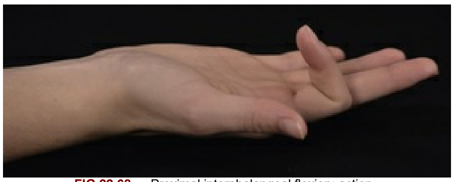
1. Body position	The client is seated, with the forearm supinated, wrist at neutral, fingers extended, and hand and forearm resting on the dorsal surface.[6,10,12] The therapist sits opposite or next to the client on the side being tested.	
2. Action	While demonstrating movement from neutral to full PIP flexion, the therapist says, "Move your finger like I did" (FIG 22.68). Observe the client actively performing the movement.	 FIG 22.68 Proximal interphalangeal flexion: action.
3. Test position	If client performs through available PROM, place the PIP joint in midflexion and proceed. If not, follow procedure for testing grades Poor, Trace, and Zero (0).	
4. Stabilize	The therapist stabilizes the MP joint and proximal phalanx of the finger being tested in extension. [6,7,10,14]	
5. Pressure	Tell the client, "Don't let me move you." Apply pressure over volar middle phalanx toward PIP extension,[6,10,14] adjusting pressure to client's abilities (FIG 22.69). If pressure is maximal = Normal, moderate = Good, minimal = Good−, slight = Fair+, and no pressure = Fair.	

		 FIG 22.69 Proximal interphalangeal flexion: application of pressure.

Procedure for Testing Grades Poor (2), Trace (1), and Zero (0)

1. Body position	The client is seated, with the forearm in neutral rotation and the wrist at neutral, resting on the ulnar border.[12,21] The therapist sits opposite or next to the client on the side to be tested.	
2. Action	Move client's PIP joint into PIP flexion twice while stating, "Move your finger like I did." (a) If client performs full ROM, place in mid-PIP flexion and apply slight pressure toward PIP extension. (i) If tolerates pressure = Poor+. (ii) No pressure = Poor. (iii) If the test for grades Poor and below is done with the forearm in full supination, partial ROM against gravity may be graded Poor.[10] (b) If client performs through partial ROM, do not apply pressure = Poor−. (c) If client is unable to perform motion, place PIP joint in midposition and state, "Try to move your finger like I did." Palpate over the volar proximal phalanx and palm for muscle contraction (FIG 22.70). (i) If muscle contraction palpable = Trace. (ii) If no contraction palpable = Zero.	 FIG 22.70 Proximal interphalangeal flexion: body position, action, and palpation—muscle grades 2 and below. Simultaneous palpation of all of the tendons of the FDS.
Specific muscle testing: It is often important to isolate the flexor digitorum superficialis to ensure that it is intact and functioning. If DIP flexion precedes PIP flexion, the FDP is assisting with PIP flexion.[7,12,13,15,17,21] Stabilizing all of the fingers not being tested in MP and IP extension prevents the FDP from flexing the PIP joint. Many individuals cannot isolate flexion of the small finger PIP joint, even with MP stabilization. To ensure that the FDP is inactive, the therapist may wiggle the DIP joint while applying pressure to the middle phalanx.[4,6,12,15,21] **Substitution**: Active insufficiency of the extrinsic finger flexors can result in apparent finger flexion through partial ROM when the wrist is actively or passively extended due to tenodesis,[10,13,21] so the therapist should ensure this is not the mistaken for active finger flexion.		

Distal Interphalangeal Flexion, Second Through Fifth Fingers (Figs. 22.71 to 22.74)

Muscle[10,13]	**Innervation**[10,13]
Flexor digitorum profundus (FDP)	Median and ulnar nerves, C8, T1

Procedure for Testing Grades Normal (5), Good (4), and Fair (3)

1. Body position	The client is seated, with the forearm supinated, wrist at neutral, and fingers extended.[10] The therapist sits opposite or next to the client on the side being tested.[12]	
2. Action	While demonstrating movement from neutral to full PIP flexion, the therapist says, "Move your finger like I did" (FIG 22.71). Observe the client actively performing the movement.	

		 FIG 22.71 Distal interphalangeal flexion: action.
3. Test position	If client performs through available PROM, place the DIP joint in midflexion and proceed. If not, follow procedure for testing grades Poor, Trace, and Zero.	
4. Stabilize	The therapist stabilizes the PIP joint and middle phalanx in extension on the finger being tested.[6,21]	
5. Pressure	Tell the client, “Don't let me move you.” Apply pressure over volar distal phalanx toward DIP extension,[6,7,10,14] adjusting pressure to client's abilities (FIG 22.72). If pressure is maximal = Normal, moderate = Good, minimal = Good−, slight = Fair+, and no pressure = Fair.	 FIG 22.72 Distal interphalangeal flexion: application of pressure.

Procedure for Testing Grades Poor (2), Trace (1), and Zero (0)

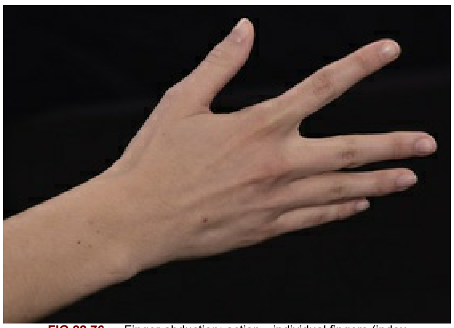
1. Body position	The client is seated, with the forearm in midposition and the wrist at neutral, resting on the ulnar border.[12,21] The therapist sits opposite or next to the client on the side to be tested.	
2. Action	Move client's DIP joint into flexion twice while stating, “Move your finger like I did.” (a) If client performs full ROM, place in mid-DIP flexion and apply slight pressure toward PIP extension. (i) If tolerates pressure = Poor+. (ii) No pressure = Poor. (iii) If the test for grades Poor and below is done with the forearm in full supination, partial ROM against gravity may be graded Poor.[10] (b) If client performs through partial ROM, do not apply pressure = Poor−. (c) If client is unable to perform motion, place DIP joint in midposition and state, “Try to move your finger like I did.” Palpate over the volar proximal surface of the middle phalanx[6,10,15] (FIG 22.73) and palm for muscle contraction (FIG 22.74). (i) If muscle contraction palpable = Trace. (ii) If no contraction palpable = Zero.	 FIG 22.73 Distal interphalangeal flexion: body position, action, and palpation—muscle grades 2 and below. Palpation of the FDP tendon of the index finger.

		 FIG 22.74 Distal interphalangeal flexion: body position, action, and palpation—muscle grades 2 and below. Palpation of the FDP tendons.
Substitutions: None possible during the testing procedure if the wrist is well stabilized because the FDP is the only muscle that can flex the DIP joint when it is isolated. During normal hand function, however, wrist extension with tendon action of the finger flexors can produce partial flexion of the DIP joints.[10,15,21]		

Finger Abduction (Figs. 22.75 to 22.77)

Muscles[10,12]	Innervation[10,12]
Dorsal interossei of the second, third, and fourth fingers	Ulnar nerve, C8, T1
Abductor digiti minimi (fifth finger)	Deep branch of ulnar nerve, C8, T1

Procedure for Testing Grades Normal (5), Good (4), and Fair (3)

1. Body position	The client is seated or supine with forearm pronated (neutral position can be used for index and long radial abductors), wrist in neutral, and fingers extended and adducted. The therapist is seated opposite or next to the client on the side to be tested.[10,13]	
2. Action	While demonstrating movement from neutral to full finger abduction, the therapist says, "Move your fingers like I did." Observe client actively perform the movement of spreading the fingers apart (FIGS 22.75 and 22.76).	 FIG 22.75 Finger abduction: action—all fingers.  FIG 22.76 Finger abduction: action—individual fingers (index finger).
3. Test position	If client performs through available PROM, place the finger in midabduction and proceed. If not, follow procedure for testing grades Poor, Trace, and Zero.	
4. Stabilize	The therapist stabilizes the wrist and metacarpals on the supporting surface.	
5. Pressure	Tell the client, "Don't let me move you." Apply pressure over lateral proximal phalanx (index and long fingers) and medial proximal phalanx (long, ring, and	

	small fingers)[6,14] toward adduction, adjusting pressure to client's abilities (FIG 22.77). An alternative mode of resistance is to flick each finger toward adduction. If the finger rebounds, the grade is N (5).[12] Note that the long finger is the axis for the hand so it abducts both radially and ulnarly. If pressure is maximal = Normal, moderate = Good, minimal = Good−, slight = Fair+, and no pressure = Fair. If not tested against gravity, use professional judgment when grading. For example, partial ROM in the gravity-minimized position may be graded Poor and full ROM graded Fair.[10,13]	 FIG 22.77 Finger abduction: application of pressure.

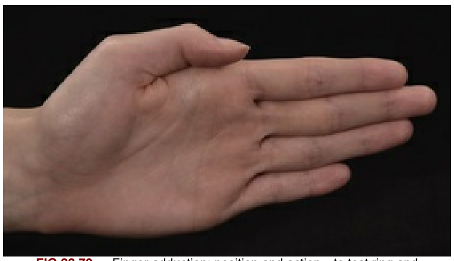
Procedure for Testing Grades Poor (2), Trace (1), and Zero (0)

1. Body position	The client is seated or supine with forearm pronated, wrist in neutral, and fingers extended and adducted. The therapist is seated opposite or next to the client on the side to be tested.[10,13]
2. Action	Move client's finger into abduction twice while stating, "Move your finger like I did." (a) If client performs full ROM, place in mid-MP abduction and apply slight pressure toward adduction. (i) If tolerates pressure = Poor+. (ii) No pressure = Poor. (b) If client performs through partial ROM, do not apply pressure = Poor−. (c) If client is unable to perform motion, place MP joint in midabduction and state, "Try to move your finger like I did." Palpate over lateral metacarpal for index and long fingers, and medial metacarpal for muscle contraction. Because the muscles for long and ring fingers are very small and deep, contraction may not be palpable. (i) If muscle contraction palpable = Trace. (ii) If no contraction palpable = Zero.
Substitutions: Extensor digitorum can assist weak or absent finger abduction, but abduction will be accompanied by MP extension.[6,15,21]	

Finger Adduction (Figs. 22.78 to 22.81)

Muscles[10-14]	**Innervation**[10,13]
Palmar interossei, second, fourth, and fifth fingers	Ulnar nerve, C8, T1

Procedure for Testing Grades Normal (5), Good (4), and Fair (3)

1. Body position	The client is seated or supine. Forearm is pronated (shoulder in 90 degrees abduction) to test index finger (FIG 22.78), and forearm is in midposition to test ring and small fingers (FIG 22.79). Wrist is in neutral position and fingers extended and abducted.[10,13] The therapist is seated opposite or next to the client on the side to be tested.	 FIG 22.78 Finger adduction: position and action—to test the index finger.  FIG 22.79 Finger adduction: position and action—to test ring and little finger.
2. Action	While demonstrating movement from neutral to full finger adduction, the therapist says, "Move your finger like I did." Observe the client adducting the index, ring, and small fingers toward the middle finger (see FIGS 22.78 and 22.79).	
3. Test position	If client performs through available PROM, place the finger in adduction and proceed. If not, follow procedure for testing grades Poor, Trace, and Zero.	
4. Stabilize	The therapist stabilizes the wrist and metacarpals.[6]	
5. Pressure	Tell the client, "Don't let me move you." Apply pressure over medial proximal phalanx (index finger) (FIG 22.80) and lateral proximal phalanx (ring and small fingers) (FIG 22.81) toward abduction, adjusting pressure to client's abilities.[6,14] These muscles are very small, and resistance must be modified to accommodate their comparatively limited power. Fingers can be grasped at the distal phalanx and flicked in the direction of abduction. If the finger snaps back to the adducted position, the grade is Normal.[12] If pressure is maximal = Normal, moderate = Good, minimal = Good−, slight = Fair+, and no pressure = Fair. If not tested	

against gravity, use professional judgment when grading. The therapist's judgment must be used in determining the degree of weakness. Achievement of full ROM may be graded Fair and partial ROM graded Poor.[10,12]

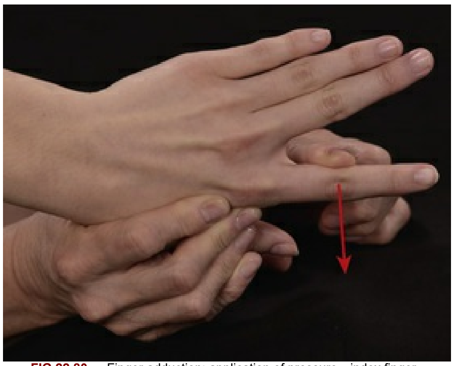


FIG 22.80 Finger adduction: application of pressure—index finger.

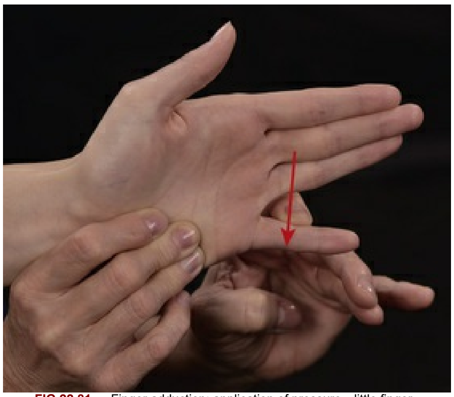


FIG 22.81 Finger adduction: application of pressure—little finger.

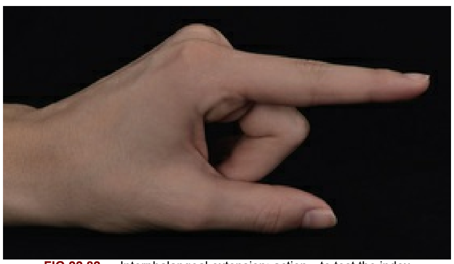
Procedure for Testing Grades Poor (2), Trace (1), and Zero (0)

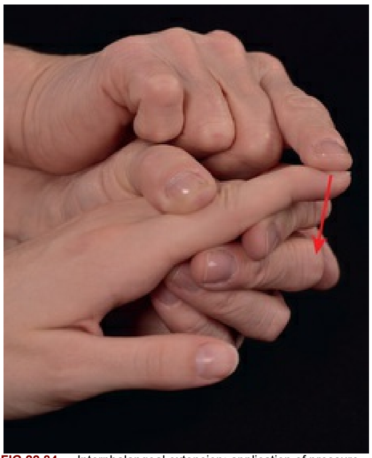
1. Body position	The client is seated or supine with forearm pronated, wrist in neutral, and fingers extended and abducted. The therapist is seated opposite or next to the client on the side to be tested.[10,13]
2. Action	Move client's finger into adduction twice while stating, "Move your finger like I did." (a) If client performs full ROM, place in adduction and apply slight pressure toward abduction. (i) If tolerates pressure = Poor+. (ii) No pressure = Poor. (b) If client performs through partial ROM, do not apply pressure = Poor−. (c) If client is unable to perform motion, place MP joint in midabduction and state, "Try to move your finger like I did." Because these muscles are very small and deep, contraction is not usually palpable.[6] (i) If muscle contraction palpable = Trace. (ii) If no contraction palpable = Zero.
Substitutions: Flexor digitorum profundus and superficialis can substitute for weak adductors, but IP flexion will occur with finger adduction.[13,15,21]	

Interphalangeal Extension (Figs. 22.82 to 22.85)

Muscles[10,13]	**Innervation**[10,13,18]
Lumbricals 1 and 2 (index and long)	Median nerve, C8, T1
Lumbricals 3 and 4 (ring and small)	Ulnar nerve, C8, T1
Dorsal interossei (index, long, and ring)	Deep branch of ulnar nerve, C8, T1
Palmar interossei (index, ring, and small)	Deep branch of ulnar nerve, C8, T1

Procedure for Testing Grades Normal (5), Good (4), and Fair (3)

1. Body position	The client is seated or supine with forearm supinated and wrist in midextension and neutral deviation. The therapist is seated or standing next to the client on the side to be tested.	
2. Action	While demonstrating movement from neutral to full PIP and DIP extension, the therapist says, "Move your finger like I did." Observe the client actively straightening both IP joints (FIG 22.82).	 FIG 22.82 Interphalangeal extension: action—to test the index

		finger.
3. Test position	If client performs through available PROM, place the IP joints in midextension and proceed. If not, follow procedure for testing grades Poor, Trace, and Zero.	
4. Stabilize	The therapist stabilizes the proximal phalanx.	
5. Pressure	Tell the client, “Don't let me move you.” Apply pressure over the dorsal middle (FIG 22.83) and distal phalanx (FIG 22.84) toward flexion, adjusting pressure to client's abilities. If pressure is maximal = Normal, moderate = Good, minimal = Good−, slight = Fair+, and no pressure = Fair.	 FIG 22.83 Interphalangeal extension: application of pressure—middle phalanx.  FIG 22.84 Interphalangeal extension: application of pressure—distal phalanx.

Procedure for Testing Grades Poor (2), Trace (1), and Zero (0)

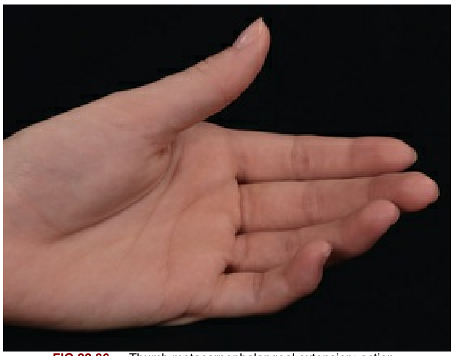
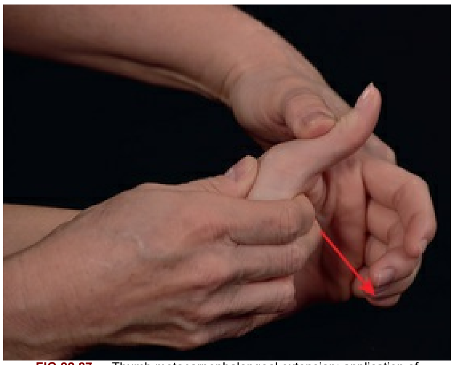
1. Body position	The client is seated or supine with forearm in midforearm rotation and wrist in midextension and neutral deviation. The therapist is seated or standing next to the client on the side to be tested (FIG 22.85).	 FIG 22.85 Interphalangeal extension: body position, action, and palpation—muscle grades 2 and below.
2. Action	Move client's PIP and DIP joints into extension twice while stating, “Move your finger like I did.” (a) If client performs full ROM, place in midextension and apply slight pressure toward flexion. (i) If tolerates pressure = Poor+. (ii) No pressure = Poor. (b) If client performs through partial ROM do not apply pressure = Poor−. (c) If client is unable to perform motion, place extension in midposition and state, “Try to move your	

	finger like I did." Because the intrinsic hand muscles that perform IP extension are very small and deep, it may be difficult to palpate for muscle contraction. (i) If muscle contraction palpable = Trace. (ii) If no contraction palpable = Zero.	
Substitution: Because the extensor digitorum inserts into the dorsal hood, if the wrist and MP joints are positioned in flexion (to prevent the ED from becoming actively insufficient), the ED can extend the IP joints. Passive tension in the ED can also result in finger extension at the MP and IP joints via tenodesis action. Positioning the wrist in extension when testing IP extension prevents this substitution from occurring.		

Thumb Metacarpophalangeal Extension (Figs. 22.86 to 22.88)

Muscles[10,12-14]	**Innervation**[10,12-14]
Extensor pollicis brevis (EPB)	Radial nerve, C7, C8
Extensor pollicis longus (EPL)	Radial nerve, C7, C8

Procedure for Testing Grades Normal (5), Good (4), and Fair (3)

1. Body position	The client is seated or supine with forearm in midposition, wrist in neutral, and hand and forearm resting on the ulnar border.[6,10,13] Because thumb extension occurs in the sagittal plane (plane parallel to the hand), the thumbnail should face the ceiling to test against gravity. The therapist is seated or standing next to the client on the side to be tested. The thumb is flexed into the palm at the MP joint, and the IP joint is extended but relaxed.	
2. Action	While demonstrating movement from neutral to full extension, the therapist says, "Move your thumb like I did." Observe the client actively extending the thumb MP joint (FIG 22.86). It is difficult for many people to extend the MP joint without extending the IP joint simultaneously.	 FIG 22.86 Thumb metacarpophalangeal extension: action.
3. Test position	If client performs through available PROM, place the thumb in midextension and proceed. If not, follow procedure for testing grades Poor, Trace, and Zero.	
4. Stabilize	The therapist stabilizes the first metacarpal and wrist in neutral.[6]	
5. Pressure	Tell the client, "Don't let me move you." Apply pressure over the dorsal surface of the proximal phalanx toward MP flexion,[6,10,12-14] adjusting pressure to client's abilities (FIG 22.87). If pressure is maximal = Normal, moderate = Good, minimal = Good−, slight = Fair+, and no pressure = Fair.	 FIG 22.87 Thumb metacarpophalangeal extension: application of pressure.

Procedure for Testing Grades Poor (2), Trace (1), and Zero (0)

1. Body position	Forearm is fully pronated and resting on the volar surface,[21] or forearm is supinated to about 70 degrees resting on dorsal surface. The therapist sits opposite or next to the client on the side being tested, except that the therapist may stabilize the first metacarpal, holding the hand slightly above the supporting surface. The test may also be performed in the same manner as for grades Normal to Fair, with modified grading.[10]	
2. Action	Move client's thumb MP into extension twice while stating, "Move your thumb like I did." (a) If client performs full ROM, place in mid-MP extension and apply slight pressure toward MP flexion. (i) If tolerates pressure = Poor+. (ii) No pressure = Poor. (iii) If midposition of the forearm was used, partial ROM is graded Poor and full ROM is graded Fair.[10,12] (b) If client performs through partial ROM do not apply pressure = Poor−. (c) If client is unable to perform motion, place MP in midposition and state, "Try to move your thumb like I did." Palpate the extensor pollicis brevis tendon on the dorsoradial aspect of the base of the first metacarpal (FIG 22.88). It lies just medial to the abductor pollicis longus tendon on the radial side of the anatomical snuffbox, which is the hollow space created between the EPL and EPB tendons when the thumb is fully extended and radially abducted.[4,6,7] (i) If muscle contraction palpable = Trace. (ii) If no contraction palpable = Zero.	

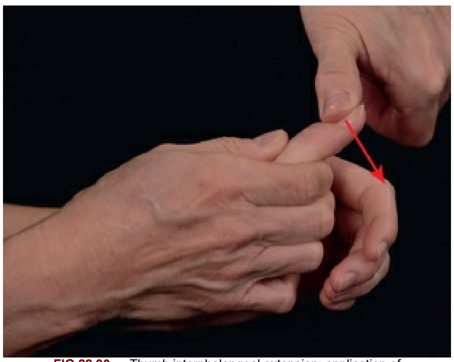
			 FIG 22.88 Thumb metacarpophalangeal extension: body position, action, and palpation—muscle grades 2 and below.

Specific muscle testing: To isolate the extensor pollicis brevis, the thumb IP joint should be flexed or relaxed to prevent extensor pollicis longus from acting.[6,7,13,15,21] It is difficult for many individuals to isolate this motion.

Thumb Interphalangeal Extension (Figs. 22.89 to 22.92)

Muscles[10,12-14]	**Innervation**[10,12-14]
Extensor pollicis longus (EPL)	Radial nerve, C7, C8

Procedure for Testing Grades Normal (5), Good (4), and Fair (3)

1. Body position	The client is seated or supine, forearm in midposition, wrist at neutral, and hand and forearm resting on the ulnar border.[6,10,13] The thumb is adducted, the MP joint is extended or slightly flexed, and the IP is flexed.[6] The therapist sits opposite or next to the client on the side being tested. Because IP extension occurs in a plane parallel to the palm, the thumbnail should be facing the side.	
2. Action	While demonstrating movement from neutral to full IP extension, the therapist says, "Move your thumb like I did" (FIG 22.89). Observe the client actively performing the movement.	 FIG 22.89 Thumb interphalangeal extension: action.
3. Test position	If client performs through available PROM, place the thumb in midextension and proceed. If not, follow procedure for testing grades Poor, Trace, and Zero.	
4. Stabilize	The therapist stabilizes the wrist in neutral position, the first metacarpal, and the proximal phalanx of the thumb.[6]	
5. Pressure	Tell the client, "Don't let me move you." Apply pressure over dorsal distal phalanx toward flexion,[6,10,14] adjusting pressure to client's abilities (FIG 22.90). If pressure is maximal = Normal, moderate = Good, minimal = Good−, slight = Fair+, and no pressure = Fair.	 FIG 22.90 Thumb interphalangeal extension: application of pressure.

Procedure for Testing Grades Poor (2), Trace (1), and Zero (0)

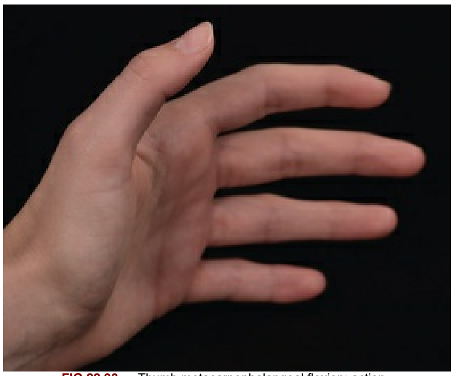
1. Body position	Forearm is fully pronated and resting on the volar surface,[21] or forearm is supinated to about 70 degrees resting on dorsal surface. The therapist may stabilize so that the client's hand is held slightly above the supporting surface. The thumb is adducted and IP joint is flexed. The therapist sits opposite or next to the client on the side being tested.	
2. Action	Move client's thumb IP into extension twice while stating, “Move your thumb like I did.” (a) If client performs full ROM, place in extension and apply slight pressure toward flexion. (i) If tolerates pressure = Poor+. (ii) No pressure = Poor. (iii) If tested against gravity, partial ROM is graded Poor.[10] (b) If client performs through partial ROM do not apply pressure = Poor−. (c) If client is unable to perform motion, place IP joint in midposition and state, “Try to move your thumb like I did.” Palpate the EPL tendon on the dorsal surface of the hand medial to the EPB tendon, between the head of the first metacarpal and the base of the second on the ulnar side of the anatomical snuffbox[4,6,10] (FIG 22.91). The EPL tendon may also be palpated over the dorsal proximal phalanx (FIG 22.92). (i) If muscle contraction palpable = Trace. (ii) If no contraction palpable = Zero.	 **FIG 22.91** Thumb interphalangeal extension: body position, action, and palpation of the EPL—muscle grades 2 and below.  **FIG 22.92** Thumb interphalangeal extension: body position, action and alternate palpation of the EPL—muscle grades 2 and below.
Substitution: A quick contraction of the flexor pollicis longus followed by rapid release will cause the IP joint to rebound into extension.[6] IP flexion will precede IP extension.[7,15] The abductor pollicis brevis, the flexor pollicis brevis, the oblique fibers of the adductor pollicis, and the first palmar interosseous can extend the IP joint because of their insertions into the extensor expansion of the thumb.[14,20] Stabilization of the wrist in slight extension prevents thumb extension occurring from passive tension in the EPL with wrist flexion.		

Thumb Metacarpophalangeal Flexion (Figs. 22.93 to 22.95)

Muscles[10,12-14]	**Innervation**[10,12-14]
Flexor pollicis brevis (FPB)	Median, C8, T1
Flexor pollicis longus (FPL)	Median nerve, C8, T1

Procedure for Testing Grades Normal (5), Good (4), and Fair (3)

1. Body position	The client is seated or supine. Thumb flexion occurs in the sagittal plane (the plane parallel to the hand), so to perform this movement against gravity the client's shoulder is internally rotated and flexed to approximately 90 degrees (upper extremity must be parallel to the floor). The forearm will be fully pronated with the thumbnail facing the floor. The therapist is seated next to or opposite the client.[7,10,14]	
2. Action	While demonstrating movement from neutral to full MP flexion, the therapist says, “Move your thumb like I did.” Observe the client actively performing the movement (FIG 22.93).	

		 FIG 22.93 Thumb metacarpophalangeal flexion: action.
3. Test position	If client performs through available PROM, place the finger in midflexion and proceed. If not, follow procedure for testing grades Poor, Trace, and Zero.	
4. Stabilize	The therapist stabilizes the wrist and first metacarpal.[12]	
5. Pressure	Tell the client, "Don't let me move you." Apply pressure over the volar surface of the proximal phalanx toward MP extension, adjusting pressure to client's abilities[6,7,10,14] (FIG 22.94). If pressure is maximal = Normal, moderate = Good, minimal = Good−, slight = Fair+, and no pressure = Fair.	 FIG 22.94 Thumb metacarpophalangeal flexion: application of pressure.

Procedure for Testing Grades Poor (2), Trace (1), and Zero (0)

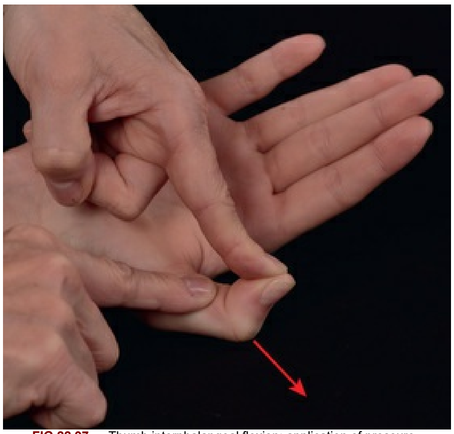
1. Body position	Client is seated with supinated forearm resting on table or in therapist's hand. The therapist sits opposite or next to the client on the side being tested.	
2. Action	Move client's MP into flexion twice while stating, "Move your thumb like I did." (a) If client performs full ROM, place in midflexion and apply slight pressure toward extension. (i) If tolerates pressure = Poor+. (ii) No pressure = Poor. (b) If client performs through partial ROM do not apply pressure = Poor−. (c) If client is unable to perform motion, place MP in midposition and state, "Try to move your thumb like I did." Palpate the client over the middle of the palmar surface of the thenar eminence just medial to the abductor pollicis brevis muscle[6,10] (FIG 22.95). (i) If muscle contraction palpable = Trace. (ii) If no contraction palpable = Zero.	 FIG 22.95 Thumb metacarpophalangeal flexion: body position, action, and palpation—muscle grades 2 and below.
Specific muscle testing: To test the integrity of the flexor pollicis brevis, ensure that the IP joint remains extended during MP flexion.[6,7,12,13,15,21] It may not be possible for some individuals to isolate flexion to the MP joint. **Substitution**: Quick extension of the thumb is followed by a "rebound" to a flexed position if the first metacarpal and wrist are not stabilized.		

Thumb Interphalangeal Flexion (Figs. 22.96 to 22.98)

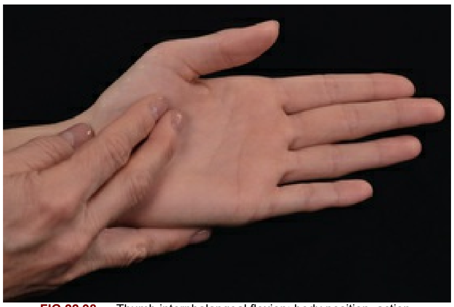
Muscles[6,10,12]	**Innervation**[10,13]
Flexor pollicis longus (FPL)	Median nerve, C8, T1

Procedure for Testing Grades Normal (5), Good (4), and Fair (3)

1. Body position	The client is seated or supine. Thumb flexion occurs in the sagittal plane (the plane parallel to the hand), so to perform this movement against gravity the client's shoulder is internally rotated and flexed to approximately 90 degrees (upper extremity must be parallel to the floor). The forearm will be fully pronated with the thumbnail facing the floor. The therapist is seated next to or opposite the client.[7,10,14]	
2. Action	While demonstrating movement from neutral to full IP flexion, the therapist says, "Move your thumb like I did" (FIG 22.96). Observe the client actively performing the movement.	

		 FIG 22.96 Thumb interphalangeal flexion: action.
3. Test position	If client performs through available PROM, place the thumb in midflexion and proceed. If not, follow procedure for testing grades Poor, Trace, and Zero.	
4. Stabilize	The therapist stabilizes the wrist and first metacarpal.[12]	
5. Pressure	Tell the client, “Don't let me move you.” Apply pressure over the volar surface of the distal phalanx toward MP extension adjusting pressure to client's abilities[6,10,12-14] (FIG 22.97). If pressure is maximal = Normal, moderate = Good, minimal = Good−, slight = Fair+, and no pressure = Fair.	 FIG 22.97 Thumb interphalangeal flexion: application of pressure.

Procedure for Testing Grades Poor (2), Trace (1), and Zero (0)

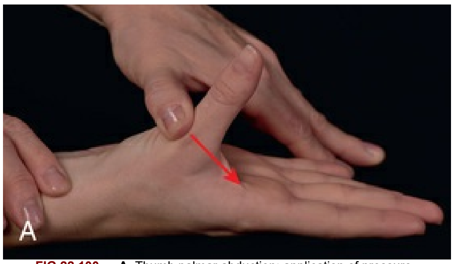
1. Body position	Forearm is fully pronated and resting on the volar surface,[21] or forearm is supinated to about 70 degrees resting on dorsal surface. The IP joint is flexed. The therapist sits opposite or next to the client on the side being tested.	
2. Action	Move client's thumb IP into extension twice while stating, “Move your thumb like I did.” (a) If client performs full ROM, place in extension and apply slight pressure toward flexion. (i) If tolerates pressure = Poor+. (ii) No pressure = Poor. (b) If client performs through partial ROM, do not apply pressure = Poor−. (c) If client is unable to perform motion, place IP in midposition and state, “Try to move your thumb like I did.” Palpate over the volar surface of the palmar surface of the proximal phalanx[6] (FIG 22.98). (i) If muscle contraction palpable = Trace. (ii) If no contraction palpable = Zero.	 FIG 22.98 Thumb interphalangeal flexion: body position, action, and palpation—muscle grades 2 and below.
Substitution: Quick extension of the thumb is followed by a “rebound” of the thumb IP joint into a flexed position if the proximal phalanx and metacarpal are not stabilized. The therapist should observe for IP extension preceding IP flexion.[6,7,12,13,15,21]		

Thumb Palmar Abduction (Also Referred to as Abduction of the Carpal-Metacarpal Joint) (Figs. 22.99 to 22.100B)

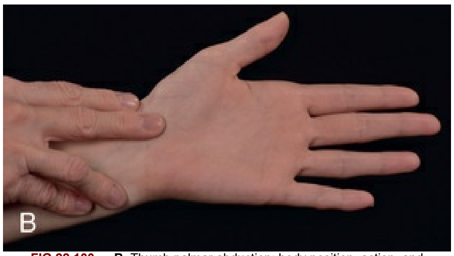
Muscles[13,14]	**Innervation**[13,14]
Abductor pollicis brevis (APB)	Median nerve, C8, T1
Abductor pollicis longus (APL)	Posterior interosseous nerve, C7, C8 continuation of deep branch of radial nerve

Procedure for Testing Grades Normal (5), Good (4), and Fair (3)

1. Body position	The client is seated or supine, forearm in supination, wrist at neutral, and thumb relaxed in adduction against the volar aspect of the index finger. The therapist	

	sits opposite or next to the client on the side to be tested.[6,7,10,12-14]	
2. Action	Thumb abduction, also known as palmar abduction, is movement of the first metacarpal in a plane perpendicular to the palm.[6,14] While demonstrating movement from neutral to full abduction, the therapist says, “Move your thumb like I did” (FIG 22.99). Observe the client actively performing the movement and note that movement is occurring at the carpal-metacarpal joint.	 FIG 22.99 Thumb palmar abduction: action.
3. Test position	If client performs through available PROM, place the thumb in abduction and proceed. If not, follow procedure for testing grades Poor, Trace, and Zero.	
4. Stabilize	The therapist stabilizes the wrist (and hand if needed).	
5. Pressure	Tell the client, “Don't let me move you.” Apply pressure distal first metacarpal toward adduction (the palm),[6,14] adjusting pressure to client's abilities (FIG 22.100, A). If pressure is maximal = Normal, moderate = Good, minimal = Good−, slight = Fair+, and no pressure = Fair.	 FIG 22.100 **A,** Thumb palmar abduction: application of pressure.

Procedure for Testing Grades Poor (2), Trace (1), and Zero (0)

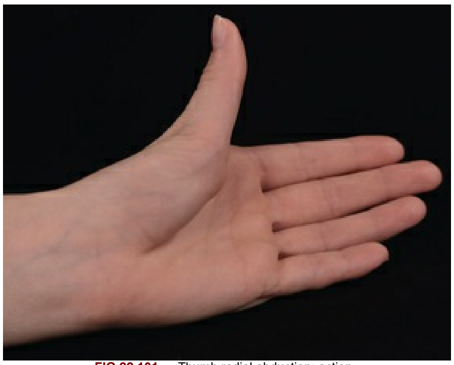
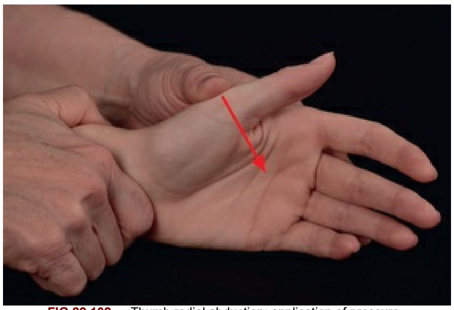
1. Body position	Client is seated with the forearm and wrist in neutral, ulnar border of forearm and hand resting on table.[12,21] The therapist sits opposite or next to the client on the side being tested.	
2. Action	Move client's thumb into abduction twice while stating, “Move your thumb like I did.” (a) If client performs full ROM, place in abduction and apply slight pressure toward adduction. (i) If tolerates pressure = Poor+. (ii) No pressure = Poor. (b) If client performs through partial ROM, do not apply pressure = Poor−. (c) If client is unable to perform motion, place in abduction and state, “Try to move your thumb like I did.” Palpate over volar radial wrist (Figure 22.100, B) and superior surface of the thenar eminence for muscle contraction. (i) If muscle contraction palpable = Trace. (ii) If no contraction palpable = Zero.	 FIG 22.100 **B,** Thumb palmar abduction: body position, action, and palpation—muscle grades 2 and below.
Specific muscle testing: It is very difficult to test the abductor pollicis brevis and longus independently.		

Thumb Radial Abduction (Also Referred to as Extension of the Carpal-Metacarpal Joint) (Figs. 22.101 to 22.103)

Muscles[12,14]	Innervation[12,14]
Extensor pollicis brevis (EPB)	Radial nerve, C7, C8
Extensor pollicis longus (EPL)	Radial nerve, C7, C8
Abductor pollicis longus (APL)	Radial nerve, C6–8

Procedure for Testing Grades Normal (5), Good (4), and Fair (3)

1. Body position	The client is seated or supine, forearm in neutral rotation, wrist at neutral, thumb adducted and slightly flexed across the palm. Hand and forearm are resting on the ulnar border.[14] The therapist sits opposite or next to the client on the side being tested.	
2. Action	While demonstrating movement from neutral to full carpal-metacarpal extension, the therapist says, “Move your thumb like I did.” Observe the client performing the movement. The thumb should extend at the carpal-metacarpal joint as well as the MP and IP joints (FIG 22.101).	

		 FIG 22.101 Thumb radial abduction: action.
3. Test position	If client performs through available PROM, place the finger in midabduction and proceed. If not, follow procedure for testing grades Poor, Trace, and Zero.	
4. Stabilize	The therapist stabilizes the wrist and metacarpals of the fingers.[10,14]	
5. Pressure	Tell the client, "Don't let me move you." Apply pressure over distal, lateral surface of the first metacarpal toward flexion, adjusting pressure to client's abilities (FIG 22.102). If pressure is maximal = Normal, moderate = Good, minimal = Good−, slight = Fair+, and no pressure = Fair.	 FIG 22.102 Thumb radial abduction: application of pressure.

Procedure for Testing Grades Poor (2), Trace (1), and Zero (0)

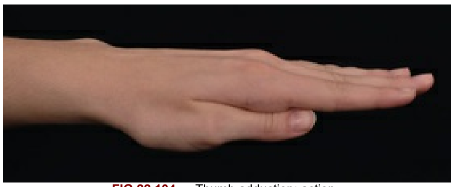
1. Body position	Client is seated with forearm in supination; dorsal surface of forearm resting on table.[10] The therapist sits opposite or next to the client on the side being tested.	
2. Action	Move client's first carpal-metacarpal (CMC) joint into extension twice while stating, "Move your thumb like I did." (a) If client performs full ROM, place in extension and apply slight pressure toward flexion. (i) If tolerates pressure = Poor+. (ii) No pressure = Poor. (b) If client performs through partial ROM do not apply pressure = Poor−. (c) If client is unable to perform motion, place CMC in extension and state, "Try to move your thumb like I did." Palpate over dorsal lateral wrist for tension in the EPB, EPL, or APL (FIG 22.103). (i) If muscle contraction palpable = Trace. (ii) If no contraction palpable = Zero.	 FIG 22.103 Thumb radial abduction: body position, action, and palpation—muscle grades 2 and below.
Specific muscle testing: Action in the EPB, EPL, and APL can be isolated by palpation and often visualization of the tendons in the lateral wrist. **Substitution**: Stabilization of the wrist prevents radial deviation from CMC extension.		

Thumb Adduction (Figs. 22.104 to 22.106)

Muscles[10,12-14]	Innervation[10,12-14]
Adductor pollicis (AP)	Ulnar nerve, C8, T1

Procedure for Testing Grades Normal (5), Good (4), and Fair (3)

1. Body	The client is seated or supine, forearm pronated, wrist at neutral, and thumb	

position	relaxed and in palmar abduction.[10,13,21] The therapist is sitting opposite or next to the client on the side to be tested.	
2. Action	While demonstrating movement from neutral to full adduction, the therapist says, “Move your thumb like I did” (FIG 22.104). Observe the client adducting the thumb into the palm.[10,12]	 FIG 22.104 Thumb adduction: action.
3. Test position	If client performs through available PROM, place the finger in midadduction and proceed. Space must be allowed between the first and second metacarpals for the therapist's finger. If not, follow procedure for testing grades Poor, Trace, and Zero.	
4. Stabilize	The therapist stabilizes the wrist and metacarpals by grasping the hand around the ulnar side and supporting it slightly above the resting surface.[10,13]	
5. Pressure	Tell the client, “Don't let me move you.” Apply pressure downward toward palmar abduction by placing finger between first and second metacarpals or grasping the first metacarpal head[10] (FIG 22.105). Adjust pressure to client's abilities. If pressure is maximal = Normal, moderate = Good, minimal = Good−, slight = Fair+, and no pressure = Fair.	 FIG 22.105 Thumb adduction: application of pressure.

Procedure for Testing Grades Poor (2), Trace (1), and Zero (0)

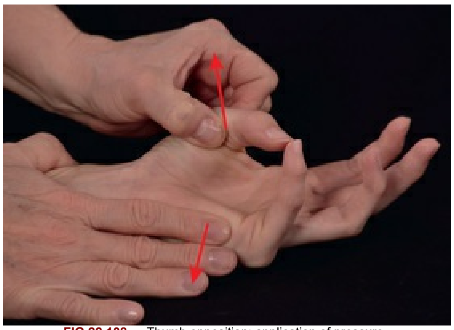
1. Body position	Client is seated with the forearm and wrist in neutral, ulnar border of forearm and hand resting on table.[21] The therapist sits opposite or next to the client on the side being tested.	
2. Action	Move client's wrist into adduction twice while stating, “Move your thumb like I did.” (a) If client performs full ROM, place in adduction and apply slight pressure toward abduction. (i) If tolerates pressure = Poor+. (ii) No pressure = Poor. (b) If client performs through partial ROM do not apply pressure = Poor−. (c) If client is unable to perform motion, place first CMC in midposition and state, “Try to move your thumb like I did.” Palpate the AP on the palmar side of the thumb web space[6,15] (FIG 22.106). (i) If muscle contraction palpable = Trace. (ii) If no contraction palpable = Zero.	 FIG 22.106 Thumb adduction: body position, action, and palpation—muscle grades 2 and below.
Substitution: The FPL or EPL may substitute; however, adduction will be preceded by thumb flexion or extension.[13,15,21]		

Opposition of the Thumb to the Fifth Finger (Figs. 22.107 to 22.109)

Muscles[10,13]	**Innervation**[10,13]
Opponens pollicis	Median nerve, C8, T1
Opponens digiti minimi	Ulnar nerve, C8, T1

Procedure for Testing Grades Normal (5), Good (4), and Fair (3)

1. Body position	The client is seated or supine, with forearm supinated, wrist at neutral, thumb in palmar abduction, and fifth finger extended.[6,7,10,14] The therapist sits opposite or next to the client on the side to be tested.	
2. Action	While demonstrating movement from open hand with small finger abducted and thumb extended, the therapist says, “Touch your thumb to your small finger like I did.” Observe the client opposing the thumb to touch the thumb pad to the pad of the fifth finger, which flexes and rotates toward the thumb (FIG 22.107).[6,7]	

		 FIG 22.107 Thumb opposition: action.
3. Test position	If client performs through available PROM, proceed with stabilization. If not, follow procedure for testing grades Poor, Trace, and Zero.	
4. Stabilize	Rest forearm and wrist on table with padding to stabilize, as both of the therapist's hands must be free to apply pressure.	
5. Pressure	Tell the client, "Don't let me move you." Apply pressure at the distal ends of the first and fifth metacarpals toward reposition of these bones and flattening of the palm of the hand (FIG 22.108).[10,12] Adjust pressure to client's abilities. If pressure is maximal = Normal, moderate = Good, minimal = Good−, slight = Fair+, and no pressure = Fair.	 FIG 22.108 Thumb opposition: application of pressure.

Procedure for Testing Grades Poor (2), Trace (1), and Zero (0)

1. Body position	Client is seated with elbow flexed and resting on table, forearm and wrist in neutral and hand in open position. Therapist supports forearm and wrist if weak. The therapist sits opposite or next to the client on the side being tested.	
2. Action	Touch client's thumb tip to the small fingertip twice while stating, "Move your fingers like I did." (a) If client performs full ROM, leave in opposed position and apply slight pressure toward reposition. (i) If tolerates pressure = Poor+. (ii) No pressure = Poor. (b) If client performs through partial ROM, do not apply pressure = Poor−. (c) If client is unable to perform motion, touch client's thumb tip to small fingertip and state, "Try to move your fingers like I did." Palpate the thenar and hypothenar eminences of the palm[6,10,15] (FIG 22.109). (i) If muscle contraction palpable = Trace. (ii) If no contraction palpable = Zero.	 FIG 22.109 Thumb opposition: body position, action, and palpation—muscle grades 2 and below.
Substitution: APB will assist with opposition by flexing and medially rotating the CMC joint, but the IP joint will extend. The FPB will flex and medially rotate the CMC joint, but the thumb will not move away from the palm of the hand. The FPL will flex and slightly rotate the CMC joint, but the thumb will not move away from the palm, and the IP joint will flex strongly.[15,21] The DIP joints of the thumb and little finger may flex to meet, giving the appearance of full opposition.[7,12]		

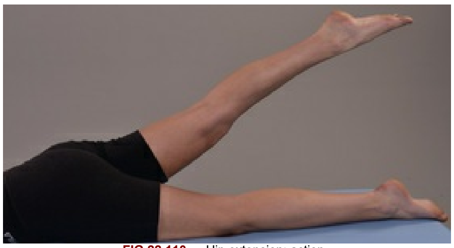
Manual Muscle Testing of the Lower Extremity

Muscle testing of lower extremity (LE) motions follows the same principles as those used for the upper extremity. Because the distal LE rotates in utero to allow humans to ambulate in a bipedal fashion, the muscles that flex the knee, ankle, and toes lie posterior to the knee joint, and the extensors lie anterior. LE muscle strength is traditionally measured by OT professionals via screening and not manual muscle testing, therefore this chapter presents only some of the LE motions.

Hip Extension (Figs. 22.110 to 22.111)

Muscles[6,12,14]	Innervation[10,13]
Gluteus maximus	Inferior gluteal nerve, L5–S2
Semitendinosus	Sciatic nerve, L5–S2
Semimembranosus	Sciatic nerve, L5–S2
Biceps femoris (long head)	Sciatic nerve, L5–S2
Adductor magnus	Obturator, L2–4

Procedure for Testing Grades Normal (5), Good (4), and Fair (3)

1. Body position	The client is seated or supine with forearm in neutral rotation and wrist in slight extension and neutral deviation. The therapist is seated or standing next to the client on the side to be tested. The client is prone, with the hip at neutral and the knee flexed to about 90 degrees[6,12] or extended.[12] The therapist stands next to the client on the opposite side.[14] Two pillows may be placed under the pelvis to flex the hips.[6,7]	
2. Action	While demonstrating movement from neutral to full hip extension, the therapist says, "Move your leg like I did." Observe the client actively performing the movement (FIG 22.110).	 FIG 22.110 Hip extension: action.
3. Test position	If client performs through available PROM, place the hip in midextension and proceed. If not, follow procedure for testing grades Poor, Trace, and Zero.	
4. Stabilize	The therapist stabilizes over the iliac crest on the side being tested.[10,12]	
5. Pressure	Tell the client, "Don't let me move you." Apply pressure at the distal end of the posterior aspect of the thigh, downward, toward flexion,[10,12-14] adjusting pressure to client's abilities (FIG 22.111). If pressure is maximal = Normal, moderate = Good, minimal = Good−, slight = Fair+, and no pressure = Fair.	 FIG 22.111 Hip extension: application of pressure.

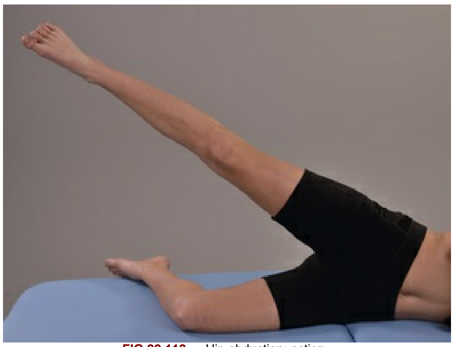
Procedure for Testing Grades Poor (2), Trace (1), and Zero (0)

1. Body position	Client is in a side-lying position. The therapist stands in front of the client, supporting the upper leg in extension and slight abduction.[10] The lower leg (to be tested) is flexed at the hip and knee.
2. Action	Move client's leg into hip extension twice while stating, "Move your leg like I did." (a) If client performs full ROM, place in midextension and apply slight pressure toward flexion. (i) If tolerates pressure = Poor+. (ii) No pressure = Poor. (b) If client performs through partial ROM, do not apply pressure = Poor−. (c) If client is unable to perform motion, place hip in midposition and state, "Try to move your hip like I did." Palpate over the middle posterior surface of the buttock[15] and the posterior thigh for muscle contraction. (i) If muscle contraction palpable = Trace. (ii) If no contraction palpable = Zero.
Specific muscle testing: The gluteus maximus can be isolated by keeping the knee flexed while extending the hip to minimize the action of the hamstring muscles on the hip. **Substitution**: Elevation of the pelvis and extension of the lumbar spine can produce some hip extension. In the supine position, gravity and eccentric contraction of the hip flexors can return the flexed hip to extension.[15] Hip external rotation, abduction, or adduction may be used to substitute.[7]	

Hip Abduction (Figs. 22.112 to 22.113)

Muscles[6,10,12]	Innervation[10,12-14]
Gluteus medius	Superior gluteal nerve, L4–S1
Gluteus minimus	Superior gluteal nerve, L4–S1
Tensor fasciae latae	Superior gluteal nerve, L4–S1
Sartorius	Femoral nerve, L2

Procedure for Testing Grades Normal (5), Good (4), and Fair (3)

1. Body position	The client assumes a side-lying position, with the upper leg (to be tested) with the knee extended and hip extended slightly beyond the neutral position and slight forward rotation of the pelvis[12]; the lower leg is flexed at the hip and knee to provide a wide base of support.[7] The therapist stands behind or in front of the client.[6,7,10,12-14]	
2. Action	The client abducts the upper leg, lifting the leg upward toward the ceiling (FIG 22.112).	 FIG 22.112 Hip abduction: action.
3. Test Position	If the client performs through available PROM, place the leg in mid hip abduction and proceed. If not, follow the procedure for testing grades Poor, Trace, and Zero.	
4. Stabilize	Provide stabilization at the pelvis over the iliac crest.[10,14]	
5. Pressure	Tell the client "Don't let me move you." Provide pressure at the point just proximal to the knee in a downward direction toward adduction (FIG 22.113).	 FIG 22.113 Hip abduction: application of pressure.

Procedures for Testing Grades Poor (2), Trace (1), and Zero (0)

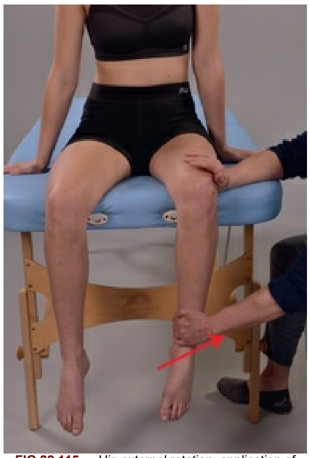
1. Body Position	The client is supine, with both legs extended and in neutral rotation. The therapist stands next to the client on the opposite side.[10] The therapist may use one hand to support at the ankle and slightly lift the test leg off the surface, being careful to offer no resistance or assistance to the movement.[12]
2. Action	Move client's leg into hip abduction moving the free leg sideward twice while maintaining neutral rotation during this movement and stating "Move your leg like I did." (a) If patient performs full ROM, place leg in mid-abduction and apply slight pressure toward adduction. (i) If tolerates pressure = Poor+. (ii) No pressure = Poor. (b) If patient performs through partial ROM, do not apply pressure = Poor−. (c) If client is unable to perform motion, place hip in mid-abduction position and state "Try to move your hip like I did." Palpate the gluteus medius on the lateral aspect of the ilium above the greater trochanter of the femur. (i) If muscle contraction palpable = Trace. (ii) If no contraction palpable = Zero.
Substitution: Lateral muscles of the trunk may contract to bring the pelvis toward the thorax, effecting partial abduction at the hip.[10] If the hip is externally rotated, the hip flexors may assist in abduction.[6,7,10,15]	

Hip External Rotation (Figs. 22.114 to 22.115)

Muscles[10,12]	Innervation[10,12]
Quadratus femoris	Femoral nerve, L2–4
Piriformis	Sacral plexus, S1, S2
Obturator internus	Sacral plexus, L5–S1
Obturator externus	Obturator nerve, L3, L4
Gemellus superior	Obturator internus, L5, S1
Gemellus inferior	Obturator internus, L5, S1

Procedure for Testing Grades Normal (5), Good (4), and Fair (3)

1. Body position	The client is seated, with knees flexed over the edge of the table. A small pad or folded towel is placed under the knee on the side to be tested. The therapist stands in front of the client toward	

	the side to be tested.[6,10,12-14]	
2. Action	While demonstrating movement from neutral to full external rotation, the therapist says, “Move your leg like I did.” Observe the client actively rotating the thigh outwardly; the foot will move medially or toward the midline (FIG 22.114).	 FIG 22.114 Hip external rotation: action.
3. Test position	If client performs through available PROM, place the hip in midexternal rotation and proceed. If not, follow procedure for testing grades Poor, Trace, and Zero.	
4. Stabilize	The therapist stabilizes the lateral aspect of the knee on the side to be tested. The client may grasp the edge of the table to stabilize the trunk and pelvis.[6,10,14]	
5. Pressure	Tell the client, “Don't let me move you.” Apply pressure at the medial aspect of the lower leg, just proximal to the ankle, in a lateral direction toward internal rotation over the distal leg (just proximal to the ankle joint) medially,[6,7,10,12-14] adjusting pressure to client's abilities. Because the long lever arm multiplies the force significantly, it is extremely important to apply pressure carefully and gradually; joint injury can occur if pressure is sudden and forceful (FIG 22.115). Clients with knee instability should be tested in the supine position.[7,10] If pressure is maximal = Normal, moderate = Good, minimal = Good−, slight = Fair+, and no pressure = Fair.	 FIG 22.115 Hip external rotation: application of pressure.

Procedure for Testing Grades Poor (2), Trace (1), and Zero (0)

1. Body position	The client is supine, with hips and knees extended; the hip to be tested is internally rotated. The therapist is standing next to the client on the opposite side.[10,12]
2. Action	Move client's hip into external rotation twice while stating, “Move your leg like I did.” Observe the client actively rotating the thigh.[10] (a) If client performs full ROM, place in midexternal rotation and apply slight pressure toward internal rotation. (i) If tolerates pressure = Poor+. (ii) No pressure = Poor. (iii) Muscles are graded Poor if ROM in the gravity-minimized position can be achieved against slight resistance during the second half of the ROM. (b) If client performs through partial ROM, do not apply pressure = Poor−. (c) If client is unable to perform motion, place hip in midposition and state, “Try to move your leg like I did.” These deep muscles are difficult or impossible to palpate.[6] Action of the external rotators may be detected by palpating deeply posterior to the greater trochanter of the femur.[10] (i) If muscle contraction palpable = Trace. (ii) If no contraction palpable = Zero.
Substitution: The gluteus maximus may substitute for the deep external rotators when the hip is in extension. The sartorius may substitute, but external rotation will be accompanied by hip flexion, abduction, and knee flexion.[7,15]	

Knee Extension (Figs. 22.116 to 22.117)

Muscles[10]	Innervation[10]
Rectus femoris	Femoral nerve, L2–4
Vastus intermedius	Femoral nerve, L2–4
Vastus medialis	Femoral nerve, L2–l4
Vastus lateralis	Femoral nerve, L2–l4
Tensor fasciae latae	Superior gluteal nerve, L4–S1

Procedure for Testing Grades Normal (5), Good (4), and Fair (3)

1. Body	The client is seated, with knees flexed over the edge of the table and feet	

position	suspended off the floor. The client may lean backward slightly to release tension on the hamstrings and grasp the edge of the table for stability.[6,10,12] The therapist stands next to the client on the side to be tested.[6,12]	
2. Action	While demonstrating movement from neutral to full knee extension, the therapist says, “Move your knee like I did.” Observe the client actively performing the movement (FIG 22.116).	 FIG 22.116 Knee extension: action.
3. Test position	If client performs through available PROM, place the knee in midextension and proceed. If not, follow procedure for testing grades Poor, Trace, and Zero.	
4. Stabilize	The therapist stabilizes the thigh by placing one hand under the client's knee to cushion it from the edge of the table. The client may grasp the edge of the table.[7,10,12-14]	
5. Pressure	Tell the client, “Don't let me move you.” Apply pressure on the anterior surface of the leg, just above the ankle, with downward pressure toward knee flexion,[6,10,14] adjusting pressure to client's abilities. Because resistance to a locked knee can cause joint injury,[10] ensure that the knee is tested in midextension and not at the end ROM of knee extension[7,10] (FIG 22.117). If pressure is maximal = Normal, moderate = Good, minimal = Good−, slight = Fair+, and no pressure = Fair.	 FIG 22.117 Knee extension: application of pressure.

Procedure for Testing Grades Poor (2), Trace (1), and Zero (0)

1. Body position	The client assumes a side-lying position on the side to be tested. The lower leg is positioned with the hip extended and the knee flexed to 90 degrees. The therapist stands behind the client.
2. Action	Move client's knee into extension twice while stating, “Move your leg like I did.” (a) If client performs full ROM, place in midknee extension and apply slight pressure toward flexion. (i) If tolerates pressure = Poor+. (ii) No pressure = Poor. (b) If client performs through partial ROM, do not apply pressure = Poor−. (c) If client is unable to perform motion, place knee in midposition and state, “Try to move your leg like I did.” Palpate over the anterior aspect of the thigh. (i) If muscle contraction palpable = Trace. (ii) If no contraction palpable = Zero.
Substitutions:	Tensor fasciae latae may substitute for or assist weak quadriceps. In this case, hip internal rotation will accompany knee extension.[6,10,14] Observe for hip movement.

Ankle Dorsiflexion (Figs. 22.118 to 22.119)

Muscles[6,10,12]	**Innervation**[6,10,14]
Tibialis anterior	Peroneal nerve, L4–S1
Extensor digitorum longus	Deep fibular nerve, L5–S1
Peroneus (fibularis) tertius	Superficial fibular nerve, L5, S1, S2
Extensor hallucis longus	Deep fibular nerve, L5, S1

Procedure for Testing Grades Normal (5), Good (4), and Fair (3)

1. Body position	The client is seated, with the legs flexed at the knees, over the edge of the table. The therapist sits in front of the client, slightly to the side to be tested.[6,10,12-14]	
2. Action	While demonstrating movement from neutral to full dorsiflexion, the therapist says, “Move your foot like I did.” Observe the client actively performing the movement (FIG 22.118).	

		 FIG 22.118 Ankle dorsiflexion: action.
3. Test position	If client performs through available PROM, place the ankle in middorsiflexion and proceed. If not, follow procedure for testing grades Poor, Trace, and Zero.	
4. Stabilize	The therapist stabilizes the leg, just above the ankle. The client's heel can rest in the therapist's lap.[6,12]	
5. Pressure	Tell the client, "Don't let me move you." Apply pressure on the dorsal aspect of the foot (top of foot), toward plantar flexion[6,10,14] adjusting pressure to client's abilities (FIG 22.119). If pressure is maximal = Normal, moderate = Good, minimal = Good−, slight = Fair+, and no pressure = Fair.	 FIG 22.119 Ankle dorsiflexion: application of pressure.

Procedure for Testing Grades Poor (2), Trace (1), and Zero (0)

1. Body position	Client is positioned in a side-lying position.[7,10] The therapist stands or sits opposite or next to the client on the side being tested.
2. Action	Move client's ankle into dorsiflexion twice while stating, "Move your foot like I did." (a) If client performs full ROM, place in midankle dorsiflexion and apply slight pressure toward plantar flexion (toward the floor). (i) If tolerates pressure = Poor+. (ii) No pressure = Poor. (b) If client performs through partial ROM, do not apply pressure = Poor−. (c) If client is unable to perform motion, place ankle in middorsiflexion and state, "Try to move your foot like I did." Palpate over the anterior medial aspect of the ankle joint[6,7,10] and the anterior surface of the leg, just lateral to the tibia.[15] (i) If muscle contraction palpable = Trace. (ii) If no contraction palpable = Zero. (iii) If the against-gravity position is used, exercise clinical judgment to determine muscle grades. Partial ROM against gravity can be graded Poor.[12] If the test is performed in the supine position for these grades, standard definitions of muscle grades may be used.[10]
Specific muscle testing: To isolate the peroneus tertius, dorsiflexion should be combined with eversion, whereas the tibialis anterior is isolated with the foot in inversion and dorsiflexion. To prevent the extensor hallucis longus and extensor digitorum longus, do not allow the toes to extend.[7,10,12-15]	

Foot Eversion (Figs. 22.120 to 22.121)

Muscles[10,14]	**Innervation**[10,14]
Peroneus longus	Peroneal nerve, L4–S1
Peroneus brevis	Superficial fibular nerve L5–22
Peroneus tertius	Superficial fibular nerve L5–22

Procedure for Testing Grades Normal (5), Good (4), and Fair (3)

1. Body position	The client assumes a side-lying position, with the lower leg flexed at the knee to keep it out of the way. The upper test leg is in hip extension with neutral rotation, knee extension, and ankle plantar flexion with foot inversion.[6]	
2. Action	While demonstrating movement from neutral to full eversion, the therapist says, "Move your foot like I did." Observe the client actively performing the	

	movement. Eversion is normally accompanied by some degree of plantar flexion[14,15] (FIG 22.120).	 **FIG 22.120** Foot eversion: action.
3. Test position	If client performs through available PROM, place the foot in eversion and proceed. If not, follow procedure for testing grades Poor, Trace, and Zero.	
4. Stabilize	The therapist stabilizes the leg above the ankle in a medial or lateral manner.[6]	
5. Pressure	Tell the client, "Don't let me move you." Apply pressure against the lateral border and the plantar surface of the foot toward inversion and dorsiflexion (FIG 22.121),[6,14] adjusting pressure to client's abilities. If pressure is maximal = Normal, moderate = Good, minimal = Good−, slight = Fair+, and no pressure = Fair.	 **FIG 22.121** Foot eversion: application of pressure.

Procedure for Testing Grades Poor (2), Trace (1), and Zero (0)

1. Body position	The client is supine, hip extended and in neutral rotation.[10] The knee is extended, and the ankle is in midposition.
2. Action	Move client's foot into eversion twice while stating, "Move your foot like I did." (a) If client performs full ROM, place in mideversion and apply slight pressure toward inversion. (i) If tolerates pressure = Poor+. (ii) No pressure = Poor. (b) If client performs through partial ROM, do not apply pressure = Poor−. (c) If client is unable to perform motion, place foot in midposition and state, "Try to move your foot like I did." Palpate over the upper half of the lateral aspect of the calf, ankle, and lateral border of the foot and over the base of the fifth metatarsal.[6,10,15] (i) If muscle contraction palpable = Trace. (ii) If no contraction palpable = Zero.
Specific muscle testing: To isolate the peroneus tertius, allow dorsiflexion along with eversion. To prevent the extensor hallucis longus from acting, do not allow the toes to extend.[7,10,12-15]	

Results of Assessment as a Basis for Intervention Planning

When planning intervention for maintenance or improvement of strength, the OT practitioner considers several factors in the clinical reasoning process before determining intervention priorities, goals, and modalities. Results of the muscle strength assessment will suggest the progression of the intervention program. What is the degree of weakness? Is it generalized or specific to one or more muscle groups? Are the muscle grades generally the same throughout, or is there significant disparity in muscle grades? If there is disparity, is there an imbalance of strength between the agonist and antagonist muscles that necessitates protection of the weaker muscles during OT intervention or when ADLs and IADLs are performed? When substantial imbalance between an agonist muscle and an antagonist muscle is noted, intervention goals may be directed toward strengthening the weaker group while maintaining the strength of the stronger group. Muscle imbalance may also suggest the need for an orthosis to protect the weaker muscles from overstretching while recovery is in progress. Examples of such orthoses are devices such as the bed footboard, used to prevent overstretching of the weakened ankle dorsiflexors, and the wrist cock-up splint, which can prevent overstretching of weakened wrist extensors.

Muscle grades will suggest the level of therapeutic activity or exercise that can help to maintain or improve strength. Is the weakness mild (G range), moderate (F to F+), or severe (P to 0)?[15] Muscles graded F+, for example, could be strengthened by active assisted exercise or light activity against gravity. Likewise, muscles graded P will require activity or exercise in the gravity-minimized plane, with little or no resistance, to increase strength. (See Chapter 29 for further discussion of appropriate exercise and activity for specific muscle grades.)

Endurance of the muscles (i.e., how many repetitions of the muscle contraction are possible before fatigue sets in) is an important consideration in intervention planning. A frequent goal of the therapeutic activity program is to increase endurance as well as strength. Because MMT does not measure endurance, the therapist should assess endurance by engaging the client in periods of exercise or activity graded in length to determine the length of time that the muscle group can be used in sustained activity. A correlation between strength and endurance is usually noted. Weaker muscles tend to have less endurance than stronger ones. When selecting intervention modalities for increasing endurance, the therapist may elect not to tax the muscle to its maximal ability but rather to emphasize repetitive action at less than the maximal contraction to increase endurance and prevent fatigue.[15]

Sensory loss, which often accompanies muscle weakness, complicates the ability of the client to perform in an activity program. If little or no tactile or proprioceptive feedback is obtained from motion, the impulse to move is decreased or lost, depending on the severity of sensory loss. Thus the movement may appear weak and ineffective even when strength is adequate for performance of a specific activity. With some diagnoses, a sensory reeducation program (see Chapter 23) may be indicated to increase the client's sensory awareness and feedback received from the part. In other instances, the therapist may elect to teach compensation techniques to address the sensory loss. These techniques include the use of mirrors, video playback, and biofeedback, which can be used as adjuncts to the strengthening program.

Other important considerations in the therapist's clinical reasoning include the diagnosis and expected course of the disease. Is strength expected to increase, decrease, or remain about the same? If strength is expected to increase, what is the expected recovery period? What is the effect of exercise or activity on muscle function? Will too much activity delay the progress of recovery? If muscle power is expected to decrease, how rapid will the progression be? Are there factors to be avoided, such as vigorous activity or an exercise program that can accelerate the decrease in strength? If strength is declining, is special equipment practical and necessary? How much muscle power is needed to operate the equipment? How long will the client be able to operate a device before a decrease in muscle power makes it impracticable?[15] In Sharon's case, the therapist must be aware of the change in her muscle strength. It is expected that muscle strength will return in a proximal-to-distal pathway, and it is critical to protect the intrinsic muscles of the hand against overexertion to ensure the possibility of full recovery. Frequent muscle testing of select muscle groups will serve as a means to monitor progression of the disease and to assist in the introduction of appropriate intervention strategies.[11,20]

The therapist should assess the effect of muscle weakness on the ability to perform ADLs; this can be observed during assessment. Which tasks are most difficult to perform because of muscle weakness? How does the client compensate for the weakness? Which tasks are most important for the client to be able to perform? Is special equipment necessary or desirable for the performance of some ADLs, such as mobile arm support for independence in eating (see Chapter 30, Section 2).

If the client is involved in a total rehabilitation program and is receiving several other healthcare services, the activity and exercise programs must be synchronized and balanced to meet the client's needs rather than the needs of the professionals, their schedules, and possibly their competition. The occupational therapist must be aware of the nature and extent of programs in which the client is engaged in physical therapy, recreation therapy, and any other services. Ideally, all members of the healthcare team should plan the exercise and activity programs together to ensure that they complement one another.

OT Practice Notes

The therapist must consider the following questions: What is the client doing in each of the therapies? How long is each treatment session? Are the goals of all of the therapies similar and complementary, or are they divergent and conflicting? Is the client being overfatigued in the total program? Are the various treatment sessions provided in rapid succession, or are they well spaced to meet the client's need for rest periods?

On the basis of these considerations and others pertinent to the specific client, the occupational therapist can select enabling and purposeful activities designed to maintain or increase strength, improve the performance of ADLs, and enable the use of special equipment, while protecting weak muscles from overstretching and overfatigue.

Summary

Many diseases and injuries result in muscle weakness. Screening tests can be used to assess the general level of strength available for the client to engage in ADLs; IADLs; and sleep and rest, educational, work, and leisure occupations. These tests can also help determine which clients and muscle groups might require MMT.

MMT evaluates the level of strength in a muscle or muscle group. It is used with clients who have motor unit (lower motor neuron) disorders and orthopedic conditions. It does not measure muscle endurance or **muscle coordination**, and it cannot be used accurately in upper motor neuron disorders when spasticity and or patterned/synergistic motion is present or when selective motion is not present.[1]

Accurate assessment of muscle strength depends on the knowledge, skill, and experience of the occupational therapist. Although there are standard definitions of muscle grades, clinical judgment is important in accurate evaluation.

Muscle test results are used to plan intervention strategies to improve occupational performance, compensate for muscle weakness, and increase strength. In some cases, muscle test results can also be used to track the expected course and progression of the disease or disorder, which can assist the OT practitioner when choosing intervention modalities and strategies, and when setting goals, as in Sharon's case.

Review Questions

1. List three general classifications of physical dysfunction in which muscle weakness is a primary symptom.
2. List at least three purposes for assessing muscle strength.
3. Discuss five considerations and their implications in intervention planning that are based on the results of muscle strength assessment.
4. Define endurance.
5. How can muscle weakness be differentiated from joint limitation?
6. If there is joint limitation, can muscle strength be measured accurately? How is strength recorded when available ROM is less than normal?
7. What does MMT measure?
8. What are the limitations of MMT?
9. When is MMT contraindicated?
10. What are the criteria for determining muscle grades?
11. In relation to the floor as a horizontal plane, describe or demonstrate what is meant by the terms *with gravity assisting, with gravity minimized, against gravity*, and *against gravity and resistance.*
12. List five factors that can influence the amount of resistance against which a muscle group can hold.
13. Define the muscle grades: N (5), F− (3−), F (3), P (2), P− (2−), T (1), and zero (0).
14. Explain what is meant by substitution.
15. How are substitutions most likely to be ruled out in the muscle testing procedure?
16. List the steps in the muscle testing procedure.
17. Is it always necessary to perform MMT to determine level of strength? If not, what alternatives may be used to make a general assessment of strength?
18. List the purposes of screening tests.

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23

Evaluation of Sensation and Intervention for Sensory Dysfunction*

Michelle R. Abrams, Cynthia C. Ivy

CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Describe how sensation is positioned within the current (2014) Occupational Therapy Practice Framework (OTPF-3).
2. Describe and compare the differences in sensory loss caused by a central nervous system dysfunction and that caused by a peripheral nerve repair.
3. Perform a sensory evaluation on a client with a peripheral nerve problem.
4. Instruct a client in an appropriate program for sensory reeducation, describe ways to upgrade the program, and name the criteria that reflect a client's readiness to have the program upgraded.
5. Explain why lack of protective sensation puts people at risk for serious injury and what types of injury are possible.
6. Identify whether a client is a candidate for compensatory strategies for sensory dysfunction, discriminative sensory reeducation, and/or cortical reorganization based on sensory evaluation findings.

KEY TERMS

Allodynia
Chemoreceptors
Dermatome
Desensitization

Dysesthesia
Graded motor imagery
Habituation
Hyperalgesia
Hypersensitivity
Kinesthesia
Mechanoreceptors
Neuropathy
Neuroplasticity
Nociceptors
Paresthesia
Proprioception
Stereognosis
Thermoreceptors
Tinel's sign

Threaded Case Study

Don, Part 1

Don is a 79-year-old, right hand–dominant gentleman who sustained a spinal cord injury 45 years ago, with resultant incomplete paraplegia at the level of T12. He has relied solely on his bilateral upper extremities for his occupations because he has functioned independently from a wheelchair level since the injury. In the course of his extensive arm use, he has developed severe bilateral carpal tunnel syndrome. The sensory loss and increased pain associated with carpal tunnel syndrome are leading to difficulties with wheelchair mobility and his ability to complete basic and higher level self-care tasks. During the occupational therapy (OT) initial evaluation, the client stated that the client factor that has had the greatest impact on his life is the sensory loss in his hands. This is leading to difficulty with occupational performance, including his wheelchair mobility, because he now needs to use his vision to see how his hands are placed around the rim of the wheels for fear of them getting caught and injured in the spokes of the wheel. He believes that his wheelchair mobility signifies his level of independence and also provides for bilateral upper extremity exercise. He states that he typically chooses not to park in a "handicap" spot in order to allow others "who really need it" to park there, and that he enjoys the extra exercise he feels he gains by parking farther away and using his arms to maneuver the wheelchair to get to his destination. Don believes that transitioning to a motorized wheelchair at this time would be a symbol of weakness and a loss of function. He has recently undergone a right endoscopic carpal tunnel decompression, and his hand surgeon anticipates excellent sensory recovery. However, Don will need to make modifications to try to reduce weight bearing on his hands during his recovery so as not to further irritate the median nerve as it passes through the carpal tunnel.

Critical Thinking Questions

1. What sensory tests would be most appropriate for Don?

2. Describe a sensory reeducation program that would be appropriate for Don.

3. What will you tell Don regarding typical sensory recovery after carpal tunnel release and the modifications that he will have to make to try to minimize weight bearing through his hands?

Threaded Case Study

Mario, Part 1

Mario is an 84-year-old, right hand–dominant male who sustained a circular saw injury, with resultant amputation of his right fourth (ring) finger and fifth (small) finger at the level of the fingertips, just distal to the distal interphalangeal (DIP) joints. He is an active senior who had been in the tile and granite profession and now enjoys woodworking, wine making, and dancing with his wife. He has osteoarthritis throughout many joints of his body, including his hands, hips, and knees, but is otherwise generally healthy. He has had prior hand surgeries, followed by hand occupational therapy for joint replacements in his fingers and also a thumb fracture. These surgical corrections and injuries grossly affected his function due to limitations in active range of motion (AROM) and functional strength, but they did not directly affect his sensation in his fingertips. Although Mario considered losing the tips of two fingers a relatively minor injury compared to the recovery required for joint replacements in his hand, he has come to realize the functional implications of sensory dysfunction. He not only has decreased sensation at the residual portion of his amputated digits, he also has hypersensitivity, along with phantom limb pain (PLP). Mario communicated that his leisure activities are the occupations that are the most affected by the amputation and resultant sensory dysfunction. He reports specific difficulty with tool use in both woodworking and wine making. He also notices negative effects in his social participation because he has become less comfortable with driving, which he needs to do in order to go dancing with his wife; the sensory changes make it difficult to adequately and confidently grip the steering wheel. In order to sufficiently cover the residual portion of his fingers with soft tissue, surgical amputation was performed distal to the DIP joint of both his ring and small fingers. His hand surgeon expects full recovery in terms of AROM at that joint, but Mario will have sensory dysfunction at the residual distal ends of his ring and small fingers.

Critical Thinking Questions

1. Why does sensation affect Mario's occupational roles?

2. How can an occupational therapist incorporate purposeful activity into Mario's treatment plan to enhance sensory perceptual skills?

3. What types of treatment methods may you incorporate to improve the remapping of his brain to connect him with his fingers once again?

People who have not experienced sensory problems probably take for granted all that sensation contributes to their daily occupational performance. By comparison, people with sensory dysfunction are likely to be acutely aware of the lost picture that normal sensation provides. This chapter discusses the functional impact of somatosensory system dysfunction on occupational performance.

Sensation is explored in terms of touch, temperature, pain, **proprioception** (sense of position; for example, with loss of proprioception, the person experiences a lack of coordination with everyday tasks, such as buttoning), and stereognosis (the ability to identify an item with the vision occluded). Techniques for sensory testing, desensitization, and sensory reeducation also are presented. This chapter offers cases illustrating sensory loss deficits and stimulates clinical reasoning that guides evaluation, intervention, and outcomes appropriate to various diagnoses.

Sensation (also called sensibility) is a body function, a component of the client factors that influence both the motor and processing aspects of performance skills.[1] Although there are several realms of sensibility or sensation in the body (e.g., the olfactory realm, the auditory realm, and even emotionality), this chapter is specific to cutaneous sensation and joint proprioceptive sensation. According to the OTPF-3, the area of occupation that Don is limited in is the activity of daily living (ADL) of functional mobility because the lack of sensation in his first three digits affects his ability to grasp and maneuver the rims of his wheelchair. Within the domain of occupation, this dysfunction will also affect his social participation. Client factors affected include body functions, including mental functions, sensory functions, and pain due to the sensory loss. Body structures include the structure of the nervous system affected by sensory dysfunction. For this reason, sensation and sensory dysfunction may affect clients' performance in nearly all areas of occupation, including ADLs, education, work, play, leisure, and social participation. For people with carpal tunnel syndrome, as in Don's case, the sensory loss typically involves the thumb, index finger, long finger, and radial half of the ring finger. This distribution of sensory loss makes it difficult to pinch with a tip pinch or three-point pinch and to grasp objects with a lateral key pinch. It often forces people to oppose their thumb to the pad of their small finger instead. This would lead to difficulties for Don in maintaining a functional grasp and lateral pinch on his wheelchair rims.

All clients with sensory dysfunction, regardless of etiology, should be evaluated to determine the occupational impact of the sensory loss. The specific sensory tests and interventions may vary. depending on the diagnosis and the prognosis for recovery. The battery of tests selected is contingent on whether the diagnosis defines the problem as either central nervous system (CNS) or peripheral nervous system (PNS) in origin, and if CNS, whether the brain or the spinal cord is involved.

A person with CNS injury with brain involvement, with or without spinal cord injury, is more likely to have deficits in proprioception and stereognosis. Persons with CNS injury may also have difficulty processing sensory feedback, which would become evident during the evaluation and may require further testing (see Chapters 25 and 26). If there is a CNS injury that only involves the spinal cord, there may be a loss of all sensation at the dermatome at the level of injury and below.

A person with PNS injury is more likely to have deficits in touch pressure awareness and two-point discrimination. A client with a history of a cerebrovascular accident (CVA), which would be considered a prior CNS insult, who then sustains a wrist fracture (a PNS injury), should be evaluated for proprioception and stereognosis, and also for pressure threshold and two-point discrimination because both the CNS and PNS systems are affected. Raynaud's phenomenon, brachial plexus injury, neuroma, severed nerve, and amputation are examples of other conditions that may lead to sensory dysfunction from the PNS. However, radiculopathy, traumatic brain injury, neurodegenerative diseases, and CNS cancers or cancer treatments may lead to sensory dysfunction in the CNS.

Furthermore, it is useful to have the sensory test follow the motor examination and functional interview with the client (refer to Chapters 19 and 20). These two preceding portions of the evaluation will allow for greater information to determine where to begin sensory testing and the battery of sensory tests on which to focus. In Don's case, the OT interview allowed the therapist to focus on the distribution of the median and ulnar nerves of the hand. In Mario's case, the motor evaluation, which was normal, revealed that his functional deficits were due entirely to the sensory loss.

Somatotopic Arrangement

Sensory information is received and organized somatotopically in the primary somatosensory cortex of the brain. The sensory homunculus (Fig. 23.1) is a diagram that shows the arrangement and proportions of cortical areas representing the surface of the body. Areas with large cortical representation indicate a high density of sensory receptors. As shown in Fig. 23.1, somatotopic arrangement is such that axons providing information from the index finger are situated closer to those from the thumb than to those from the foot. There is also a motor homunculus, or diagram, that follows roughly the same arrangements. Sound research studies have demonstrated the relevance of somatotopic arrangement to therapeutic strategies for normalizing impaired sensation. These strategies are effective because of the brain's plasticity, or ability to adapt to new needs.[28]

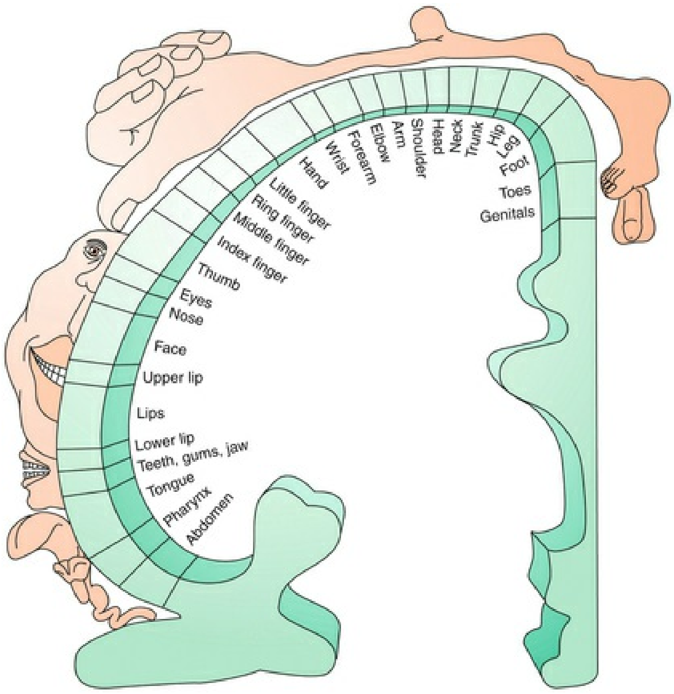


FIG 23.1 Sensory homunculus. (From Copstead LC, Banasik JL: *Pathophysiology*, ed 5, St Louis, 2013, Saunders.)

Within the somatosensory cortex there is an inherent capacity for plasticity involving the complex firing of neurons and neurotransmitters.[7] Topographical reorganization of the cerebral cortex occurs after injury and can be influenced by sensory input and through learning and experience. This has been described by the neurologist and author Frank R. Wilson as a dynamic interplay of sensorimotor and cognitive functions.[32] Referred sensations and phantom limb pain (pain felt in a part removed from its point of origin) in persons with amputations are examples of cortical reorganization. Newer techniques are being developed and used to address cortical reorganization at a clinical level.

Neuroplasticity

Our brain has the plasticity, called **neuroplasticity**, to mechanically induce neuronal reorganization. Instances in which this occurs include the processes of habituation, learning, memory, and cellular recovery after an injury. Along with changes in synaptic connections, there are also changes in nonneuronal cells. Some tenets of neuroplasticity are:

- Sensory perception is a dynamic process that is experienced by the CNS.[7,20]
- Receptor morphology is affected by hand use. The axiom “Use it or lose it” is particularly applicable here. Immobilization or disuse (e.g., a casted fracture or a highly guarded injured upper extremity) contributes to retrogressive modifications in receptors. Conversely, promoting normal use may stimulate new receptors.[28]
- Because there is overlap of the receptive fields of various nerve fibers, a single stimulus will excite different receptors.[6]

Neurons may die after CNS injuries such as spinal cord lesions and strokes. The nervous system accommodates for injuries with behavioral, physiologic, and anatomic changes. Over time, the CNS can adapt by altering the strength of neural transmission through modifications in the structure and function of neurons and synapses. It can be stimulating clinically to realize that occupational therapists facilitate recovery through functional activities and involvement in occupation resulting in somatosensory reeducation.[20]

Somatosensory System

The somatosensory system processes sensory input from superficial sources, such as the skin, and from deep sources, such as the musculoskeletal system. Sensation is stimulated by receptors in the periphery of the body (PNS), and the sensory information then travels through afferent neurons, carrying nerve impulses from the receptors to the brain (CNS).

Somatosensory receptors are individualized to respond to specific types of input. These receptors are categorized as mechanoreceptors, chemoreceptors, and thermoreceptors. **Mechanoreceptors** respond to touch, pressure, stretch, and vibration and are stimulated by mechanical deformation. **Chemoreceptors** respond to cell injury or damage and are stimulated by substances (neuropeptides) that the injured cells release. **Thermoreceptors** respond to the stimulation of heating or cooling. Each of these three types of receptors has a subset called **nociceptors**, which sense pain when stimulated.[18] Afferents, which are peripheral axons that carry information toward the brain, are categorized by the diameter of the axon. Axons with larger diameters transmit their information more quickly, in part because they are myelinated. In contrast to the axons with the larger diameter, pain is frequently carried on small-diameter, unmyelinated axons.

Disturbances in somatosensation may be manifested as paresthesia, hyperalgesia, hypersensitivity, dysesthesia, or allodynia. **Paresthesia** is a tingling, electrical, or prickling sensation. Tapping the volar aspect of the wrist may elicit paresthesias in the distribution of the median nerve in a person who has carpal tunnel syndrome due to the compressive nature of the disease. When such tapping elicits paresthesia, it is referred to as **Tinel's sign**. **Hyperalgesia** is increased pain and may occur during nerve regeneration. **Hypersensitivity** is increased sensory pain. Mario experienced hyperalgesia and hypersensitivity at his amputation sites after his surgery. **Desensitization** helps normalize the phenomenon of hypersensitivity. **Dysesthesia** is an unpleasant sensation that may be spontaneous or reactive to stimulation. **Allodynia** is pain caused by a stimulus that would not normally cause pain. An example of allodynia would be seen when a person with complex regional pain syndrome (CRPS), formerly referred to as reflex sympathetic dystrophy (RSD), experiences pain with the mere movement of air wafting over the involved arm (Table 23.1).

TABLE 23.1
Disturbances in Somatosensation

Sensory Disturbance	Description
Paresthesia	Tingling, electrical or prickling sensation
Hyperalgesia	Increased pain; often occurs during nerve regeneration
Hypersensitivity	Increased sensory pain
Dysesthesia	Unpleasant sensation that may be spontaneous or a reaction to stimulation
Allodynia	Pain caused by a stimulus that would not normally cause pain

A **dermatome** is the area of skin supplied by one spinal dorsal root and its spinal nerve. The affected dermatome correlates with the level of the spinal cord lesion. However, some peripheral nerves have innervation patterns that differ from dermatome patterns. This is due to regrouping of sensory axons in the brachial plexus and in the lumbosacral plexus (Fig. 23.2). The clinical significance of such regrouping is that sensory assessment along a dermatomal pattern is more appropriate in clients with CNS lesions, not PNS lesions. In addition, because of the central processing of deep sensory input, clients with some CNS lesions (e.g., CVA and multiple sclerosis) are more likely to have deficits in vibration, proprioception, stereognosis, and temperature. Clients with CNS dysfunction in the spinal cord and those with PNS lesions are more likely to experience deficits in pain, pressure threshold, and two-point discrimination. According to the American Spinal Injury Association (ASIA), persons with spinal cord injury are classified according to their “sensory level,” which is the most caudal intact dermatome for both pinprick and light touch.[2] **Neuropathy** is defined as impairment of the PNS. Large sensory nerve fibers carry signals of vibration, light touch, and proprioception, whereas the smaller fibers, which are also often not myelinated, transmit messages of temperature and pain. Testing for light touch, proprioception, temperature, and pain will help discern whether small or large sensory nerve fibers are affected.

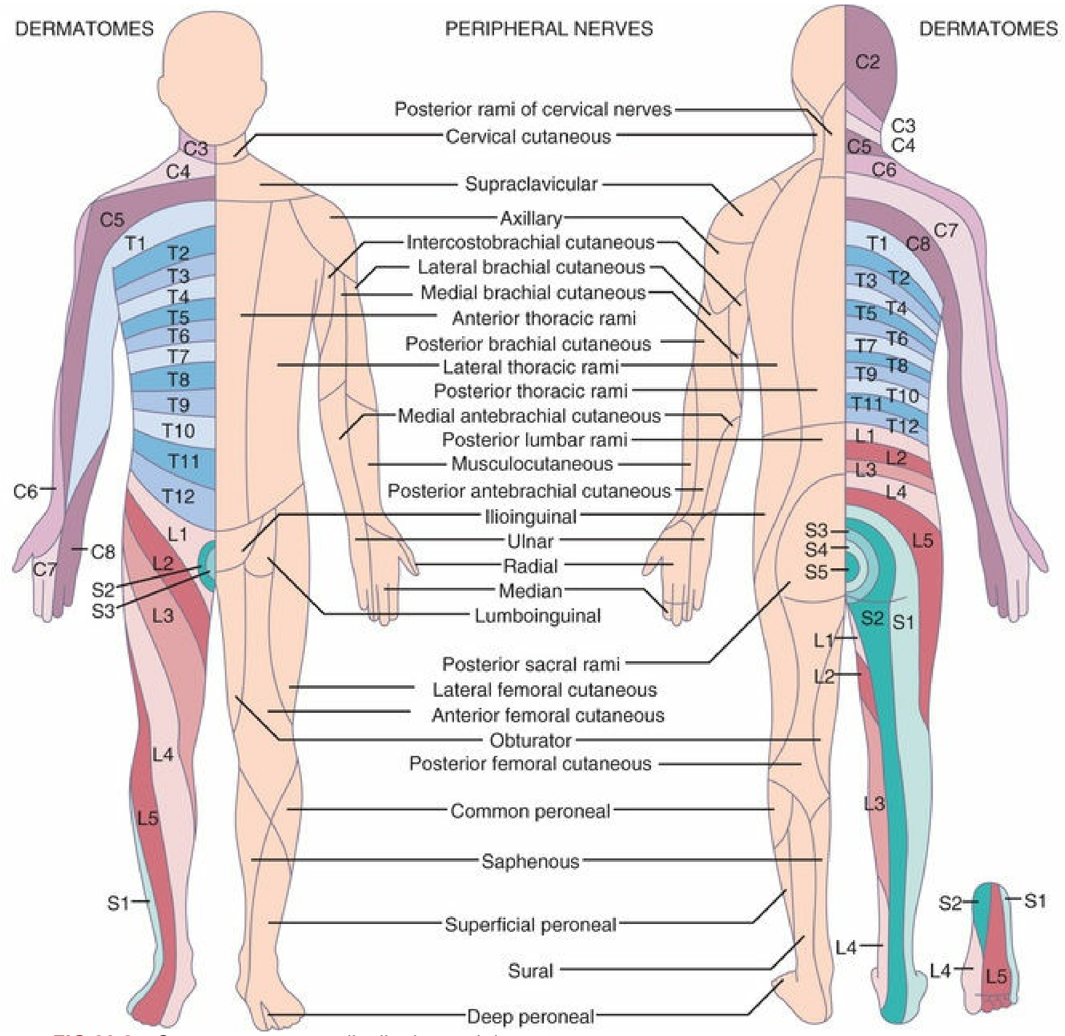


FIG 23.2 Cutaneous sensory distribution and dermatomes. (From Lundy-Ekman L: *Neuroscience: fundamentals for rehabilitation,* ed 3, St Louis, 2007, Saunders.)

Superficial Sensation

Pain, temperature, and touch are facets of superficial sensation, also called cutaneous sensation. Compared with the more proximal body parts, the distal parts have a higher density of receptors and smaller receptive fields.[16] This arrangement contributes to enhanced fingertip sensation, such as the ability to distinguish between one and two stimuli that are close together. The relevance of this in terms of daily occupations is that normal two-point discrimination enables a person to distinguish a dime from a penny without vision, as when one manipulates the coins in a pocket or wallet. Fig. 23.3 shows normal two-point discrimination values over various locations within the body.

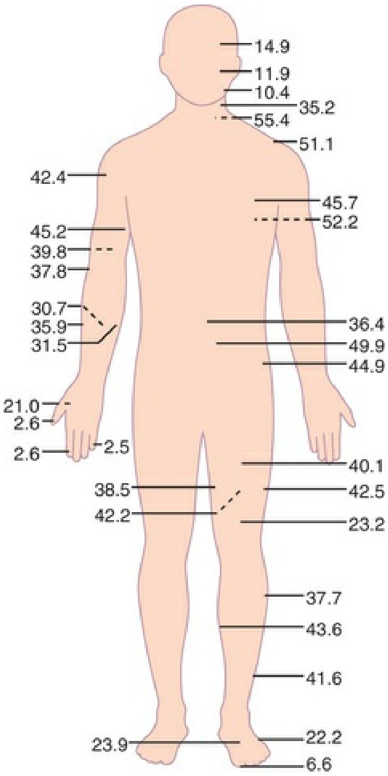


FIG 23.3 Normal two-point discrimination values over different locations of the body. (From Lundy-Ekman L: *Neuroscience: fundamentals for rehabilitation,* ed 4, St Louis, 2013, Saunders.)

Blisters, altered sweat patterns, calluses, shiny or dry skin, blanching of the skin, scars, and wounds are indicators of possible autonomic sensory problems and indicate the need to instruct the client in the use of compensatory techniques, such as vision, during daily occupations. In people with sensory problems, healing is slowed because of decreased vascularity because the blood vessels are also controlled by autonomic nerves. An absence of "wear" marks (e.g., calluses) or lack of dirt or grease stains on the hands of a mechanic, for example, may suggest that the hand is not being used. Nerve damage results in atrophy of soft tissue, which increases the tissue's susceptibility to injury because of the lack of protective padding.

Because upper extremity cutaneous sensory fibers and sympathetic nervous system fibers follow the same pathways, sympathetic phenomena may correlate with sensory function. In the upper extremity, the median nerve has more sympathetic fibers than the ulnar nerve, which may explain the increased risk for CPRS in clients with median nerve injury. Therefore, it is important to assess Don for vasomotor function (e.g., blotching of the skin), sudomotor function (e.g., abnormal sweating), pilomotor changes (e.g., absence of goose bumps), and trophic changes (e.g., atrophy of finger pulp or hair growth) because all of these signs are indicators of CRPS.

Prior to sensory testing, a history should be obtained through client interview and review of medical reports. The history should include information on name, age, hand dominance, gender, occupation, date of injury, nature of injury, client description of the sensory problem and how sensation affects functional hand use, screening of motor function, and grip and pinch tests, if appropriate. In addition, any medications the client takes that may interfere with sensation should be noted. Some examples are gabapentin, an antiseizure medication that is sometimes used to treat nerve pain, and chemotherapy medications, which may sometimes induce peripheral neuropathy.

The most accurate sensory evaluation requires an environment free of background noise, high-quality instruments, consistent testing techniques, cooperative clients, and competent testers. It is important to support the client's hand fully, positioning it with a foam wedge or towels to prevent it from moving because movement could provide sensory information that interferes with the test being administered (Fig. 23.4). For all sensory testing, the client's vision should be occluded. This is accomplished by asking the client to keep the eyes closed or by occluding the area by other means, such as with a manila folder (Fig. 23.5). A hand grid worksheet may be used to record the findings (Fig. 23.6).

FIG 23.4 The full forearm rests on a towel for sensory testing with a golf tee.

FIG 23.5 Vision occlusion during sensory testing behind a manila folder.

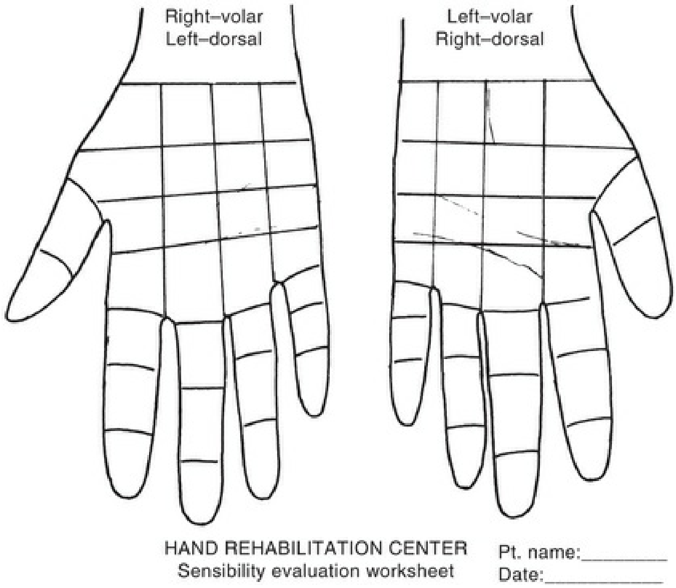


FIG 23.6 Hand grid worksheet. (From Mackin EJ, et al, editors: *Rehabilitation of the hand and upper extremity,* ed 5, St Louis, 2002, Mosby.)

Sensory screening is a time-saving method to determine some parameters of the sensory loss experienced. With hand screening, specific sites can be used to reflect larger portions of the hand innervated by the same peripheral nerve. For screening Don's median nerve function, test the thumb tip, index tip, and index proximal phalanx. For screening ulnar nerve function, test the distal and proximal ends of the small finger and the proximal ulnar aspect of the palm. For screening the radial nerve, test the dorsal part of the thumb web space (Fig. 23.7).[4] Screening may also be used for central nerves: for dermatome C5, test the anterior lateral elbow; test C6 on the dorsum of the thumb at the distal phalanx; test C7 at the dorsal middle phalanx of the long finger; test C8 at the dorsal middle phalanx of the small finger; and test T1 on the anterior medial elbow (Fig. 23.8).

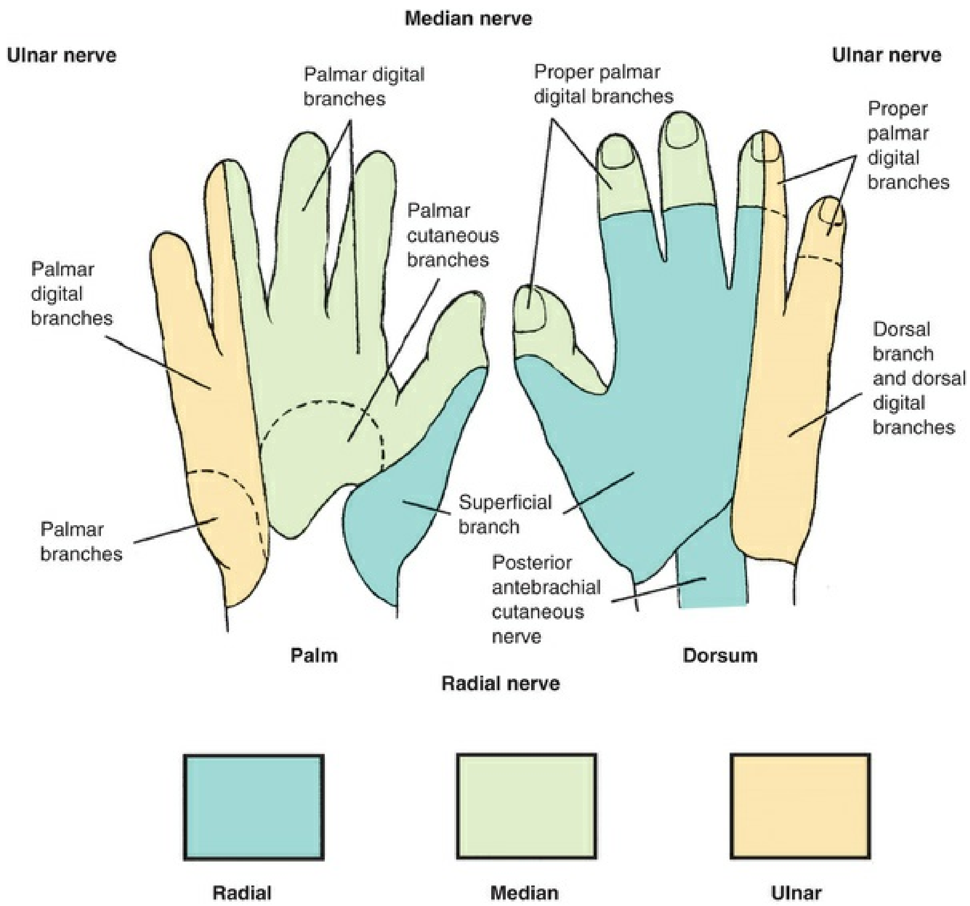
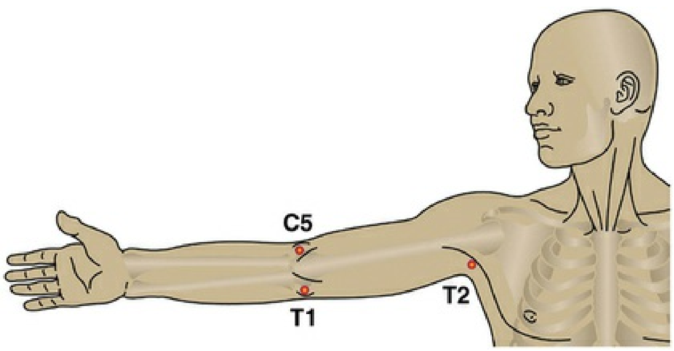


FIG 23.7 Sensory distribution of the hand. (From Trumble TE, Rayan GM, Baratz M: *Principles of hand surgery and therapy,* ed 2, Philadelphia, 2010, Saunders.)



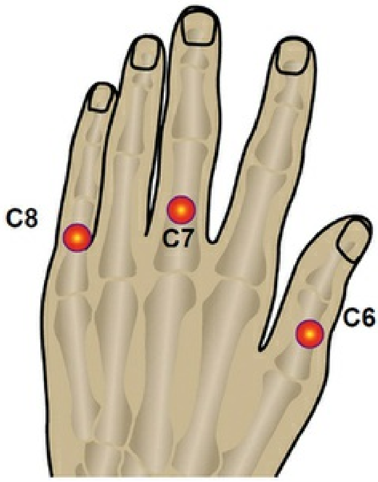


FIG 23.8 Key sensory points (International Standards for the Classification of Spinal Cord Injury). (Adapted from Neurological Classification of Spinal Cord Injury. American Spinal Injury Association: International Standards for Neurological Classification of Spinal Cord Injury, Atlanta, GA. Revised 2011, Updated 2015. Courtesy American Spinal Injury Association, Richmond, VA.)

Pain Sensation

Pain is an unpleasant sensory and perceptual experience that is associated with either actual or potential cellular damage. The experience of pain is subjective and multidimensional.[12] Pain can be tested by pinching the digit firmly or by using a sharp point, as with a golf tee or the end of a partially unwound paper clip. Recent practices caution that one should avoid traditional use of a safety pin in testing pain sensation so as not to draw blood and risk compromising tissue. Providers would need to follow Universal Precautions and use a new, sterilized safety pin with each patient to minimize the risk to the patient.

Intact pain sensation is indicative of available protective sensation. Sharp/dull testing, using both ends of a golf tee, would be an alternative method to rule out a digital nerve laceration. This could also be accomplished by use of a paper clip opened to expose one end (Fig. 23.9).

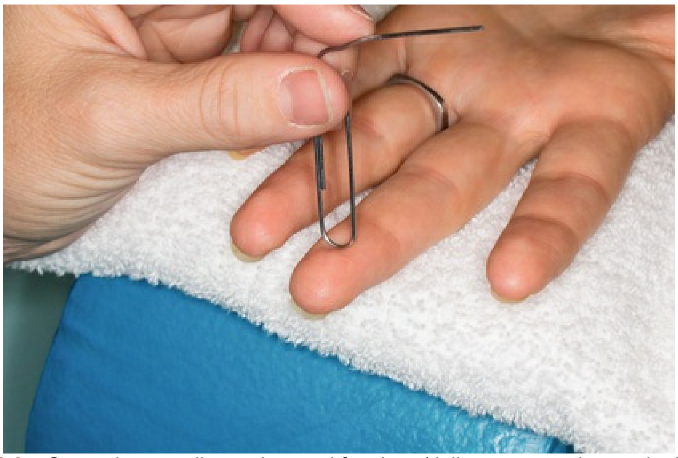


FIG 23.9 Opened paper clip can be used for sharp/dull sensory testing on the hand.

Test for pain (protective sensation)

Procedure

- Using a golf tee or an opened paper clip, assess the amount of pressure required to elicit a pain response on the uninvolved hand. This is the amount of pressure that the examiner will use on the involved side.

- Alternate randomly between the sharp and dull sides of the golf tee or paper clip and ensure that each spot has one sharp and one dull application (see Figures 23.4 and 23.9).

Response

- The client indicates "sharp" or "dull" after each application.

Scoring

- Intact protective sensation: Correct response to both sharp and dull
- Impaired protective sensation: Incorrect response to both sharp and dull
- Absent protective sensation: Inability to perceive being touched
- Hyperalgesic: Heightened pain reaction to the stimulus

Temperature Awareness

Temperature awareness is another test for protective sensation. Thermal receptors detect warmth and cold. In the clinic it is important to test temperature sensation before applying heat or cold modalities to avoid burn injuries. Thermal receptors are also critical for a person to be able to determine a safe water temperature for bathing. A client who lacks temperature awareness must learn compensatory strategies, such as testing the water temperature with an unaffected body part.

Test for temperature awareness (protective sensation)

Procedure

- Apply test tubes or metal cylinders filled with hot or cold fluid randomly to areas of the involved hand.

Response

- The client indicates "hot" or "cold" after each application.

Scoring

- A correct response to both cold and hot indicates intact temperature awareness.
- An incorrect response to either or both indicates impaired temperature awareness.

Testing for Touch Sensation

Two-point discrimination.

Two-point discrimination and touch pressure testing with monofilaments are two different tests examining various aspects of sensation. Two-point discrimination is a test for receptor density and is a good test to use for mapping improvement after nerve repair. Moving two-point discrimination returns before static two-point discrimination and is an indicator of recovery. One criticism concerns potential variability in the force of application during testing. Nonetheless, good interrater reliability has been reported with the Disk-Criminator tool.[24]

Test for static two-point discrimination

Procedure

- Use a device such as the Disk-Criminator or a Boley gauge with blunt testing ends (Fig. 23.10).

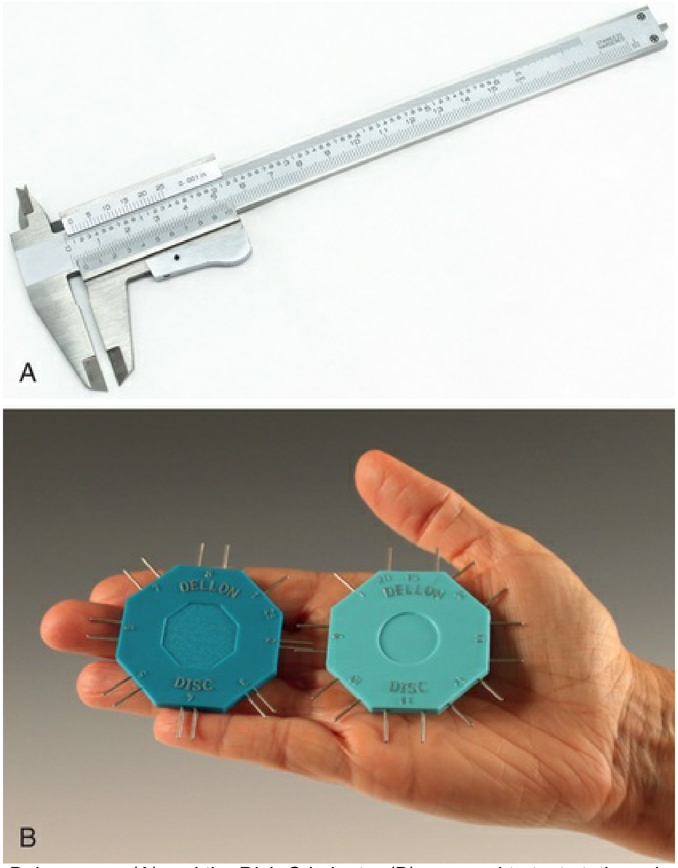


FIG 23.10 The Boley gauge (A) and the Disk-Criminator (B) are used to test static and moving two-point discrimination. (A, iStock.com; B, courtesy Danmic Global, San Jose, CA.)

- Test only the tip of each finger because the fingertip is the primary area of the hand used for exploration of objects.
- Begin with a distance of 5 mm between the testing points.
- Randomly test one or two points on the radial and ulnar aspects of each finger for 10 applications. Apply testing points parallel to the longitudinal axis of the finger so that the adjacent digital nerve is not stimulated (Fig. 23.11).

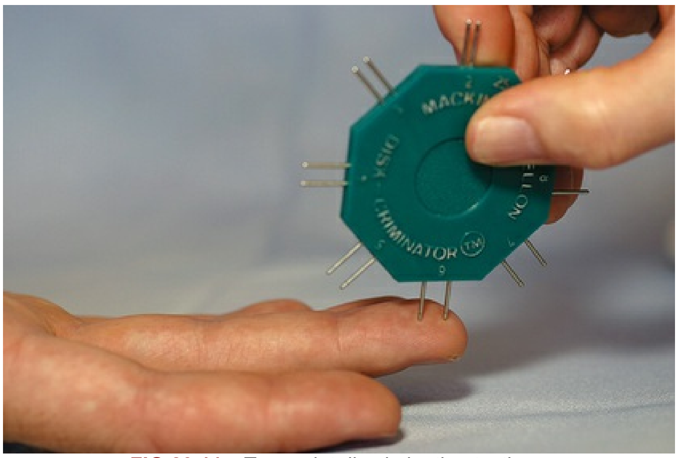


FIG 23.11 Two-point discrimination testing.

- Pressure is applied lightly; stop just when the skin begins to blanch.

Response

- The client will respond "One" or "Two" or "I don't know" after each application.

Scoring

- The client responds accurately to 7 of 10 applications at that number of millimeters of distance between the two points.
- Norms are as follows:

- 1 to 5 mm: Normal static two-point discrimination
- 6 to 10 mm: Fair static two-point discrimination
- 11 to 15 mm: Poor static two-point discrimination
- 1 point perceived: Protective sensation only
- No points perceived: Anesthetic area

Test for moving two-point discrimination

Procedure

- Begin with a distance of 8 mm between points.
- Randomly select one or two points. Move proximal to distal on the distal phalanx, parallel to the longitudinal axis of the finger, so that the adjacent digital nerve is not stimulated (see Fig. 23.11).
- The pressure applied is just enough for the client to appreciate the stimulus.
- If the client responds accurately, decrease the distance between the points and repeat the sequence until you find the smallest distance that the client can perceive accurately.

Response

- The client responds "One," "Two," or "I don't know."

Scoring

- The client responds accurately to 7 of 10 applications.
- Norms are as follows:

- 2 to 4 mm (ages 4 to 60): Normal moving two-point discrimination[17]
- 4 to 6 mm (ages 60 or older): Normal moving two-point discrimination[11]

Touch Pressure

Light touch is perceived by receptors in the superficial skin. Pressure (or deeper touch) is perceived by receptors in the subcutaneous and deeper tissues. Light touch is important for fine discriminatory hand use, whereas deep pressure is important as a form of protective sensation. Touch pressure testing examines the spectrum from light touch to deep pressure. Touch pressure testing is a good test to use for clients with nerve compression, such as carpal tunnel syndrome. Many practitioners test two-point discrimination and the touch pressure of their hand therapy patients in order to gain a more objective clinical picture and track progress. Having intact light touch pressure awareness is an indicator of better sensation than having only intact deep touch pressure awareness. Light touch pressure awareness has to be intact for two-point discrimination to be testable because the two-point discrimination test uses light touch.

Touch pressure is tested with a set of 20 monofilaments. The Semmes-Weinstein Monofilaments are often used in clinics, although there are various other brands of kits at this time. These monofilaments are of varying thickness and are marked with numbers that represent a mathematical formula of the force required to bow them when applied perpendicularly. They are color coded to correspond to five threshold categories. Practitioners will frequently use an abbreviated set of five monofilaments, one for each of these categories, often referred to as the mini-kit.

Test for touch pressure

Procedure (using full kit)

- Begin with monofilament 1.65.
- Apply the monofilament for 1 to 1.5 seconds at the pressure needed to bow the monofilament (applied perpendicularly) (Fig. 23.12).

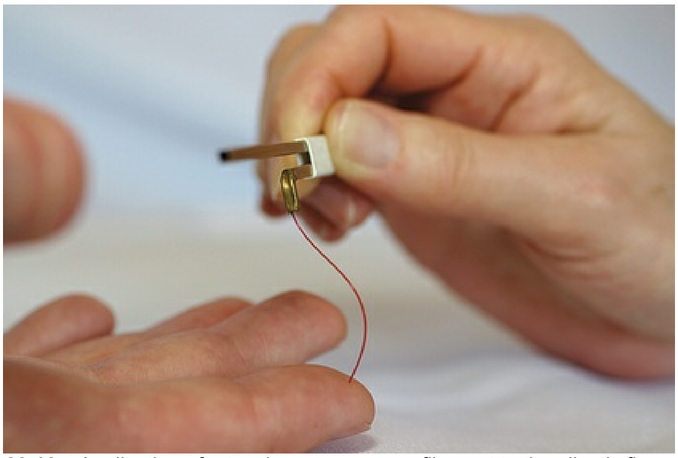


FIG 23.12 Application of a touch pressure monofilament to the client's fingertip.

- Hold the pressure for 1 to 1.5 seconds.
- Lift the monofilament in 1 to 1.5 seconds.
- The proper amount of pressure is achieved when the filament bends.
- Repeat this three times in the same spot for monofilaments 1.65 to 4.08; monofilaments higher than 4.08 are applied only once.
- Randomly select areas of the hand to test, and change the time interval between the application of monofilaments.
- If the client does not perceive the monofilament, proceed to the next (thicker) monofilament and repeat the sequence until you reach monofilament 6.65.
- If the client does perceive the monofilament, record this number on the hand grid and proceed to the next area of the hand.

Response

- The client says "Touch" when he or she feels the monofilament. The client does not need to localize or verbalize where the touch is felt on the hand.

Scoring

- The client responds to at least one of the three applications of the monofilament.
- Norms are as follows:

- Green (1.65 to 2.83): Normal light touch
- Blue (3.22 to 3.61): Diminished light touch

- Purple (3.84 to 4.31): Diminished protective sensation
- Red (4.56 to 6.65): Loss of protective sensation
- Untestable (6.65+): Inability to feel the largest monofilament

Alternate testing (using the mini-kit)

- When the mini-kit is used, the same procedure, response, and scoring as outlined above apply, but there is only one monofilament per threshold that corresponds to the five threshold categories.
- The five monofilaments used in the mini-kit are:

- Green (2.83), which indicates normal light touch
- Blue (3.61), which indicates diminished light touch
- Purple (4.31), which indicates diminished protective sensation
- Red (4.56 and 6.65), which indicates loss of protective sensation
- Untestable (6.65+), which indicates inability to feel the largest monofilament

Proprioception

Conscious proprioception derives from receptors found in muscles, tendons, and joints and is defined as awareness of joint position in space. It is through cerebral integration of information about touch and proprioception that objects can be identified by tactile cues and pressure. If proprioception is impaired, it may be difficult to gauge how much pressure to use when holding a paper cup.

Test for proprioception

Procedure

- Hold the lateral aspect of the elbow, wrist, or digit.
- Move the body part into flexion or extension (Fig. 23.13).

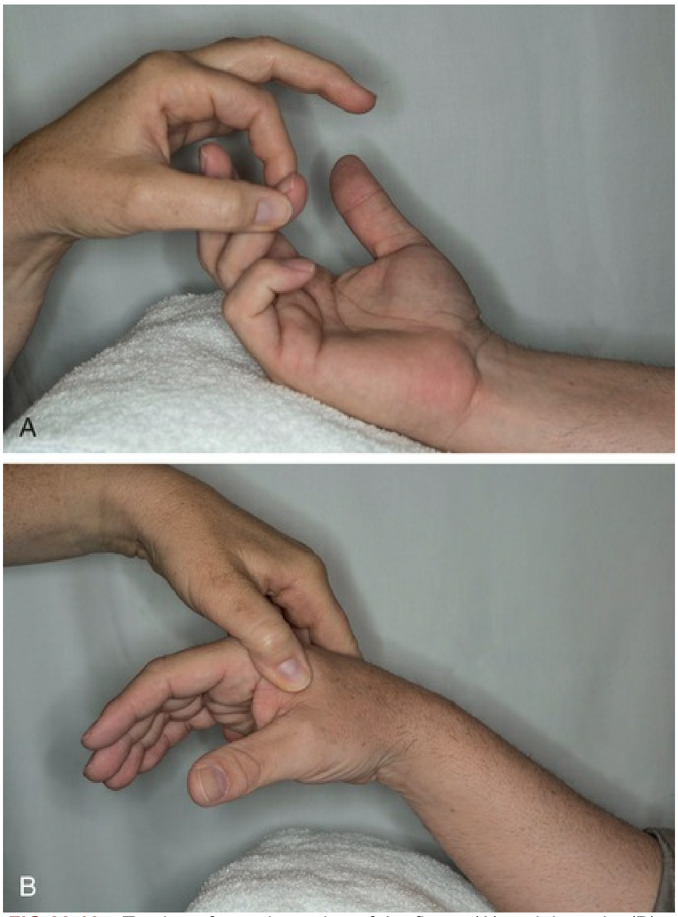


FIG 23.13 Testing of proprioception of the finger (A) and the wrist (B).

Response

- The client indicates whether the body part is being moved up or down, with "Up" and "Down" corresponding to the movement into either flexion or extension, depending on the joint. In the case of the wrist movements, "In" and "Out" may also be used for ulnar and radial deviation.

Scoring

- An accurate response indicates intact proprioception.

The term **kinesthesia** is sometimes used interchangeably with the term proprioception but can also be defined as awareness of joint movement. Some therapists make a distinction between these two terms and test for kinesthesia by moving the unaffected limb into a certain posture and having the client copy the movement with the affected side while the eyes are closed.

Stereognosis

Stereognosis is the use of both proprioceptive information and touch information to identify an item with the vision occluded. Without stereognosis, it is impossible to pick out a specific object such as a coin or a key from one's pocket, use a zipper that fastens behind you, or pick up a plate from a sink of sudsy water.

The Dellon modification[9,10] of the Moberg Pickup Test[22] is a good test for stereognosis for clients with injuries involving the median and/or ulnar nerves. This test requires the client to have the ability to participate motorically, so motor loss or weakness should be factored into the choice of this assessment. This test is based on the Moberg Pickup Test, which is a timed motor test that does not require identification of objects.[22]

Dellon modification of the Moberg Pickup Test

Procedure

- Begin with a group of 12 standardized items: wing nut, large nut, hex nut, small square nut, screw, key, nickel, dime, washer, safety pin, paper clip, and nail.
- If the ulnar nerve is not involved, tape the ulnar two fingers to the client's palm if possible.
- Test 1

- The client places the items one at a time into a box as quickly as possible (Fig. 23.14).

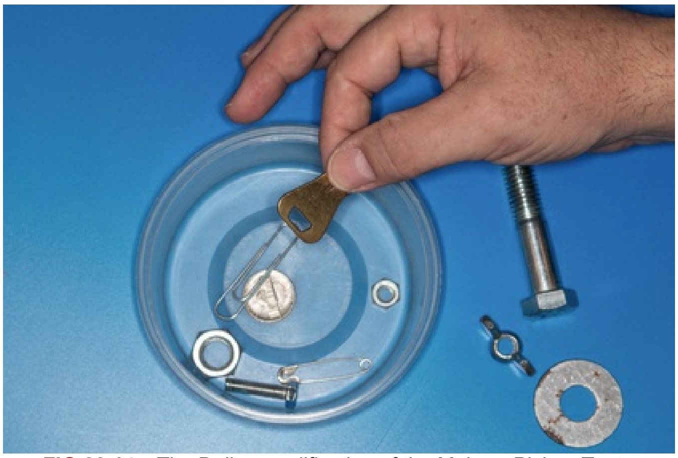


FIG 23.14 The Dellon modification of the Moberg Pickup Test.

- Record the time for two trials.

- Test 2 (initiate test 2 only if the client's deficits do not appear to be too severe during test 1).

- With the client's vision occluded, the examiner places the items into the client's radial three digits one at a time.

- The examiner records the time that it takes to identify each item, with a maximum of 30 seconds for each item.

- Each item is placed in the client's hand two times.

Response

- Test 1: The client places the items in a box as quickly as possible with the radial three digits.
- Test 2: The client manipulates the objects and attempts to identify them as quickly as possible.

Scoring

- Test 1: The time that it takes to place all the items in the box.
- Test 2: The time that it takes to identify all the items.

Localization of Touch

Localization of touch is considered to be a test of functional sensation because there is a high correlation between this test and the test for two-point discrimination. Localization of touch is an important test to perform after nerve repair because it helps determine the client's baseline and projected functional prognosis. This test can be done with a constant (static) touch or a moving touch. Localization of touch is higher order and processed in the cerebral cortex. Because it is considered to be a test of tactile discrimination that requires cortical processing, it is different from touch pressure testing.

Test for localization of touch

Procedure

- Apply the finest monofilament that the client can perceive to the center of a corresponding zone on the hand grid.
- Once the client feels a touch, have him or her open his or her eyes and use the index finger to point to the exact area where the stimulus was felt.
- Place a dot on the hand grid for a correct response.
- Place an arrow from the site of the actual stimulation to the identified site if the stimulus is identified incorrectly.

Response

- The client attempts to identify the exact location of a stimulus.

Scoring

- Correct identification of the area within 1 cm of actual placement indicates intact touch localization.[4]

Desensitization

The existence or persistence of hypersensitivity will often limit use of the affected body part and may prevent sensory reeducation from proceeding, so it is important to address this problem early, if possible, as in the case of Mario, who will need to adjust to his amputated fingertips prior to regaining full functional hand use. Desensitization for hypersensitivity is a form of treatment that aims to elicit habituation and thereby reduce the client's hypersensitivity and improve function. **Habituation** is a decrease in a response after repeated benign stimuli. There is a reduction in the excitatory neurotransmitters released, and if the stimulation continues over a prolonged period, a permanent alteration will occur, consisting of a reduction in the number of synaptic connections.[5]

Desensitization uses graded stimulation with procedures and modalities that can be slightly aversive but tolerable. The stimuli are upgraded to be slightly more noxious as the client's tolerance increases.[31] Lois Barber, an occupational therapist and pioneer in hand splinting and hand therapy, developed a desensitization approach that exposes the hypersensitive area to textures such as sandpaper, contact particles (e.g., rice), and vibration.[3] Treatment is performed for 10-minute intervals, three or four times a day. Clients can incorporate desensitization into their daily routine. For example, they may find that rubbing the hand on their textured shirt or denim pants is desensitizing and can be performed easily throughout the day.

Sensory Reeducation

Stimulation and use of a body part affect the cortical map.[21] The passage of time, use of the involved hand, and training all help promote improved functional sensibility.[13] Children have greater capacity for neural regeneration and neuroplasticity than older people do. Motivation and the ability to concentrate enhance the results of sensory reeducation. Sensory reeducation has been shown to improve the sensation of fingertip replantations even without repair of the nerves.[24] There are two types of clients who may benefit from sensory reeducation: those who require reeducation to compensate for the dangers associated with sensory loss and those who may need to effect change on nervous systems that are either hypersensitive or more dormant. These two groups are candidates for instruction in compensatory strategies for sensory loss and candidates for discriminative sensory reeducation.

Compensatory Strategies for Sensory Loss

People who lack protective sensation are at risk for serious injury because they cannot feel pinprick or hot or cold exposure. Blisters may develop after holding hot objects with people not realizing this until they visually examine the hand or notice the stench of burning flesh. After a CVA a person with left hemiparesis and left neglect may inadvertently move the left hand on top of a stove burner during a cooking task. If the client lacks protective sensation, he or she will be burned without feeling the painful sensory stimulus of the hot stove. A person such as Don is at risk for getting fingers caught in the spokes of his wheelchair due to the lack of protective sensation in his first three digits. The same frequently happens to individuals with C6 quadriplegia. Protective sensation in their thumb, index finger, and long finger may be intact, whereas sensation in their ring and little fingers is absent.

Callahan[8] identified the following instructions for compensatory strategies for sensory loss, which she refers to as protective sensory reeducation:

- Protect from exposure to sharp items or to cold or heat.
- Try to soften the amount of force used when gripping an object.
- Use built-up handles on objects whenever possible to distribute gripping pressure over a greater surface area.
- Do not persist in an activity for prolonged periods. Instead, change the tool used and rotate the work task often.
- Visually examine the skin for edema, redness, warmth, blisters, cuts, or other wounds. This is important because tissue heals more slowly when a nerve injury has occurred.
- If there is tissue injury or damage, be very careful in treating and try to avoid infection.
- Maintain skin suppleness as much as possible by applying moisturizing agents.

Discriminative Sensory Reeducation

Clients are candidates for discriminative sensory training if they have intact protective sensation with recognition of at least 4.31 on the touch pressure monofilament test. A client such as Don, who is not able to localize the stimulus but can feel it is still a candidate for discriminative sensory reeducation, as is a client with hypersensitivity, such as is the case with Mario. A client with a brain insult or nerve injury resulting in reduced discriminative sensation will be unable to fasten a bra in the back, manipulate a clasp on a necklace, or locate a wallet in a bag or pocket with the vision occluded. Discriminative sensory reeducation is graded by initially using grossly dissimilar objects, such as a spoon and a penny, and progressing over time to more similar objects, such as a dime and a penny.

When planning discriminative sensory reeducation intervention, it works best to identify short-term goals that are achievable and that will enhance function despite the sensory loss. If the client has motor involvement and cannot manually manipulate the stimulus, the stimulus can be moved over the hand instead. Discriminative sensory reeducation involves training in both localization and graded discrimination.

Localization

Localization of moving touch tends to return before localization of constant touch. Retraining is done for both. With the client's eyes closed, the eraser end of a pencil or the therapist's finger is used to touch the client's hand in the midline of one zone of the hand grid. This makes documentation easier and the intervention more accurate and consistent and minimizes afferent activity from adjacent areas of the skin. The stimulus is applied with either a moving or a constant touch. The client is told to open his or her eyes and point to the area that was touched. It has been shown that activity in the visual cortex is enhanced when touch of the hand is added to the visual stimulation, as long as the touch is provided on the same side as the visual stimulation.[30] If the answer was incorrect, the process is repeated. The steps are repeated again with the eyes closed. The full process is then repeated in a new area. As the client improves, the stimulus is changed to a lighter and smaller touch.

Graded Discrimination

Stimulation is graded from that requiring gross discrimination to that requiring fine discrimination. Levels of difficulty in discrimination are represented by sequencing of the following three categories: (1) same or different, (2) how they are the same or different, and (3) identification of the material or object.

The stimulus is applied to the skin in an area corresponding to the hand grid. Either the hand or the stimulus is moved to provide input. As earlier, the eyes are closed, then opened, and then closed for the retraining steps. Various textures can be used, such as different grades of sandpaper or fabric, or objects such as nuts and bolts or coins (Fig. 23.15). When using various textures as the stimulus, instruct the client to rub five different textures along the numb or hypersensitive areas for 2 minutes each, watching what he or she is doing for the first minute and then closing the eyes for the second minute.

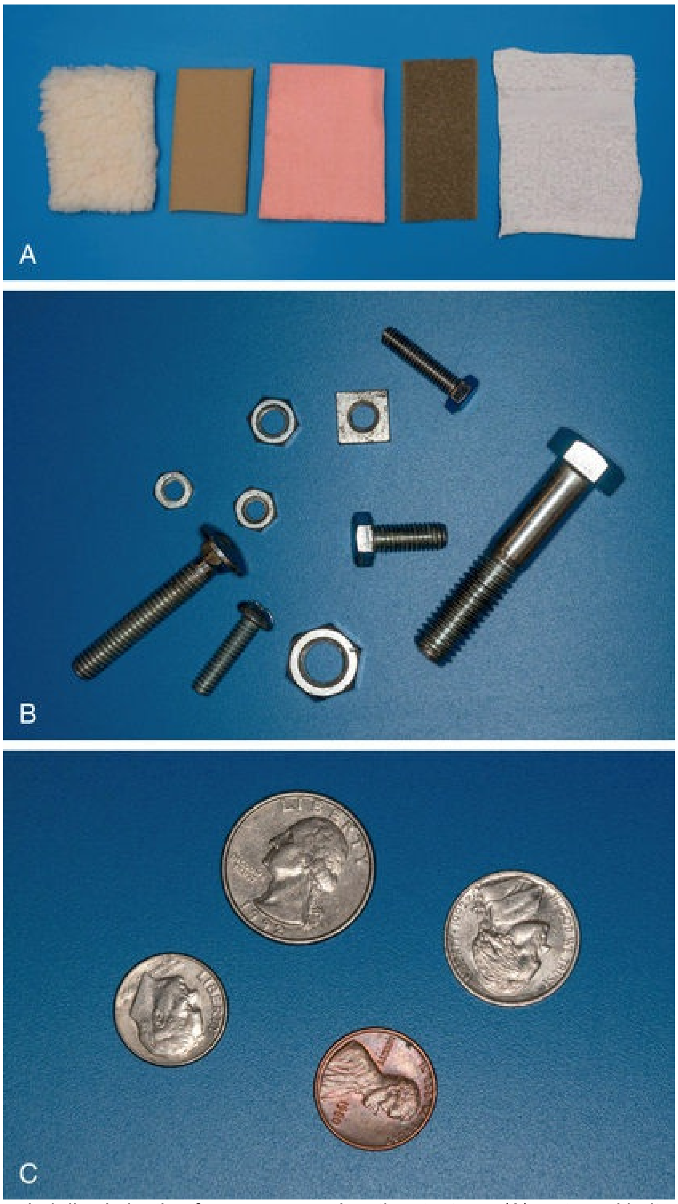


FIG 23.15 Graded discrimination for sensory reeducation: textures (A), nuts and bolts (B), and coins (C).

Another version of discriminative training involves tracing a geometrical shape or a letter or number on the fingertip or small area of the hand. This can be done with a fingertip, the end of an instrument such as a small dowel, or a pencil eraser. The client tries to identify the figure.

Difficulty is increased by adding the requirement of in-hand manipulation for motor stimulation if appropriate and by occluding the vision. Discriminative training can include identifying objects out of a box, retrieving objects from rice or sand, or performing ADLs with the eyes closed. Progress can be determined by improvement in the number of accurate responses, better mapping of areas of localization, increased speed of completing motor tasks, better status of two-point discrimination, and improved level of function involving ADLs overall.

Cortical Reorganization

Occupational therapists can use graded motor imagery to affect cortical reorganization. **Graded motor imagery** is a treatment regimen that includes interventions such as mirror visual feedback, imagined hand movements, and laterality training.[23]

In their studies, Ramachandran and Rogers-Ramachandran[26] speculated that PLP after amputation results from a disruption of the normal interaction between motor intention to move the limb and the absence of appropriate sensory or proprioceptive feedback to complete that motor task. The authors proposed that visual feedback may interrupt the pathologic cycle between the motor intention and sensibility. They developed a process by which a mirror could be used to superimpose an image of the normal limb on the location where the individual "felt" the phantom limb. Clinical observation and functional imaging studies were examined in subsequent research.[14] Based on these studies, Harris[15] hypothesized that disorganized cortical representations may lead to the experience of peripheral pain or sensory disturbances based on a disconnect between motor intention and proprioceptive or visual feedback.

Mirror therapy, one of the treatment techniques used by OTs, is based on this research. In mirror therapy the client positions the hands on either side of a mirror so that the affected hand is placed in back of the mirror and the nonaffected hand is placed in front of it; all of the client's attention is focused on the image in the mirror (Fig. 23.16).[19,29] Mirror therapy can be incorporated into treatment of sensory dysfunction by placing the same textures or simple items (e.g., coins, beans, or foam pieces) in front of and behind the mirror. The client (as in the case of Mario, who experiences PLP in his distal fingers) is then coached by the therapist to use both hands simultaneously to stimulate bilateral sensory receptors with attempts to affect cortical remapping. If pain in the affected hand precludes the client's ability to complete the task, then an imagined hand movement technique should be incorporated: the affected hand would not move beyond the limits of pain, but the unaffected hand would continue with the task. and the client's attention would continue to focus on the mirror.

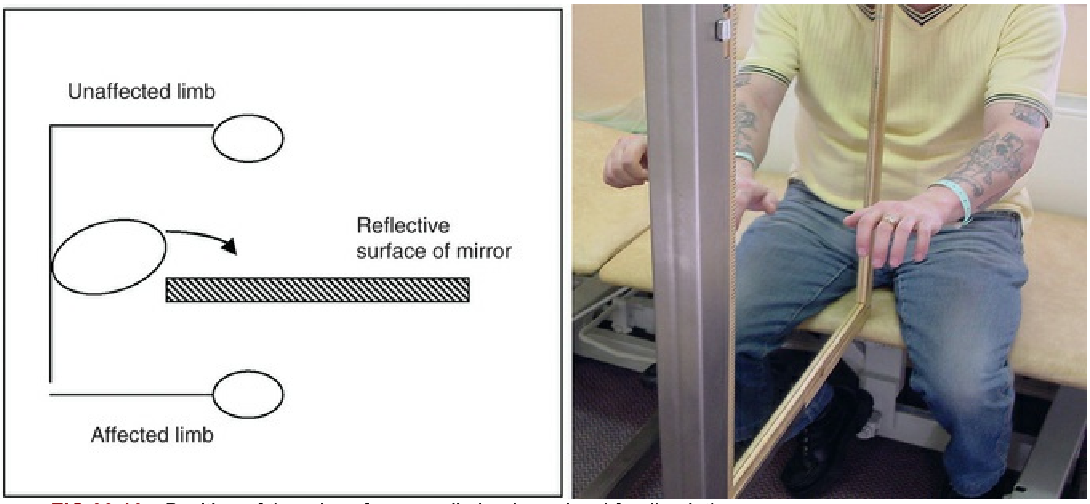


FIG 23.16 Position of the mirror for upper limb mirror visual feedback therapy. (From McCabe C: Mirror visual feedback therapy: a practical approach, *J Hand Ther* 24:171–178, 2011.)

Reinersmann et al.[27] studied limb laterality recognition tasks for their effect on the lateralization of the somatosensory system of the cerebral cortex.[27] The authors based their study of this use of the intervention on the assumption that cortical body representation becomes disrupted in disease states such as CRPS and PLP, resulting in a change in the client's body schema. They showed that there were delayed reaction times and higher error rates, compared to healthy subjects, when the client was presented with pictures of right and left hands and asked to identify the laterality of the limb (Fig. 23.17).[25] After a 4-day training course, both the healthy subjects and the clients with CRPS and PLP improved in their reaction time in the laterality recognition task. From studies such as these a connection can be drawn between the dysfunction in lateralization in the somatosensory cortex and various disease processes that affect sensation, such as CRPS and PLP. Because improvements in laterality recognition can be visualized through various treatments, as shown in these studies, this may indicate the possibility that laterality recognition training may lead to cortical reorganization.

FIG 23.17 The Recognise Hand Flash Cards (Noigroup Products; *https://www.noigroup.com*) are examples of laterality training cards. The pictures demonstrate different positions of the right and left hands. (From Priganc VW, Stralka SW: Graded motor imagery, *J Hand Ther* 24:164–169, 2011.)

Summary

Now, using the information provided in this chapter regarding the evaluation of sensation and the determination of appropriate OT intervention for sensory dysfunction, review the application of this knowledge to the two case studies presented.

Threaded Case Study

Don, Part 2

The most appropriate sensory tests for Don would be touch pressure, two-point discrimination, and the Dellon modification of the Moberg Pickup Test. Assess for touch pressure first because light touch must be intact for two-point discrimination to be tested. The Dellon modification of the Moberg Pickup Test is particularly appropriate for Don because it tests sensory function of the digits that carpal tunnel syndrome is affecting. Those digits, including the thumb, index, long, and radial aspect of the ring finger, are generally used for fine motor coordination in picking up small objects such as medications and pinching the rim of his wheelchair. Don is a good candidate for discriminative sensory reeducation to stimulate neural recovery. In order to simulate grasping the rims of his wheelchair with a lateral pinch without the need for his vision to assist, Don could practice identifying objects out of a bowl of rice with his eyes opened and then eyes closed. He could also work to find and pinch marbles or small pegs out of Theraputty with the use of his vision and with his vision occluded. Tell Don that typical recovery after successful carpal tunnel release includes decreased hypersensitivity as the desensitization program progresses. The common progression of recovery is improved pain, followed by reduced numbness, and then diminished tingling sensation. Sensory disturbances after a carpal tunnel release may take several months to fully recover. The OT should assess whether progress has been made since before surgery and would provide intervention if the progress is delayed or if there is an unintended negative outcome, such as hypersensitivity. Progress should be assessed on each visit, although threshold testing may not demonstrate significant gains at each testing, especially when the mini-kit is used.

Don should expect improving ability to feel and manipulate small objects as sensory recovery proceeds proximally to distally, with the fingertips being the last to recover. Deeper pressure will be felt before lighter pressure, and it will be easier to discern a nickel before he can discern a dime with his vision occluded; this will progress as two-point discrimination improves. Given Don's unique situation of using a wheelchair for all functional mobility, he must take special care to avoid weight bearing on his hands whenever possible so as not to further irritate the surgical site at the carpal tunnel. He may benefit from wearing a prefabricated wrist cock-up orthosis, which has a metal insert along the carpal tunnel and through the volar wrist to provide both support and a barrier during obligatory weight bearing for transfers and functional mobility.

Threaded Case Study

Mario, Part 2

In applying new knowledge of sensation to Mario's case, we note that several of his occupational leisure roles involve the use of significant tactile sensibility. This includes manipulating tools for woodworking to grade the pressure that he is applying with his grip, or the need to feel the texture of grapes in his fingertips during wine making. Sustaining a grasp on the steering wheel can be painful with the altered PLP in his residual digits, which causes Mario to choose not to drive to the dance hall and thereby eliminates one of his favorite occupations of dancing with his wife. An OT can incorporate purposeful activity into Mario's treatment plan to enhance sensory perceptual skills by having Mario bring some of his tools for woodworking or wine making to therapy. The therapist can work with Mario to determine whether there are activity modifications or compensatory strategies that can be implemented to allow him maximal functional independence in these tasks. Types of treatment methods that may be incorporated to improve the remapping of

Mario's brain to connect him with his partially amputated fingers once again include mirror therapy and laterality recognition cards.

Review Questions

1. Describe how the PNS and the CNS are connected and ways that sensory testing differs between the two.
2. Explain why the fingertips have enhanced sensation compared with more proximal body parts.
3. Name three signs that represent altered sympathetic nervous system status.
4. Explain how desensitization works.
5. What are the three categories of sensory reeducation and how do they differ?

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24

Evaluation and Treatment of Visual Deficits After Brain Injury

Mary Warren

CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Describe the role vision plays in enabling a person to complete daily occupations.
2. Describe the components of the visual perceptual hierarchy as a framework for assessment and treatment of visual processing impairment.
3. Describe how to use evaluation results to establish an intervention plan.
4. Describe the changes that may occur in visual acuity, visual field, oculomotor control, visual attention, and visual scanning in adults after an acquired brain injury.
5. Select appropriate assessments to screen visual acuity, visual field, oculomotor control, visual attention, and visual scanning in adults with acquired brain injury.
6. Identify preparatory tasks and methods, activities, and occupation interventions to address visual processing deficits in adults with an acquired brain injury.
7. Describe the role of the occupational therapist on the rehabilitation team addressing visual impairment in an adult with an acquired brain injury.

KEY TERMS

Binocular vision
Convergence insufficiency
Diplopia
Hemiinattention
Oculomotor control
Paralytic strabismus
Pattern recognition
Sensory fusion
Visual acuity
Visual attention
Visual cognition
Visual field deficit (VFD)
Visual fields
Visual memory
Visual neglect
Visual perception
Visual perceptual hierarchy
Visual scanning or search

Threaded Case Study

Penny

Penny Periwinkle, age 70, sustained a right cerebrovascular accident (CVA) from a posterior cerebral artery occlusion. She also has a 5-year history of adult-onset type 2 diabetes mellitus. The stroke caused a left homonymous hemianopia and possible hemiinattention. Penny's ophthalmologist referred her to University Low Vision Rehabilitation Clinic because Penny stated that since her vision loss, she has been unable to read or drive. Penny is also a well-known local artist, famous for her detailed ink drawings of local architecture, and she is no longer able to engage in this occupation. Penny has been married for 45 years. She has one son who lives several states away and no other family in the area. Her husband, Pot, sustained a severe stroke 5 years ago. Pot has right hemiplegia and global aphasia and requires assistance for all daily activities. Penny is his primary caregiver. Penny describes herself as fiercely independent, and she has refused outside help in caring for Pot. She faces significant challenges continuing in her roles as caregiver and artist.

Critical Thinking Questions

1. How does a left homonymous hemianopia limit Penny's ability to perform reading, driving, and other daily occupations?
2. Does Penny actually have hemiinattention, or does she have an uncompensated left hemianopia?
3. What intervention approaches can be used to increase Penny's independence and participation in daily occupations?

Role of Vision in Daily Occupations

Vision is the primary way the brain engages and learns from the world.[90] We use vision to explore the environment for resources and threats and then use the information we acquire to make decisions about how to complete our daily occupations and respond to the events occurring around us. We rely on vision because the visual system provides an efficient conduit for bringing information into the brain, and it offers certain attributes that provide us with the capability to rapidly assess and make decisions about our environment.

- *Vision is our most far-reaching sensory system and takes us farther into the environment than any of our other senses.* We can see lightning before we hear thunder; see a car careening toward us before we hear the squeal of the tires or smell the exhaust. By warning us of changes in our environment, vision enables us to *anticipate* developing situations and formulate a plan to handle them and achieve a successful outcome. So when an object is unexpectedly flung in our direction, we duck, or when we see the banana peel on the floor, we walk around it.
- *Vision can rapidly convey large amounts of detailed information.* Vision is a truly integrative sense in that it provides us with all the information we need to identify the objects in our environment and size up situations. Using vision we can instantly recognize objects, but we require more time to identify them by touch or by hearing a verbal description. Because we can rapidly get a complete picture using our visual system, we prefer the visual medium when we need to size up situations quickly and completely. This explains the popularity of television as a medium for conveying information and why we rush to watch TV when we hear about the unfolding of a significant event, such as the attack on New York City on September 11, 2001.
- *Vision provides the processing speed we need to adapt to dynamic environments.* We operate in two types of environments: static and dynamic. In static environments we are the only object moving in the room. This removes the temporal (eg, timing) requirement for an activity; we can decide when to start and stop movement and how long to take to complete an activity. In contrast, dynamic environments contain objects moving independently of us. This added temporal requirement requires us to simultaneously monitor our own movement and that of other moving objects, and only vision provides the processing speed we need to either interact with moving objects or avoid them.

Because of these attributes, we use vision as our primary interface with the world to guide how we respond to our surroundings. We rely on vision to size up situations. We say to ourselves, “He looks harmless,” or “That looks delicious.” Our language is peppered with phrases that reflect the importance of vision in decision making, such as, “I'll believe it when I see it,” “I'll keep an eye out for it,” or “I can see what you mean.” We rely on vision for social communication, using it to detect and respond to the subtle gestures and facial expressions of our companions and to understand the emotional nuance in conversations. Vision also plays an important role in our ability to safely navigate environments by warning of upcoming obstacles, such as a curb or broken pavement, and our motor actions are often driven by what we see. For example, you may be dedicated to your diet until you see the plate of donuts sitting on the table and find yourself reaching for one.

The takeaway message is that “vision rules!” It is the primary way we acquire information; it dominates our daily occupations, including recreational activities (think of life without Facebook and YouTube, watching or playing sports, or completing crafts); and it provides us with the ability to participate in dynamic, unpredictable activities, such as driving. Research has shown that even mild vision impairment from brain injury can significantly disrupt a person's life, and significant visual impairment can be devastating.[28,113]

Brief Overview of Visual Processing in the Brain

For vision to be used for occupation, the raw material of vision (eg, the pattern of light that falls on the retina) must be transformed into images of the surrounding environment that can be compared with stored visual memories and used to make decisions and respond to unfolding events. The visual processing journey encompasses many areas of the brain. Along the way, visual input is sorted out, refined, and combined with other sensory input to provide a product that can be used for adaptation.[10,53,16-68,138] The process begins in the anterior visual system, where the structures of the eye focus light rays onto the photoreceptor cells of the retina. The photoreceptor cells record the patterns of light and convey this visual input over the optic nerve and tract to the lateral geniculate nucleus (LGN; also called the lateral geniculate body) of the thalamus[10,68] (Fig. 24.1).

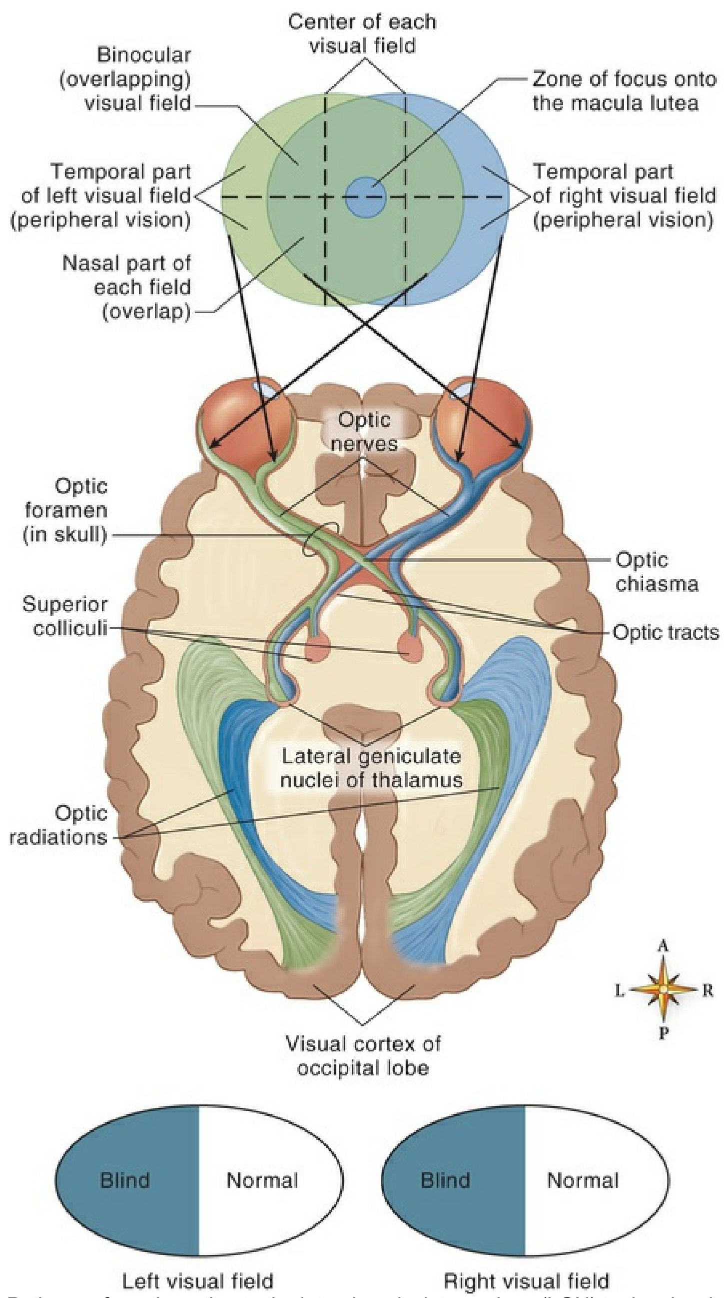

FIG 24.1 Pathways from the retina to the lateral geniculate nucleus (LGN) to the visual cortex. The reddish shaded areas show the pathway conveying visual field information—from the left half of the visual space surrounding the person—from the retina to the occipital lobe in the right hemisphere. The blue shaded areas show the pathway conveying visual field information—from the right half of the visual space

surrounding the person—to the occipital lobe in the left hemisphere. The top of the diagram shows how the visual fields of each eye overlap to provide a binocular field. The far ends of the field retain their individual color to show how the far peripheral field can be seen only by one eye because the nose occludes the other eye's view. (From Patton K, Thibodeau G: *Anatomy and physiology*, ed 9, St Louis, 2016, Elsevier.)

The optic nerve conveys visual input from just one eye. However, at the optic chiasm, the nasal fibers of the optic nerves cross over to the other side, and the temporal fibers continue on a straight pathway. This newly merged visual input from the two eyes continues on toward the LGN, traveling along the optic tracts. Because of this arrangement, when the optic tracts reach the LGN, they are providing visual input from the same hemifield in each eye. Thus, the right LGN receives images from the left half of the visual field in both eyes, and the left LGN receives images from the right half of the visual field in both eyes.[10,68] From the LGN, visual input representing one half of the visual field in each eye travels over the geniculocalcarine tracts (GCTs) to the primary visual area of the occipital lobe (the visual cortex).[68] Information from the left half of the visual field is conveyed over the GCT in the right hemisphere to the right occipital lobe, and information from the right half of the visual field is conveyed over the GCT in the left hemisphere to the left occipital lobe.

Penny's stroke occurred from an occlusion in the posterior cerebral artery feeding the right hemisphere of the brain. Consequently, the GCTs in the right hemisphere were damaged, and Penny developed a left *homonymous hemianopia.*

The visual input that enters the cortex through the calcarine fissure of the occipital lobe is used to build and maintain a library of images in the posterior cortical areas of the brain; the prefrontal areas of the cortex will draw on these posterior areas to make decisions, direct actions, and achieve goals.[51] As visual input enters the primary visual cortex, this area of the occipital lobes sorts through the incoming visual information, sharpening and fine-tuning visual detail, and then disperses this information to the posterior areas of the temporal and parietal lobes.[51,66,68,117] The posterior temporal lobe combines visual details with language and auditory input to visually identify objects.[55,66] The purpose of this processing is to answer the "what" question, as in "What am I looking at?" The posterior areas of the parietal lobe integrate vision with input from all the other senses to create internal sensory maps, which are used to orient the body in space.[11,55,66,67] Visual information processed in the posterior parietal lobe answers the "where" questions by tuning in the brain to the presence of objects surrounding the body and determining their spatial relationship to the body and to each other.[53] The sensory maps of the posterior parietal lobes are body centered and dynamic, changing in shape and content as the body moves through space.[11,21,92]

The prefrontal areas, which function as the chief executive officer of the brain, use the visual library created by the occipital lobes and posterior temporal and parietal lobes to make decisions and formulate plans.[53] The frontal eye fields, in the prefrontal lobes, direct voluntary visual search of the environment based on an expectation (memory) of where the key visual information will be found.[53,82] For example, if you were looking for a light switch in a room, your frontal eye fields would direct your visual search toward the walls because that is where you expect to find a light switch. You would not waste time searching the floor or the ceiling. Directing visual search based on the expected location of crucial visual information enables the prefrontal lobes to quickly process visual information, and it gives a person the ability to successfully engage in activities that require rapid response to visual input, such as driving or walking down a busy street. The prefrontal lobes are also responsible for directing working visual (spatial) memory.[53,140] Working memory is the ability to hold more than one piece of information "on deck" in memory and ready for immediate recall to assist in completing a task.[53] Working visual memory is the specific ability to hold a picture of an object and its location in mind while completing a task.[53] We use working memory to stay on task while completing activities. An example of working visual memory would be holding a picture of a specific brand of canned tomatoes and its location in the grocery aisle in the mind's eye while shopping for the ingredients to make chili. It is "working" memory in the sense that once you accomplish the task, you let go of the memory of the tomatoes and replace it with the next item on your list.

The brainstem and cerebellum also process visual information and contribute to the ability to use vision for daily activities.[82,147] The brainstem contains several important centers involved in visual processing. It works independently of the cortex to control basic visual functions, such as the light (pupillary) reflex, blink response, and accommodation reflex.[68,82] The superior colliculi, in the midbrain of the brainstem, are responsible for detecting moving visual stimuli that appear in the peripheral visual fields.[68,82] When motion is detected, the superior colliculi automatically initiate eye movement toward the direction of the detected motion. In performing this function, the superior colliculi serve as an early warning system to prevent the brain from being caught off guard by events occurring in the environment. The brainstem works in conjunction with the cortex and cerebellum to control other visual functions, most notably executing eye movements and focusing.[82,147]

The motor nuclei of cranial nerves (CN) III, IV, and VI, which control the extraocular muscles and move the eyes, are located in the brainstem. These cranial nerves are under the control of the brainstem, cortex, and cerebellum.[82,147] The cortex uses eye movements to shift attention to objects in the environment and fixate on critical details needed to complete a task. The cerebellum adds synergy to eye movements to ensure that the eye lands precisely on the target so it can be clearly seen. Finally the brainstem houses the vestibular nerve nuclei and many pathways that integrate the vestibular system with eye movements to provide gaze stability during movement.[82]

It is important to remember that the many brain areas that contribute to visual processing must work together for a person to make sense of what is seen and thus use visual information to adapt.[53,66,92,117] Millions of long and short neural fibers (eg, white matter pathways) tie the various cortical and subcortical structures together, forming a complex network that produces effective and efficient visual processing.[48] Just as in a car the fuel-injection system is as crucial to performance as the spark plugs, visual processing will not be completed efficiently unless all its components are working together. Brain injury disrupts communication within the system and creates gaps in the vision network. The specific type of visual deficit that occurs after brain injury depends on the area or areas of the brain affected by the injury and whether the injury caused structural damage to the brain or damaged the pathways that connect brain areas.[156] Moderate to severe brain injuries often cause structural damage to brain areas, which recover more slowly, whereas mild (concussive) injuries cause more shearing and disruption of the white matter pathways connecting the network, and these may recover more quickly.[28,156]

Process for Evaluation and Intervention

Hierarchical Model of Visual Processing

The ability to use vision to adapt to the environment requires the integration of vision within the brain to transform the raw data supplied by the retina into cognitive concepts (rules) that enable us to interpret and understand the visual world. Visual perceptual processing can be conceptualized as an organized hierarchy of visual processes and functions that interact with and subserve each other.[158,159] The **visual perceptual hierarchy** (Fig. 24.2) consists of visual cognition (visuocognition), visual memory, pattern recognition, visual scanning, and visual attention. These perceptual processes are supported by three basic visual functions that form the foundation of the hierarchy: oculomotor control, **visual fields**, and visual acuity. In the hierarchy, each process is supported by the one that precedes it and cannot properly function without integration of the lower level process. Thus, the ability to use **visual perception** to adapt is the result of the interaction of all of the processes in the hierarchy in a unified system. Although each perceptual process is discussed individually in this section, the reader should remember that the ability to use vision for daily activities requires that the processes work in synergy. Although discrete perceptual processes can be identified, they do not operate independently of one another.

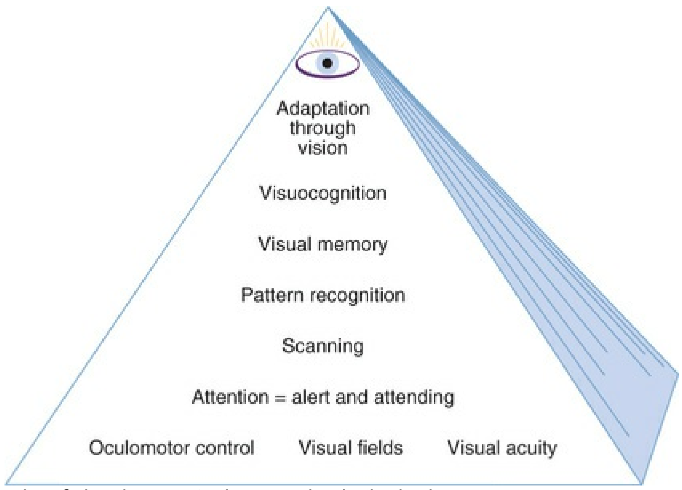

FIG 24.2 Hierarchy of visual perceptual processing in the brain. (From Warren M: A hierarchical model for evaluation and treatment of visual perceptual dysfunction in adult acquired brain injury. *Am J Occup Ther* 47:55–66, 1993.)

The highest order process in the hierarchy is visual cognition. **Visual cognition** can be defined as the ability to manipulate visual input and integrate vision with other sensory information to gain knowledge, solve problems, formulate plans, and make decisions. The development of visual cognition begins in childhood, when we combine vision with sensory input from the body to develop cognitive concepts (eg, rules) of how space and objects operate.[90] We then apply these rules to interpret what we see and make decisions. For example, if we see an adult human who is 12 inches tall, we assume that the adult must be several yards away because we know from experience that adults are not 12 inches high. Because visual cognition enables complex visual analysis, it serves as a foundation for all our academic endeavors and occupations.

Visual cognition cannot occur without the support of **visual memory**, the next process level in the hierarchy. Mental manipulation of visual input requires the ability to create, retain, and recall memories of images to use for comparison during visual analysis. For example, to interpret the illustration in Fig. 24.3, a person must be able to recall memories of the shapes of both a goose and a hawk. Adults and older children can easily resolve this illusion, but a typical toddler lacks the stored memories of the shapes of these birds to identify them. Emotion is an important component of visual memory. Emotion focuses attention and increases the likelihood that images will be stored in memory.[53,90,117,138] It is easy to recall an image of your favorite food or your childhood pet; much more difficult to remember the face of the person who rang up your groceries for you a week ago.

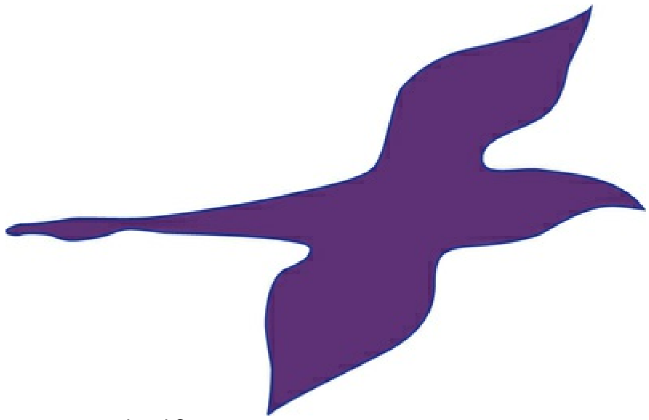

FIG 24.3 Is this a goose or a hawk? (From Warren M: A hierarchical model for evaluation and treatment of visual perceptual dysfunction in adult acquired brain injury. I, *Am J Occup Ther* 47:55–66, 1993.)

To store and access images in memory, the person must recognize the pattern making up the image. **Pattern recognition**, which subserves visual memory in the hierarchy, involves identifying the salient features of an object and using these features to distinguish the object from its surroundings.[53] A salient feature is one that distinguishes a particular object from another. For example, the salient feature that differentiates an E from an F is the lower horizontal line on the E. Pattern recognition is developed through repetition; the ability to recognize patterns improves from having seen them before in meaningful contexts. Children (and adults) spend hours viewing and deciphering patterns to develop a large library to assist with object recognition.[53] Generic memory, a subset of memory, consists of images that can be accessed by a broad range of sensory input. These images represent the common objects we use every day. An apple is an example of an everyday object that can be accessed through generic memory. To conjure up the image of an apple, I could show you an apple, but I could also have you close your eyes and then put an apple in your hand to feel, or I could release the scent of an apple, or place a slice of apple on your tongue. In each case you should easily be able to identify the object as an apple.

Pattern recognition cannot be accomplished without the next process in the hierarchy: organized *scanning* of the visual array. **Visual scanning** or **search** is accomplished through the use of saccadic eye movements. A saccade is a movement of the eye toward an object of interest in the environment. The purpose of a saccade is to focus on the object with the fovea, the area of the retina with the greatest ability to process detail. In scanning a visual scene, the eyes selectively focus on the elements critical for accurately interpreting the array.[53,82,171] The most important details are reexamined several times through a series of saccades to ensure that correct identification is made. Unessential elements in the scene are ignored.[82,171]

Visual scanning or search is actually an expression of **visual attention**. The saccadic eye movements observed in scanning reflect the engagement of visual attention as it is shifted from object to object.[53,82,117] Visual search occurs on two levels: an automatic or reflexive level, largely controlled by the brainstem (through the superior colliculi), and a voluntary level, driven by the cortex.[53,82] On a reflexive level, visual attention (and therefore visual search) is automatically engaged by any novel object moving or suddenly appearing in the peripheral visual field, such as a flash of light.[67,82] The eyes quickly move to focus on and identify the object to protect us from unexpected intrusions in the environment. Voluntary visual search, directed by the prefrontal areas of the cortex, is completed for the explicit purpose of gathering information needed to make a decision or formulate a plan.[53] Voluntary search is purposefully and consciously driven by a desire to locate certain objects in the environment, such as a misplaced set of keys, or to obtain certain information, such as where an exit is located. Voluntary visual search is completed in an organized, efficient, symmetric, and predictable pattern based on the qualities of the visual array and the goal.[79] For example, we execute a left-to-right and top-to-bottom scanning pattern when reading paragraphs of text written in English. The search pattern executed to locate a specific object in an environment is guided by the anticipated location of the object, but it is also driven by highly visible objects that “pop out” in the visual array.[95] A bright red stoplight at an intersection is an example of a feature that pops out and grabs a person's attention in an environment.

Visual attention, which subserves scanning in the hierarchy, is a critical prerequisite for visual cognitive processing. If and how a person attends to an object or information determines whether the brain will use the visual input in making decisions. People who do not attend to visual information will not initiate a search for visual information, and therefore will not complete pattern recognition or lay down a visual memory, and ultimately cannot use the visual input for making decisions. Similarly, people who attend to visual information in a random and incomplete way often lack sufficient or accurate information on which to base a decision.[117]

The level and type of visual attention the brain engages depends on the type of visual analysis needed. For example, the type of attention needed to be aware that a chair is in the room is different from the type needed to identify the style of the chair. The first instance requires a *global* awareness of the environment and the location of objects within it; the second requires *selective* visual attention to see the details of the chair and identify its features.[117] Also, a person needs to be able to use more than one type of visual attention at the same time. For example, when a woman crosses a crowded room to talk to a friend, she must be aware of the movement of other people and the placement of obstacles in the room to avoid collisions; at the same time, she must continue to focus on her friend (or target) to make contact. A large amount of neural processing is devoted to directing visual attention. Because of this, attention can be disrupted easily by brain injury, but it also has the potential for recovery with intervention.[47,53,117]

Engagement of visual attention and the other higher level processes in the hierarchy cannot occur without concise visual input from the environment.[159] As mentioned, three primary visual functions ensure that the brain receives high-quality visual input: oculomotor control, visual field, and visual acuity. **Oculomotor control** enables eye movements to be completed quickly and accurately and keeps the image focused on the fovea to ensure that it can be clearly seen. The visual fields register the visual scene and ensure that the brain receives complete visual information. Visual acuity ensures that details of the environment and tasks can be seen, including color. Thus, these visual functions supply the cortex with accurate, complete, and detailed information, which is needed to direct attention, complete pattern recognition to identify objects, lay down and access visual memory, and complete cognitive processing.[159]

Brain injury or disease can disrupt visual processing at any level in the hierarchy. Because of the unity of the hierarchy, if brain injury impairs a lower level process or function, the processes above it will also be compromised.[159] When this occurs, the client may appear to have a deficit in a higher level process, even though the deficit actually has occurred at a lower level in the hierarchy. Effective evaluation and intervention require an understanding of how brain injury affects the integration of vision at each process level and how the levels interact to enable visual perceptual processing.

Penny's left homonymous hemianopia prevents her from automatically seeing objects in the left half of her visual field. Because she does not see objects on the left, she may not attend to or search for objects on her left side. Her failure to search for objects on the left side limits her ability to locate items needed for daily activities. It also limits her ability to build an accurate spatial map of her environment; consequently, she collides with objects on the left as she tries to navigate environments. Members of the rehabilitation team working with Penny notice that she is inattentive to the left side, and their evaluation will reveal the cause of the inattention.

How Vision Impairment Affects Occupational Performance

Visual impairment can occur from disease, trauma, and aging.[82] Older adults especially may experience a combination of causes. In our case study, for example, Penny sustained a hemianopia from a stroke, which is a traumatic event, but she also has diabetes, a disease that causes many vision-related impairments.[76] Visual impairment can alter the quality and amount of visual input into the brain or alter how the brain processes and uses incoming visual input.[82] Either way, clients with brain injuries can experience a decrease in the ability to use vision to complete daily occupations. Changes are observed in vision-dependent activities (ie, activities that can be completed successfully only by using visual input).[91] Two of the most vision-dependent daily activities are reading and driving. However, good vision also is required for many instrumental activities of daily living (IADLs), such as meal preparation, financial management, and medication management, and some basic ADLs (BADLs), such as applying makeup. Clients with visual impairment may process visual information so slowly that they are unable to participate in dynamic activities such as driving or in group activities (eg, playing cards with friends).

People with vision impairment are also prone to making errors because of insufficient or poor-quality visual input. They may misread the amount due on a bill and write a check for the wrong amount, or step out in front of an oncoming car because they did not see it. Continuously making even small errors can erode an individual's self-efficacy and confidence. The person may stop engaging in even highly valued occupations because of fear and frustration.[91,157] In addition, because vision is needed most to engage successfully in dynamic environments, people with vision impairment often limit participation in community environments, which can lead to social isolation. The inability to complete valued occupations, combined with limited social participation, can lead to depression in individuals such as Penny, who acquire vision impairment after a lifetime of good vision.[64,113]

Clearly, visual impairment may limit the client's participation in many vision-dependent daily activities inside and outside the home.[163]

Recall, for example, that Penny was referred for therapy because she has difficulty reading, and she also is unable to drive.

Yet, despite its significance, the effect of visual impairment on occupational performance is often attributed to other causes, such as motor or cognitive impairment, especially when the visual impairment occurs in conjunction with a brain injury. The reason is that visual impairment is a hidden disability. Unlike hemiplegia, which can be easily observed after a stroke, significant visual impairment (eg, hemianopia) has few outward signs.

Despite the fact that she is missing 50% of her vision, Penny looks just like a normally sighted adult as she waits in the therapy gym for her intervention session with the occupational therapist.

Evaluation and Intervention Process in Occupational Therapy

Specific OT assessments and interventions for vision impairment are described later in the chapter. First, it is important to consider the process of OT evaluation and intervention. As stated in the "Occupational Therapy Practice Framework: Domain and Process," third edition,[4] (OTPF-3), the current version (2014) of the OT Framework, the profession of occupational therapy is grounded in the belief that "active engagement in occupation promotes, facilitates, supports and maintains health and participation" (OTPF-3, p. S4). Although it is important for clients to become independent in their daily occupations, the ultimate goal is participation. Participation is driven by effort and a belief that one is capable of successfully completing an activity, and it is strongly influenced by personal expectations, current abilities, context, and environment.

Penny told her ophthalmologist that she could no longer paint, even though the ophthalmologist found that her visual acuity, and thus her ability to see details and color, was normal. Is Penny really incapable of engaging in this valued occupation, or is the effort required to participate too great for her to derive any pleasure from painting? Or does she feel that she can no longer measure up to her previous high standard of performance?

To answer these questions and determine why Penny feels unable to paint, the occupational therapist must consider the interrelatedness of the client factors, performance skills, performance patterns, context, and environment that contribute and enable Penny to engage in this occupation.

Evaluation

The evaluation conducted by the occupational therapist has three purposes: (1) to identify limitations in occupation, (2) to link the occupational limitations to the presence of a visual impairment, and (3) to develop an appropriate intervention plan based on the results of the evaluation. In addressing evaluation and intervention, it is important to remember that a client's visual performance is significant not in terms of how it deviates from an established norm, but rather in how it interferes with occupational performance. A client is considered to have a visual impairment that requires intervention if the impairment interferes with performance of a necessary or desired daily occupation.

A team approach is required to provide effective intervention to a client with vision impairment. The OT must collaborate with the ophthalmologist and/or optometrist to understand how the client's vision has changed and address visual impairments. Both of these eye care specialists diagnose, manage, and treat visual impairment. As physicians, ophthalmologists are primarily responsible for diagnosing and treating the medical conditions that cause the visual impairment.[3] Board-certified neuroophthalmologists treat the largest number of people with visual impairment from brain injury. Consequently, they often work with occupational therapists and serve as referral sources and consultants to OT practice. *Optometrists* are independent healthcare providers who have a clinical doctorate of optometry from a postgraduate university program. Although they are not medical doctors, optometrists also diagnose and treat medical conditions causing vision loss and provide most of the primary eye care in the United States.[5] Some optometrists specialize in neurorehabilitation and provide services to individuals with brain injury.

Because Penny's stroke affected only her vision, she did not need inpatient rehabilitation and instead was seen by her ophthalmologist, who referred her to a low vision outpatient rehabilitation program.

However, many clients with brain injury experience significant deficits in multiple body functions and require more comprehensive inpatient and outpatient rehabilitation programs. In an ideal medical rehabilitation program, the ophthalmologist or optometrist would also be a member of the rehabilitation team and evaluate the client's vision at several intervals during the recovery period. The eye care physicians would provide information to the other team members on the client's overall eye health; diagnose deficits in visual acuity, visual field, and oculomotor control; and provide a prognosis and medical and optical management of the client. Currently however, eye care physicians are rarely integrated into rehabilitation teams, and the client must be referred to the physician's practice. Obtaining a referral can be a difficult and time-consuming process. To justify referral to the eye care specialist, the OT will be expected to provide evidence to the medical director or case manager overseeing the client's recovery that a visual impairment may be present and the impairment limits occupational performance. For this reason, the occupational therapist must be well versed in completing basic visual assessments to screen for visual impairment.

Several assessments are available to occupational therapists to screen visual performance. This chapter uses subtests from the Brain Injury Visual Assessment Battery for Adults (biVABA, *http://www.visabilities.com*), developed by the author, to illustrate evaluation.[158] The biVABA was designed specifically as a tool to help occupational therapists develop effective intervention plans for adults with visual impairment caused by brain injury. The battery consists of 17 subtests, including commonly used assessments to screen basic visual function, along with tests designed specifically for occupational therapists. The term *screen* is purposefully used to describe the level of assessment conducted by the occupational therapist. By definition, a screening assessment is a quick assessment that can suggest whether an impairment may exist. However, it is not conclusive; that is, it is not able to actually state the cause of the impairment or diagnose the condition. As licensed healthcare providers, occupational therapists do not have the professional qualifications to state the cause (eg, diagnose a visual condition)—that is the role of the ophthalmologist or optometrist. In Penny's case, the ophthalmologist diagnosed Penny's hemianopia and referred her to occupational therapy with that diagnosis.

If Penny had sustained a more severe stroke and been admitted to a rehabilitation floor without an ophthalmologist diagnosing the hemianopia, the occupational therapist, completing an initial assessment of Penny, might screen for a visual field deficit using one of the assessments described later in this chapter. The results of the screening assessment might suggest that Penny had a left hemianopia, but the OT would not be able to state that in the OT assessment. For the diagnosis of hemianopia to have been made, Penny would have had to have been referred to an ophthalmologist.

Intervention

Recovery from brain injury often spans months or years rather than days or weeks. Some vision impairment from brain injury (notably some forms of oculomotor impairment) have been shown to respond to restorative interventions and improve over time.[145,146] Other types of impairment (notably visual field deficits, such as Penny's hemianopia) usually are more permanent,[25,124] and still others (eg, visual attention deficits) may recover slowly over several months.[29,42,71] Currently there is little research evidence to support the efficacy of interventions that aim to restore visual function to normal levels.[29,124,146] In addition, most of the proposed restorative interventions require significant amounts of therapy time and cannot be implemented within the very brief time allotted to rehabilitation.[71,112,145,146,149] If there is no guarantee that intervention can restore visual processing to normal levels during the time the client is receiving occupational therapy services, and if the client's vision is limiting his or her ability to participate in needed and valued occupations, the focus of OT intervention is compensatory to enable the client to use current visual abilities to participate in valued activities and occupations. This focus aligns with the overarching goal of OT intervention, as stated in the OTPF-3, to promote the client's health and participation despite disability.[4] This focus also is consistent with current research showing that neuroplasticity in the brain is stimulated when a person attempts to engage in meaningful tasks.[47]

Although all types of OT intervention can be used, interventions that use activities and occupations to enable the client to engage in meaningful daily activities should be the primary focus of therapy. Education and training can be used in conjunction with occupation to increase the effectiveness of the intervention. Among the OT intervention approaches described in the practice Framework, modifying the context of the occupation and environment to enable compensation and adaptation is the key approach. Environmental modification is a significant, even critical, part of every intervention provided to the client, regardless of the type of vision impairment, because it facilitates visual processing at every level of the visual perceptual hierarchy. Because modification is used with all clients with vision impairment, its components are described here and then mentioned again in the sections on specific visual deficits.

We rely on vision to provide us with details about our world; the visual components of an environment, which include lighting, contrast, pattern, and size, can either facilitate or impede a person's ability to learn about and engage the environment. People with vision impairment, whether from brain injury, age-related eye disease, or simply aging, are especially influenced by the visibility of the task and the environment. To create an environment that enables the client to use his or her current visual processing as efficiently as possible, the therapist modifies the basic visual components of the task and environment to create a more visible context. This is accomplished by evaluating the activity and occupational demands of the desired occupation. The occupational therapist identifies the objects needed to complete the activity and assesses their properties to determine whether and how to modify them to make them as visible as possible to the client. At the same time, the OT considers the space demands of the environment where the occupation or activity will be completed and determines the modifications needed to increase its visibility.

Maximum visibility of a task and an environment can be achieved by considering and implementing the modifications presented in the next four sections.

Increase the Contrast of Key Components of the Task and Environment

Key components are the features of a task or an environment that guide completion of the desired occupation. Changing the background color to contrast with an object can help the client see the object more clearly. The application of this technique can be as simple as using a black cup for milk and a white cup for coffee. If the background color cannot be changed (eg, carpeted steps), color can be added to the object or feature to make it more visible. For example, on carpeted stairs, a line of bright orange duct tape can be applied to the edge of each step to distinguish between them; or, a person may purchase a bright pink cover for his or her cell phone to locate it more easily.[41,50]

Reduce or Eliminate Any Background Pattern

Patterned backgrounds have the effect of camouflaging the objects lying on them. Using solid colors on background surfaces such as bedspreads, place mats, dishes, countertops, rugs, towels, and furniture coverings can increase the visibility of objects placed on them. Clutter also creates significant and often distracting patterns in an environment, making it more difficult to locate objects. People with visual processing deficits perform best in simple environments that contain only the objects needed for daily occupations.[50]

Enlarge Critical Features of Objects and Environments

Increasing the size of a feature or object makes it more visible. Instructions can be reprinted in larger print, medications and other items relabeled, and calendars enlarged. The last line of print that is easily read on the reading acuity test card indicates the minimum size that print should be enlarged for the client. Contrast should be increased in addition to size; it does little good, for example, to enlarge print if the print is faint. Black on white or white on black print is usually more visible than any other color combination. Many commonly used items now are available in larger print, including calculators, clocks, watches, telephones, and check registers; health devices (eg, glucose monitors, blood pressure cuffs, and weight scales); and leisure items (eg, playing cards, games, and puzzles).

When vision-dependent steps in a task or task components cannot be made more visible, the occupational therapist should consider eliminating them from the occupation. For example, toothpaste can be applied directly to the tongue rather than the toothbrush; phone numbers can be voice dialed; and prechopped vegetables can be purchased.

Provide Adequate, Good-Quality Illumination

Increasing the intensity, amount, and quality of available light enables objects and environmental features to be seen more readily and reduces the need for high contrast between objects. For example, facial features can be identified more easily if a person's face is fully illuminated. Lighting should be strategically placed to provide full, even illumination without areas of surface shadow. The light should be positioned as close to the task surface as possible to obtain optimal brightness and illumination of the task.[41]

Many people with acquired brain injury experience photophobia, an abnormal sensitivity to light that is uncomfortable and often painful.[2,24,45] Light sensitivity is a complaint voiced by people with traumatic brain injury (TBI); neurologic diseases (eg, Parkinson's disease and multiple sclerosis), and age-related eye disease (eg, macular degeneration, diabetic retinopathy, and glaucoma).[45] For these individuals, light is often both friend and foe; they need more illumination to see the details in the environment, but at the same time, lighting often causes visual stress and uncomfortable side effects, including excessive blinking, tearing, eye pain, and headache. These side effects cause people to avoid or limit participation in occupations that occur in environments where lighting cannot be controlled (eg, virtually all community environments) or to take sometimes extreme measures to reduce light emission into the eye, such as by wearing dark sunglasses and wide-brimmed hats indoors, using thick drapes on windows, and turning off all lights in a room.

The challenge for the occupational therapist is to find lighting sources that provide adequate illumination without discomfort. Many occupational therapists use the Lux IQ Diagnostic System (*http://www.jasperridge.net*), a standardized light assessment, to determine the best color and type of light for a client with light sensitivity. Fluorescent lighting, so commonly used because of its energy efficiency, is actually the least tolerated light source. Fluorescent lighting emits a short wavelength flicker (50 to 60 Hz) that can be quite noxious to individuals with photophobia associated with TBI and migraine.[2,45] Halogen bulbs often provide a well-tolerated source of bright illumination, and LED is generally tolerated well. However, all types of lighting should be considered, including fluorescent, because there is a wide variation among clients. Tinted eyeglass lenses or fit-over shields and a wide-brimmed hat may reduce glare and ease discomfort in situations in which lighting cannot be controlled, such as community use environments.[45] Changing the background on computer screens and smart phones from white to a darker color may also alleviate some eyestrain. Using blinds to filter incoming light from windows and covering glare-prone surfaces (eg, countertops) with nonglare materials can create a more comfortable environment.[41]

A structured environment also reduces visual stress by creating an explicit and predictable environment that places less demand on visual attention. Cluttered environments with haphazardly placed objects create challenges even for people with normal visual processing. If possible, the number of objects in the environment should be reduced and those remaining arranged in an orderly fashion. Items used daily should be arranged on accessible shelves in single rows. Rarely used items should be stored on upper and lower shelves or removed. Commercially available organizing systems can be used to store items together to create workstations. For example, all items used for grooming can be placed together in a basket. Once closets and shelves have been rearranged and simplified, the family and the client should be educated on the importance of maintaining the structure. The practice of putting items back where they belong and maintaining organization reduces cognitive load and frustration and facilitates independence.

It also is important for the occupational therapist to help the client establish performance patterns to support occupational performance. Establishing routines, such as shopping at off hours to avoid a crowded grocery store, reduces both cognitive and visual stress. Establishing a habit of leaving the keys in a bowl by the door reduces the need for visual search; cleaning eyeglasses daily ensures a brighter image.

Evaluation and Intervention for Specific Visual Deficits

The visual perceptual hierarchy provides the framework for the discussion of evaluation and intervention for specific visual impairments from brain injury. Many of the changes in visual processing after brain injury occur because of impairment in lower levels of the hierarchy. When this lower level processing is disrupted, the visual input into the brain can be limited, inconsistent, or of poor quality, impairing the brain's ability to use vision for occupational performance. This section describes evaluation and intervention for impairments that occur in the first five levels of the hierarchy: visual acuity, oculomotor control, visual field, visual attention, and visual scanning.

Visual Acuity

Visual acuity is the ability to see visual details and color. In delivering these details, acuity contributes to the brain's ability to quickly identify objects. Good acuity, therefore, facilitates information processing and decision making. For this reason, occupational therapists must know whether the client's acuity has been diminished by the brain injury or another cause and collaborate with the eye physicians to make sure the client has the best possible acuity.

Acuity results from a multistep process that begins with the focusing of light onto the retina.[66,68,82] Light rays enter the eye through the pupil and are focused on the retina by the anterior structures of the eye: the cornea, lens, and optic media (Fig. 24.4). The photoreceptor cells in the retina, acting like film in a camera, process the light and record a “picture” that is relayed to the rest of the brain via the optic nerve and pathway.[66] Although the concept is simple, the process is complex and involves many components. These components include the ability to focus light precisely onto the retinal cells, maintain a sharp focus over various focal distances, obtain sufficient illumination of the retina to capture a quality image, and transmit the image to centers in the brain for perceptual processing.[66,68] Any compromise of the structures involved in this process will cause the image to blur and reduce acuity.[51,147]

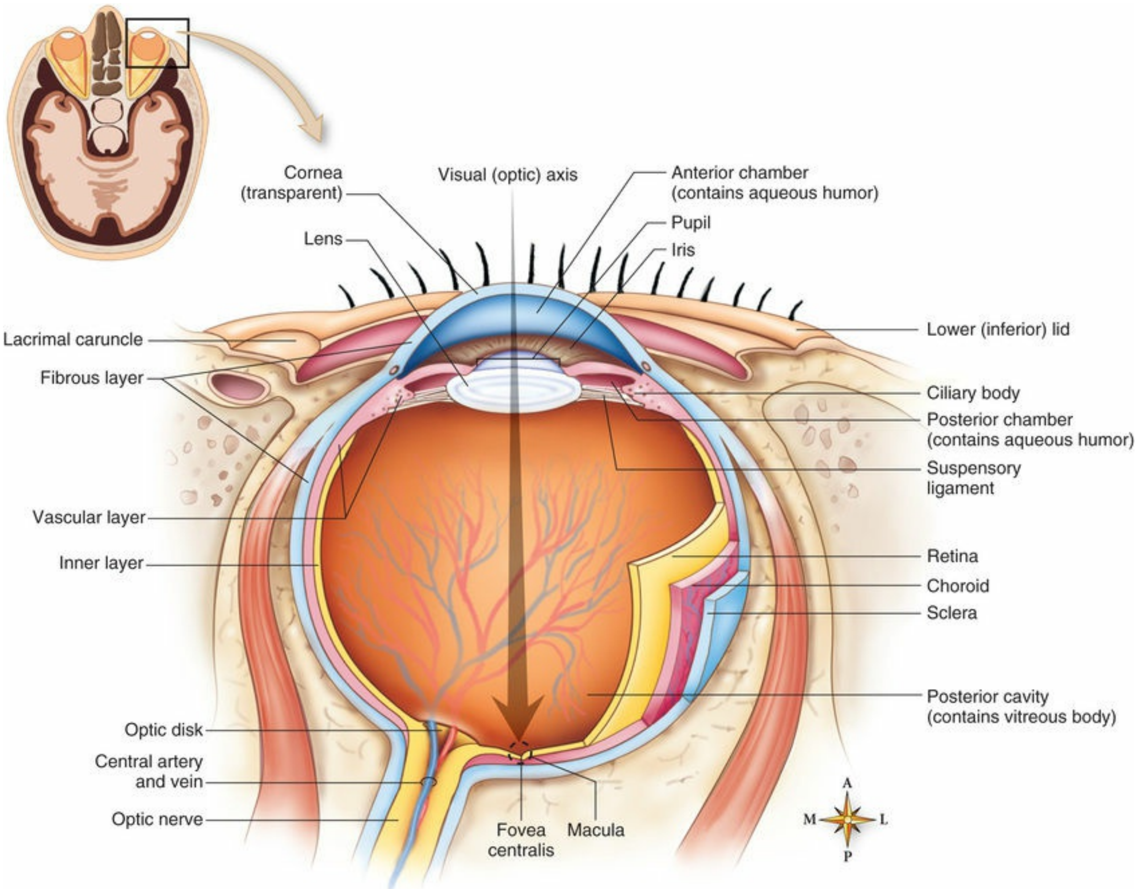

FIG 24.4 The structures of the eyeball. Images pass through the transparent cornea, lens, and vitreous to focus on the photoreceptor cells of the retina. (From Patton K, Thibodeau G: *Anatomy and physiology*, ed 9, St Louis, 2016, Elsevier.)

Visual acuity is measured by having the person identify progressively smaller optotypes on a chart placed at a specified distance. The optotypes may be letters, numbers, or symbols. Acuity level is commonly expressed in the United States as a Snellen equivalent fraction (eg, 20/20).[52] The Snellen chart is often used as a quick means of determining visual acuity. The fraction represents a ratio of the test distance to the size of the optotype. In everyday terms, a measurement of 20/20 means that standing at a distance of 20 feet, the viewer can see the letter (or optotype) that a person with normal vision can see at 20 feet; 20/200 would indicate that a person standing at a distance of 20 feet can see an optotype that a person with normal vision could identify at 200 feet.

Visual acuity is associated with the ability to see high-contrast, black-on-white optotypes on a test chart. However, visual acuity actually represents a continuum of visual function ranging from the ability to detect high-contrast features on one end of the continuum to the ability to detect low-contrast features (eg, beige on white) on the other end. Low-contrast acuity, also known as contrast sensitivity, is the ability to detect the borders of objects reliably as they decrease in contrast (rather than size) from their background.[101] Contrast sensitivity makes it possible to distinguish and identify faint features of objects, such as the curve of a concrete curb or the protrusion of the nose on the face. Because much of the environment is made up of low-contrast features, contrast sensitivity is a critical visual function for safely negotiating the environment. For example, curbs and steps are routinely the same color throughout, and without contrast sensitivity, it would not be possible to see the depth in the curb or step. Carpets, walls, doors, doorframes, and furniture also are often monochromatic; without the ability to distinguish low-contrast features, it might not be possible to locate a door or avoid a chair jutting out into the pathway. One of the most common low-contrast objects is the human face. Human faces contain very little color differentiation between the facial features: the nose is the same color as the forehead, cheeks, and chin. To see the unique features of a human face requires very good contrast sensitivity. Research has shown that people with brain injury may experience impaired low-contrast acuity even when their high-contrast acuity is within normal limits.[101] Therefore, both forms of acuity (high and low contrast) must be measured to obtain an accurate assessment of acuity function.

Two forms of high-contrast visual acuity are measured: distance acuity and reading (near) acuity. Distance acuity is the ability to see objects at a distance. Near acuity, the ability to see objects clearly as they come close to the eye. depends on the neural process of accommodation.[147] Accommodation enables the eye to maintain clear focus on objects as they come closer.[54,82] When an object approaches the eye, its point of focus on the retina is pushed farther back, eventually causing the image to go out of focus. The eye adjusts for this through the process of accommodation. There are three basic steps to the process. As the object comes closer, (1) the eyes converge (turn inward) to ensure that the light rays entering the eye stay parallel and in focus; (2) the crystalline lens of the eye thickens to refract the light rays more strongly and shorten the focal distance; and (3) the pupil constricts to reduce scattering of the light rays. These three steps keep objects in focus when the person is viewing them up close. Multiple neural structures are involved in coordinating accommodation, including the cone photoreceptor cells in the retina, the optic nerve, LGN, occipital lobe, posterior parietal lobe, frontal eye fields, cerebellum, and both nuclei of the CN III (ie, the oculomotor nerve).[147] Much of the coordination occurs through the midbrain area of the brainstem, which is vulnerable to closed TBI.[54,56,147]

Individuals with accommodative dysfunction may demonstrate normal distance acuity (which does not require accommodation) and impaired reading acuity (which requires accommodation). A normal byproduct of aging, called presbyopia, can also reduce accommodation. Until the fourth decade of life, the accommodation process works efficiently to ensure equal acuity when an individual views objects up close and at a distance. However, as a person approaches age 50, the lens of the eye gradually becomes less flexible, which reduces its ability to keep images in focus as they come closer; the result is presbyopia.[31] People with this condition frequently complain of difficulty reading small print. Presbyopia is corrected either by using reading glasses to magnify print or, if the person already wears eyeglasses, by adding a magnifying lens or “reading aid” to the base of the lenses to create a bifocal.

Deficits in Visual Acuity

Most deficiencies in visual acuity are caused by defects in the optical system (the cornea or lens or even the length of the eyeball) that cause images to be focused poorly on the retina.[52,65,66] The three most common optical defects affecting acuity are myopia (nearsightedness), hyperopia (farsightedness), and astigmatism (Fig. 24.5).[52] In myopia, the image of an object is focused at a point in front of the retina; therefore, it is blurred when it reaches the retina. Myopia is corrected by placing a concave lens in front of the eye. In hyperopia, the image comes into focus behind the retina; this causes the image to remain out of focus on the retina. Hyperopia is corrected by placing a convex lens in front of the eye. In astigmatism, light is focused differently by two meridians 90 degrees apart. This defect usually is the result of a cornea that is not perfectly spherical, but instead shaped more like a spoon, or when the cornea is dimpled rather than smooth. Astigmatism causes images to blur because the two meridians cannot be simultaneously focused on the retina. Astigmatism is corrected by placing a cylindrical lens in front of the eye.

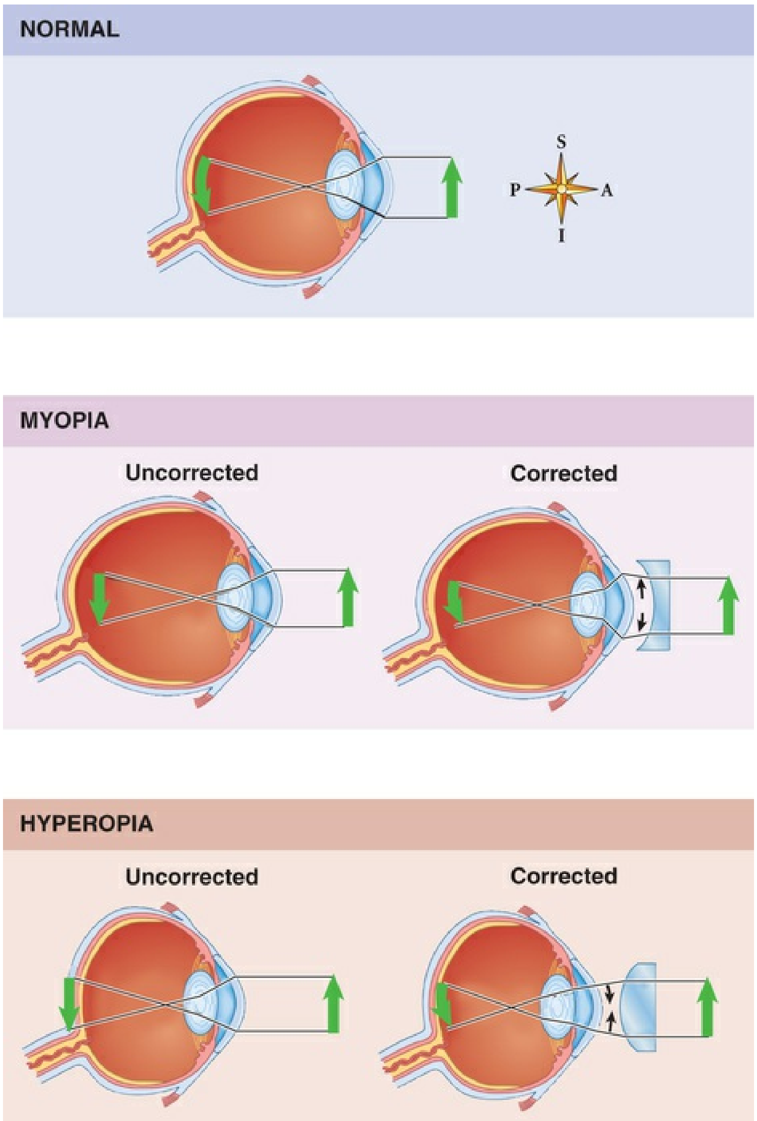

FIG 24.5 Normal, myopic, and hyperopic optical refraction of light coming into the eye and the types of lens used to correct myopic and hyperopic optical refractive errors. (From Patton K, Thibodeau G: *Anatomy and physiology*, ed 9, St Louis, 2016, Elsevier.)

Reduced visual acuity from acquired brain injury primarily occurs as a result of difficulty focusing, retinal damage, optic nerve damage, and/or damage to the occipital lobe and posterior cortical processing areas of the brain.[a] These areas may be damaged by trauma or a disease process.[20,32,83,126]

It is not possible to describe all the conditions that can cause reduced acuity after brain injury, but the following four sections discuss some of the more common ones.

Difficulty focusing.

Sharp focusing of an image on the retina requires that the structures between the outside of the eye and the retina be transparent and able to focus the images entering the eye. Images entering the eye pass through four transparent mediums: the cornea, aqueous humor, crystalline lens, and vitreous humor. An opacity or irregularity in these structures will prevent light and images from properly reaching the photoreceptor cells in the retina. With TBI, damage can occur to the cornea and lens in the eye during the assault to the head and create opacities or irregularities that reduce the quality of the incoming visual input. For example, debris or shrapnel may penetrate the inner layers of the cornea, causing a scar to develop on the cornea. The irregular surface caused by the scar causes the light rays passing through the cornea to be unevenly dispersed, and the person will have blurred, distorted vision.[37] Blunt trauma to the eye can displace the lens, creating a distorted image; it may also induce the development of a cataract that eventually clouds the lens and blurs vision.[83,128]

Corneal scarring and lens displacement immediately impair vision, whereas it may take several months for a cataract to develop and reduce acuity.

Impaired accommodation also diminishes the focusing ability of the eye. Brain injury, disease, and age can disrupt the delicate balance of accommodation, resulting in blurred vision in close-up viewing.[b] Ciuffreda et al.[35] found that accommodative dysfunction was the most commonly identified oculomotor impairment in clients referred for visual examinations after TBI and stroke. Presbyopia creates a nearly universal need for bifocals and reading glasses in older adults. Accommodative dysfunction is also commonly observed in people with Parkinson's disease.[20] Individuals with accommodative dysfunction frequently complain of difficulty reading, reduced concentration, and headache.[2,24,36,37,147] Because the client may demonstrate normal distance acuity but reduced reading acuity, it is important to screen both distant and reading acuity. If there is a significant difference between the two acuities, the client should be referred to an optometrist or ophthalmologist for further evaluation. The eye specialist may prescribe reading glasses and/or eye exercises to strengthen accommodation.[36]

Damage to the retina.

Injury or disease can damage the photoreceptor cells of the retina, preventing these cells from capturing images. Two eye diseases—age-related macular degeneration (AMD) and diabetic retinopathy (DR)—damage the photoreceptor cells in the central (eg, macular/foveal) visual field. AMD is the leading cause of low vision in older adults, and DR is the leading cause of low vision and blindness in individuals younger than age 65.[40] Damage to the central retina diminishes both high- and low-contrast visual acuity, impairing accurate identification of objects. It is not uncommon for an older adult who has been referred for intervention for stroke-related disability also to demonstrate reduced visual acuity from an age-related eye disease.[126] Too often the vision loss resulting from the eye disease is either overlooked or misdiagnosed as impaired attention or cognition associated with the stroke.

Traumatic injuries to the eye can cause retinal hemorrhage or a detachment of retinal cells immediately or several days after the initial trauma.[83,155,156] Retinal detachments usually can be successfully repaired when detected within a few hours of onset. However, if the detachment accompanies a significant brain injury, the trauma team may be focused on sustaining body functions and may not thoroughly assess the eyes for damage. If the trauma client is not sufficiently aware to describe visual symptoms, the detachment may not be diagnosed until after permanent damage has occurred.

Damage to the optic nerve.

Trauma is the most common cause of optic nerve damage in brain injury.[65,128,155,156] Damage can occur from a penetrating injury to the nerve (eg, a bullet wound to the head) or from optic canal fracture associated with facial or blunt forehead fractures.[65] These fractures are most common in children and young adults and usually affect only one of the nerves.[54] Severe closed-head injuries can cause stretching or tearing of the optic nerves, resulting in significant and usually bilateral damage to the nerves. Bilateral optic nerve injury can also result from compression of the nerves from intracranial swelling or hematoma.[65]

Two fairly common neurologic diseases, glaucoma and optic neuritis, can damage the optic nerves. Glaucoma is a collection of optic nerve diseases that usually affect the peripheral visual field first and may progress into the central field, reducing visual acuity.[40,52] Multiple sclerosis can cause demyelination and inflammation of the optic nerve, a condition called optic neuritis. Optic neuritis can cause reduced visual acuity and color vision, visual field deficit, orbital pain, dulled vision, and sensitivity to light.[32]

Damage to posterior cortical processing.

People with injuries to the posterior areas of the cortex, including the occipital lobes and posterior parietal and temporal lobes, can experience a variety of visual disturbances, including blurred vision, reduced contrast sensitivity, a perception of dark or dim vision, light sensitivity, and reduced dark adaptation.[49,83,173] As previously discussed, clients with light sensitivity (eg, photophobia) may be bothered by normal levels of artificial lighting or outdoor environments and avoid these environments or wear sunglasses and wide-brimmed hats. In contrast, people with impaired dark adaptation complain of dark or dim vision and seek additional lighting for tasks and environments. Some people may be able to tolerate and see clearly only within a very small range of lighting conditions.[45]

Occupational Limitations

Reduced visual acuity can cause limitations in a significant number of daily occupations. The severity of the limitation depends on the extent of the acuity loss and whether the impairment is in the central or peripheral field. Central field impairment affects the ability to discriminate small visual details and to distinguish contrast and color. Daily activities that involve reading, writing, and fine motor coordination will be affected, such as meal preparation, medication management, financial management, grooming, and shopping. When the peripheral field is affected the client experiences difficulty with mobility. Peripheral field deficits impair the ability to locate landmarks and obstacles, accurately detect motion, and maintain orientation in the environment. The client will experience difficulty with activities in the community, such as driving, shopping, and participation in social activities.

Evaluation

All OT evaluations begin with observation of the client's performance of daily activities. Clients with reduced acuity often complain of an inability to read print and may report that the print is too small or too faint to read, and that letters are distorted, parts of words are missing, or the words run together and swirl on the page. Clients with impaired contrast sensitivity may complain of an inability to see faces clearly. They may also have difficulty distinguishing between colors of similar hue, such as navy blue and black, and detecting subtle low-contrast features, such as the difference between the last step and the landing when the two are the same color.

When ADL performance suggests impaired acuity, the occupational therapist should screen high- and low-contrast acuity. If it appears that the client has difficulty focusing to see up close, the therapist should screen both distance and reading acuity. Distance acuity charts measure acuity at a distance of 1 meter or greater, and reading acuity charts measure acuity at the typical reading distance of 40 cm (16 inches).[133] Near acuity can be measured using single optotypes or words. It is most often measured using words because reading is the primary activity enabled by near acuity. Reading acuity charts contain sentences in progressively smaller sizes of print. To obtain an accurate measurement, the occupational therapist must be sure that the chart is well illuminated and held at the correct distance. Adequate illumination is important because as illumination decreases, so does acuity (no one can read a letter chart in the dark). Because acuity is depicted as a fraction of distance over letter size (eg, 20/20 or 20/200), the measurement is not accurate unless the viewing distance is precise. All test charts specify a distance at which they are to be used, and this should not be altered.

The client's acuity level is recorded at the smallest line of optotypes that can be read with good accuracy.[133] The client is instructed to read the optotypes on the chart out loud, beginning with the largest line and continuing until the print is too small to see. Clients with brain injury may have deficits in cognition, language, and perception that can interfere with the ability to provide an accurate and timely response in a testing situation. Extra time may be needed for the client to locate the optotype, process the image, and respond. Slowness in responding, therefore, does not necessarily indicate that the client lacks the acuity to identify the optotype.[133] If the client struggles in identifying the optotypes on each line but is accurate, the test should proceed until the client reaches a line where he or she is unable to accurately identify the majority of the optotypes. If the client understands speech but is unable to speak, the therapist can offer a choice (eg, "Is it this, or is it that?" and the client can respond with a nod). If the client has poor scanning and attention, all the optotypes on a line can be covered except one, which the client is asked to identify.

The therapist should always screen acuity using the client's best-corrected vision. Eyeglasses correct for refractive errors, so if the client habitually wears glasses to see distances or for reading, he or she must wear them during the test. Although it seems obvious that every client should be wearing his or her corrective lenses, research has shown that people frequently are admitted to rehabilitation floors without their glasses. Lotery et al.[85] found that more than 25% of clients receiving inpatient rehabilitation after a stroke who routinely wore glasses, did not have them with them, and that among those who did, nearly one-fourth of the eyeglasses were dirty, scratched, or needed repair. Roche et al.[121] evaluated individuals admitted to an orthopedic floor and, like Lotery, found that 25% of the clients did not have their glasses with them in the hospital; of those who did, 85% of the spectacles were dirty or in poor repair.

The most useful chart is one that measures visual acuity as low as 20/1000, so that significant reductions in acuity can be identified. Standard acuity charts measure visual acuity primarily in the range that can be compensated for with eyeglasses and measure nothing below the 20/200 level. Because some conditions (eg, optic nerve damage and macular diseases) can result in profound vision loss (less than 20/400 acuity), it is important to be able to measure acuity in the lower ranges so that appropriate referral and task modifications can be provided to the client. The LeaNumbers Intermediate Low Vision Test Chart (Good-Lite, *http://www.good-lite.com*), which is included in the biVABA, is an example of a test chart that measures visual acuity in the low vision ranges.

Low contrast acuity (contrast sensitivity) also is measured by viewing optotypes printed on a chart held at a specified distance from the client. However, for this type of testing, the optotypes (which may be letters, numbers, symbols, or sine wave gratings) remain the same size but diminish in contrast as the person proceeds down or across the chart. The client reads down the chart as far as possible until the optotype is too faint to be identified. There are many forms of contrast sensitivity tests. The MARS Letter contrast sensitivity chart measures peak contrast sensitivity using letters.[7] The chart is normed for individuals over age 60, and the client's contrast ability can be categorized as normal or as moderate, severe, or profound impairment. The least expensive and most portable test charts are those designed by Dr. Lea Hyvarinen; they include the LeaNumbers Low Contrast Screener (part of the biVABA), the LeaSymbols Low Contrast Screener, and the LeaNumbers and LeaSymbols Low Contrast Tests (Good-Lite). As with high-contrast acuity testing, the test chart must be held at a specific distance and must be well illuminated to obtain an accurate measurement.

It is important to remember that the occupational therapist screens acuity to obtain a general understanding of how well the client is able to see and to determine whether vision is limiting occupational performance. If a significant limitation in acuity is observed on the screening, the occupational therapist should seek referral of the client to an ophthalmologist or optometrist to determine the cause and prognosis of the impairment and whether acuity can be improved using lenses, surgery, or medications.

Intervention

The first step in intervention is to make sure the client is wearing prescribed glasses and that the glasses are clean and in good repair. The second step, especially for older clients, is to seek referral to an optometrist or ophthalmologist if it has been more than 2 years since the client's last refraction. In the study by Lotery et al.,[85] mentioned earlier, the investigators found that half of the participants who wore glasses benefitted from a new refraction. Park et al.[105,106] found that nearly half of the clients referred to optometry from a general inpatient rehabilitation floor in an urban hospital benefitted from updated refraction of their glasses. In this study, the participants had been admitted to the rehabilitation floor with 27 different primary diagnoses, but nearly 75% of the sample had a neurologic condition documented in their medical history. A client with best-corrected acuity in the low vision range (20/60 Snellen acuity or below) should be referred to a low vision rehabilitation program for specialized intervention.

It is important that deficiencies in high-contrast and low-contrast acuity be identified early in the rehabilitation process to obtain an accurate picture of the client's rehabilitation potential. Studies have shown that uncorrected visual impairment may appear as cognitive impairment.[19,60] Using highly educated, healthy, and normally sighted participants with artificially blurred vision, Bertone et al.[19] tested the individuals' ability to complete nonverbal neuropsychological tests commonly used to assess cognitive status in adults. They found that even a slight reduction in acuity (ie, from 20/20 to 20/40) resulted in poorer performance on certain nonverbal tests. The takeaway message for this research is that the client's visual acuity must be determined first, before neuropsychological and reading tests are administered, and that the client must be wearing his or her eyeglasses for the test.

When screening indicates that the client has reduced high-contrast or low-contrast acuity, the occupational therapist should modify the client's environment and tasks to increase the visibility of key features. This is accomplished by using the interventions described in the previous section: increase contrast; reduce pattern; provide good-quality, even illumination; enlarge objects; and provide a structured, predictable environment. In addition to environmental modification, the client may benefit from the variety of services available to assist individuals with vision loss. These services are generally free of charge. The resource librarian in the public library can usually provide contact information, or the OT can contact an advocacy organization, such as the American Foundation for the Blind (*http://www.afb.org*). The following are other examples of available services.

1. The National Library Service for the Blind and Physically Handicapped offers recorded books, magazines, and music through its Talking Books program (*http://www.loc.gov/nls/*). Each state has at least one talking book library.

2. Most states offer radio reading services in conjunction with a university-sponsored public radio station. The person is provided with a dedicated radio that is tuned to the reading service, which provides special programming (eg, reading of portions of the local newspaper each day).

3. Local telephone companies often offer free directory assistance to individuals with disabilities; most pharmacies will provide large-print medication labels, and many businesses will provide large-print bills.

The location of Penny's stroke, in the middle cerebral artery, would not cause a change in visual acuity. However, Penny's diabetes may cause diabetic retinopathy and other eye conditions that can cause significant vision loss. After learning that Penny had diabetes, the optometrist carefully evaluated the health of her eyes and checked her acuity. The optometrist saw changes in the retina that indicated that Penny has macular edema, an indication of early-stage background diabetic retinopathy. The disease has not yet reduced her visual acuity. The optometrist cautioned Penny that she must maintain her blood glucose at the level prescribed by her physician, monitor her diet, and check her blood glucose levels several times a day. The optometrist asked the occupational therapist to evaluate Penny's ability to compensate for the hemianopia when performing diabetes self-management tasks, including drawing insulin, using a glucometer to monitor blood glucose levels, and preparing meals according to her prescribed meal plan.

Oculomotor Function

The purpose of the oculomotor system is to achieve and maintain foveation of an object.[54] That is, the oculomotor system ensures that the target is focused on the fovea of both retinas (to ensure a clear image) and that focus is maintained as long as needed to accomplish the desired goal. This is a daunting task because human beings interact within dynamic, moving environments. An image focused on the fovea is always in danger of slipping off as the head or object is moved. Foveation is achieved and maintained by eye movements that keep the target stabilized on the retina during fixation, gaze shift, and head movement.[54,82]

Another function of oculomotor control is to provide binocular vision. **Binocular vision** ensures perception of a single image even though the brain receives two separate visual images (one from each eye). The process of combining two visual images into one is called **sensory fusion**. For sensory fusion to occur, corresponding photoreceptor cells (eg, cone cells and rod cells) in the two retinas must be stimulated with the same image. If the photoreceptors are stimulated and if the images match in size and clarity, the brain is able to fuse the two images perceptually into one. The eyes must work together in an integrated binocular system to maintain sensory fusion. If the eyes do not align with each other or if there is a significant difference between the eyes in acuity, images may appear blurry or even doubled (eg, diplopia).[54,82,129]

Oculomotor Dysfunction

The pathways controlling eye movements are very complex and involve multiple areas of the brain in the cortex, thalamus, brainstem, and cerebellum.[145] Deficits in oculomotor control after brain injury are common, ranging in prevalence from 50% to 90%.[145] Impairment can result from cranial nerve lesions affecting one or more of the extraocular muscles that control eye movements and/or disruption of the central neural control of the internal and external eye muscles, affecting the coordination of eye movements.[9,51,82,155,156] Either condition can reduce the speed, control, and coordination of eye movements.

Three pairs of cranial nerves control the extraocular muscles: the oculomotor nerve (CN III), the trochlear nerve (CN IV), and the abducens nerve (CN VI). These three nerves are responsible for controlling seven pairs of striated muscles that move the eye.[54,82] When a person who had intact CN function experiences a CN lesion, the muscles innervated by that nerve are weakened or paralyzed, causing a condition known as **paralytic strabismus**.[46,82,127,129] Strabismus means misalignment, and there are several different forms of strabismus.[82,127,129] In paralytic strabismus the eye is unable to move in the direction of the paretic muscles; this disrupts the ability of the eyes to move together. An eye turn may be observed (ie, the eye turns in or out). Because the eyes must always move together and line up evenly to maintain a single visual image, the person experiences diplopia. Diplopia is a primary characteristic of CN lesions.[96,127,129] **Diplopia** creates perceptual distortion, and the performance limitations the client experiences depend on where the diplopia occurs in the focal range (the range in which a person can keep objects in focus). Diplopia occurring near the body disrupts reading and activities requiring eye-hand coordination, such as pouring liquids, writing, and grooming. Diplopia occurring at a distance beyond arm's reach affects walking, driving, TV viewing, and playing sports such as golf and tennis. To eliminate the double image, the client often assumes a head position that avoids the field of action of the paretic muscle.[9,129] For example, a client with a left lateral rectus palsy (CN VI) will turn the head to the left to avoid the need to abduct the eye. A client with paralysis of the right superior oblique muscle (CN IV) will tilt the head to the right and downward to avoid the action of that muscle.[9] Unless oculomotor function is carefully assessed, these alterations in head position may be interpreted as resulting from changes in muscle tone in the neck rather than as a functional adaptation purposely assumed to stabilize vision.

CN lesions are estimated to account for approximately 6% to 12% of the oculomotor impairment that occurs from TBI or stroke, and they are associated with moderate to severe brain trauma.[156] Most oculomotor impairment results from damage to the neural centers that coordinate eye movements. The brainstem, cortex, and cerebellum all exert control over the extraocular muscles via the cranial nerves.[82] Injury in these areas can cause the person to experience difficulty executing and coordinating eye movements even when the cranial nerves are intact.[35,63,70,82,155] The focusing system is the most vulnerable oculomotor system in mild and moderate to severe brain injury.[147] Studies show that nearly half of all those with a brain injury who are referred for visual assessment have complaints related to focusing.[147]

The most commonly identified focusing disorder is **convergence insufficiency**.[2,35,70,147,155] Convergence is the muscle action of moving the eyes inward in adduction. It is one of the three components of accommodation, the process that keeps objects in focus as they come into close view. When convergence insufficiency occurs, clients have difficulty obtaining or sustaining adequate focus during near vision tasks. Clients with this condition often complain of fatigue, eye pain, or headache after a period of sustained viewing in near tasks. Their primary complaint is reading.[24,87,147] As the eye muscles fatigue from the exertion of sustaining convergence during reading, fusion breaks down and the client may experience odd visual phenomena, such as print swirling and moving on the page or the page going blank. Because CN function is usually intact, the client's complaints may be attributed to inattention, lack of effort, or dyslexia rather than oculomotor impairment.

People with oculomotor impairment from TBI often experience multiple changes in vision, including photophobia, convergence insufficiency and other accommodative dysfunctions, visual field deficits, visual inattention and neglect, nystagmus, and difficulties with saccadic and eye pursuit movements.[2,24,87,156] After TBI many people also experience vestibular impairment in conjunction with oculomotor impairment.[131] These conditions occur together and create a very complex case in terms of evaluation and treatment.

It is important to remember that oculomotor impairment also occurs with neurologic diseases, most notably Parkinson's disease and multiple sclerosis, and also Alzheimer's disease. Individuals with Parkinson's disease can experience convergence insufficiency and other accommodative dysfunctions, diplopia, and an increased blink rate associated with blepharitis[20,45]; in addition, they often complain of blurred vision and have difficulty reading. Individuals with multiple sclerosis can experience diplopia from involvement of the cranial nerves and nystagmus, and those with Alzheimer's disease can experience difficulty executing and controlling saccades.[167]

Evaluation

Because a number of factors can disrupt the control of eye movements, considerable skill and expertise are needed to diagnose an oculomotor deficit accurately and to determine the appropriate intervention. It is imperative that the client be referred for diagnosis and management to a neuroophthalmologist or an optometrist who specializes in visual impairment caused by neurologic conditions. The occupational therapist is often one of the first members of the rehabilitation team to observe that the client may have an oculomotor impairment affecting occupational performance. This frequently places the occupational therapist in the position of requesting further evaluation by an eye care specialist. To make an appropriate referral, the occupational therapist must perform a screening to identify patterns of oculomotor dysfunction that may be contributing to the occupational limitations observed in the client.

The occupational therapist uses a "listen and look" approach to screen the client. The therapist *listens* to the complaints voiced by the client or the rehabilitation team and *looks* for changes in oculomotor control that may account for these complaints. This approach is described in the biVABA manual, and the following evaluation steps are from that assessment.[158]

The first step in assessment is to obtain the client's visual history. The history is necessary because adults with childhood histories of oculomotor dysfunction or reduced acuity often display oculomotor abnormalities that they have adapted to and that do not affect functional performance.[147] The client may wear eyeglasses to correct for the deficiencies, and the eyeglasses must be worn during the assessment to obtain accurate results. Questions to ask include whether the client had good vision before the brain injury; has had a prior head injury; has a history of conditions that may affect oculomotor control (eg, congenital strabismus, lazy eye, or amblyopia), and whether he or she currently wears eyeglasses and the purpose of the glasses. Glasses that correct oculomotor deficiencies are generally prescribed to be worn at all times, in contrast to glasses worn to correct acuity just for reading or for distance.

If the client reports diplopia, the therapist should ask about the characteristics of the diplopia. Does it disappear when one or the other eye is closed? This suggests impairment of the extraocular muscles. Do objects double side to side or on top of one another? Is the diplopia present at near distances or at far distances? Is there any area in the range of focus where the client is able to achieve single vision? The answers to these questions may suggest CN involvement (Table 24.1) and also may supply important information about limitations the client may experience in daily activities. The therapist should ask about the client's ability to complete daily activities and look for a pattern, such as difficulty completing activities that require sustained focus in near space (reading, writing, and quilting); whether the client's visual difficulty seems to change with the focal length of the task; whether complaints of fatigue and reduced concentration follow activities that require sustained focusing.

TABLE 24.1

Summary of Oculomotor Deficits Associated With Cranial Nerve Lesions

Oculomotor Nerve III	Trochlear Nerve IV	Abducens Nerve VI
Impaired vertical eye movements	Impaired downward and lateral eye movements	Impaired lateral eye movements
Lateral diplopia for near-vision tasks	Vertical diplopia for near-vision tasks	Lateral diplopia for far-vision tasks
Dilation of pupil and impaired accommodation		Bilateral lesion: Assumes downward head tilt
Ptosis of the eyelid		

After the interview, the therapist should observe the client's eyes and eye movements for deficiencies. The therapist instructs the client to look at a distant target and observes the eyes for asymmetries in pupil size, eyelid function, and eye position. Asymmetries such as a dilated pupil in one eye or a droopy eyelid may indicate CN involvement.[83] Next, the therapist instructs the client to track a moving target (eg, a penlight or pencil topper) vertically, horizontally, and diagonally.[96,127,129] The therapist observes the eyes and notes (1) the symmetry of the eye movement; (2) whether the eyes move the same distance in each direction; and (3) whether the eyes are able to stay on target with a minimum of jerking movements in the middle part of the range. The therapist assesses convergence by instructing the client to track the target as it moves toward the bridge of the nose. The client should be able to easily follow the target inward and be able to repeat this action several times before experiencing stress or fatigue. Difficulty or effort in converging or maintaining convergence while focusing on the target may indicate convergence insufficiency and/or other accommodative dysfunction.[129]

If the client complains of diplopia, the therapist may complete a cover-uncover and/or an alternate cover test to determine which eye is involved and whether the double vision is associated with a phoria or tropia.[127] The suffix *-tropia* is used when there is a noticeable deviation of the position of one eye in relation to the other when the client views an object.[127,129] The suffix *-phoria* is used when there is a deviation of the eye that is held in check by fusion and therefore is not noticeable when the client focuses on an object. These terms are used in conjunction with four prefixes that describe the direction of the deviation: *eso-,* meaning a turning in of the eye; *exo-,* a turning out of the eye; *hypo-,* a turning downward of the eye; and *hyper-,* a turning upward of the eye. *Esotropia,* therefore, describes an observable, inward deviation of the eye commonly described as "crossed eyes," whereas *esophoria* indicates that the eye drifts inward when the client is not focusing on an object but is held in check when the client does focus on an object.[129]

Cover tests are based on the principle that when an eye is required to fixate on an object, it does so with the fovea. If an eye that is not fixating on a target is suddenly required to foveate, it will achieve foveation by making a saccade toward the target.[127] By requiring the client to fixate with both eyes on a target and then covering one of the client's eyes during fixation, the therapist can determine whether the two eyes are aligned in focusing on the target and, if not, which eye has difficulty maintain alignment. Two tests are used: a cover/uncover test, which is completed when a tropia is suspected, and a cross or alternate-cover test, which is completed when a phoria is suspected.[96,129] If the two eyes are aligned equally and fixating on the target, no movement of either eye will be observed when one eye is covered or uncovered. If the eyes are not aligned, the deviating eye will move to take up fixation when the nonaffected eye is covered. Clients with tropias generally complain of constant diplopia when viewing objects, whereas clients with phorias may be bothered only intermittently, usually when they are fatigued or stressed by sustained viewing of a target. Clients with both conditions may experience significant visual stress, which can manifest as headaches, eyestrain, or decreased concentration.[129]

The occupational therapist should compare the information gathered from the screening with observations of occupational performance to determine whether the oculomotor dysfunction is contributing to the client's functional limitations. For example, the presence of convergence insufficiency may help explain the difficulty the client is having in maintaining concentration when reading. When oculomotor deficiencies appear to limit occupational performance, the occupational therapist must seek referral to an ophthalmologist or optometrist, who can determine the cause of the deficiency, the prognosis for improvement, and treatment options.

Intervention

Oculomotor dysfunction usually does not prevent the client from completing an occupation, but it does affect participation in daily activities.[24,45,145,146] The client may experience difficulty coordinating eye movements for reading and other activities; he or she may experience doubling and blurring of visual images and may not be able to sustain focus on near objects or quickly switch between near and far focal distances. These difficulties, especially when combined with photophobia, can cause the client to experience significant visual stress, which may trigger the onset of headache, eyestrain, neck strain, and fatigue.[2,45] The client may begin to avoid participating in activities that trigger visual stress. Many of these activities involve reading (because of the need to sustain a close focal distance) or, like driving, take place in community environments and require the person to adjust to bright and changing lighting. Computer work and viewing television are also often stressful activities because of sustained focus and glare from the screens.

Role of Ophthalmologists and Optometrists

Ophthalmologists and optometrists diagnose the cause of the oculomotor impairment and also offer interventions to reestablish fusion and binocularity through the use of occlusion, application of a prism or lenses, eye exercises, and surgery.[a] The last three interventions are completed only by the eye physicians. Occupational therapists, under the direction of a physician, may apply occlusion. Because most oculomotor dysfunctions resolve without intervention within 6 months of the brain injury,[105] ophthalmologists generally apply either a prism or occlusion to eliminate the client's diplopia during the recuperation period. If the diplopia persists and becomes chronic, the ophthalmologist may recommend surgery by a specialist to reestablish fusion. Optometrists have a different perspective; they believe that control of eye movements and accommodation can be improved through carefully prescribed exercises, which they use in addition to occlusion and prisms to reestablish binocularity.[36] The intervention selected for a client depends on the prognosis for recovery, the client's ability to participate in therapy and her or his financial resources, and the eye specialist providing the consultation.

Occlusion.

Diplopia causes images to double and blur; this distortion creates confusion for the client and limits participation in daily activities. Therefore, diplopia must be eliminated if the client is to benefit fully from rehabilitation. Occlusion can be achieved by assuming a head position or by covering one eye with an opaque or a translucent material.[127,129] Because assuming a deviant head position often affects motor and postural control, the preferred method is to cover one eye. Occlusion of the eye can be achieved through either complete or partial occlusion.[127,129]

With complete occlusion, all the vision in one eye is occluded, often by application of a “pirate patch,” a clip-on occluder, or opaque tape. The challenge with using complete occlusion is that it eliminates all peripheral visual input to one eye, disrupting normal mechanisms for control of balance and orientation to space. This can cause the client to feel off balance and disoriented when navigating environments. Another challenge is that most clients cannot tolerate long periods of occlusion of an eye, especially of the dominant eye, because the other eye becomes fatigued. Therefore, for the comfort of the client, the period of occlusion is alternated between the eyes. Even though altering occlusion reduces fatigue of the working eye, clients often resist having their dominant eye occluded for even short periods because that is the eye used to direct fixation. As a result, the client does not adhere to the occlusion schedule.

Partial occlusion involves covering a portion of the visual field in one eye. Just enough occlusion is applied to eliminate the diplopia without completely covering the eye.[127] Several different types of occluders are used for partial occlusion.[127,129] One technique that can be easily performed by the OT practitioner is to apply a strip of translucent material (eg, 3M Transpore surgical tape) to the central portion of the eyeglass lens (Fig. 24.6). The client is instructed to view a target that is doubling, and the therapist applies the Transpore tape from the nasal rim toward the center of the lens until the client reports that the diplopia is gone when viewing the target. The tape is applied to the nondominant eye for the greater comfort of the client. The width of the tape is gradually reduced as the muscle paresis resolves. Partial occlusion provides a kinder, gentler way to achieve single vision without disrupting balance or orientation. Usually the client is more comfortable and therefore more willing to engage in activities. The main disadvantage of this type of occlusion is that the client must either wear prescription lenses or have tape applied to a pair of frames with plano (nonrefractive) lenses.

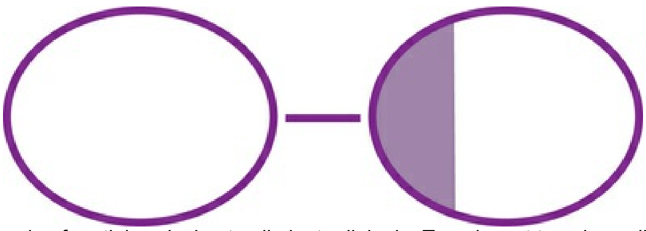

FIG 24.6 Example of partial occlusion to eliminate diplopia. Translucent tape is applied to the nasal portion of the eyeglass lens on the side of the nondominant eye. (From Warren M: Brain Injury Visual Assessment Battery for Adults test manual. visAbilities Rehab Services. http://www.visabilities.com.)

As an OT intervention, occlusion is considered a modification and adaptation intervention approach. The goal is to eliminate the stress caused by the diplopia so that the client is willing to participate in daily activities and therapy. Occlusion has no therapeutic purpose other than to eliminate the double image. However, it is still considered an optometric or ophthalmologic intervention, and as such the occupational therapist should not apply occlusion without a physician's oversight. The referring physician should be consulted and must sign off on use of the modification, just as is done when a splint or sling is applied.

Prisms and lenses.

Ophthalmologists and optometrists may apply a prism to the lens of the client's eyeglasses to reestablish single vision in the primary directions of gaze: looking straight ahead and looking down.[36,83,127,129] Application of a prism displaces the image, causing the disparate images created by the strabismus to fuse into a single image.[129] The prism can be permanently ground into the client's eyeglass lens or temporarily applied to the lens using a plastic Fresnel press-on prism.[127] A prism is used only as long as it is needed to maintain fusion. If the paresis is resolving, the client is gradually weaned from the prism by reducing the dioptic strength of the prism over a period of time commensurate with the rate of recovery. Lenses can boost focusing, and the optometrist or ophthalmologist may use lenses to assist clients who experience accommodative dysfunction from conditions such as convergence insufficiency to achieve and maintain focus with less effort.

Eye exercises.

There is disagreement over whether eye exercises can improve oculomotor control any faster than normal recovery.[90] Traditionally there has been only limited and inconclusive evidence supporting the efficacy of using eye exercises to restore binocular function and improve oculomotor control after adult acquired brain injury.[36,57,70,86] However, several recent, carefully planned studies have shown evidence of the effectiveness of precise exercise protocols for improving vergence and accommodation in people with mild head trauma.[145,146] As an optometric intervention, eye exercises do not fall within the OT scope of practice and should be prescribed and supervised only by an optometrist.

Surgery.

Surgery is recommended when the degree of strabismus is too great to be overcome consistently and easily by fusional effort or when a significant strabismic condition does not resolve within 12 to 18 months.[129] The general approach in surgery is to make the action of one of the extraocular muscles either weaker or stronger by changing the position of its attachment on the eyeball. The position of the eye in the socket is changed by the procedure, and the image is realigned. An ophthalmologist specially trained in strabismus surgery performs this surgery.

Role of the Occupational Therapist

The OT's role is to enable the client to participate in necessary and desired daily occupations despite the challenges and discomfort of oculomotor impairment. It is important to remember that people with oculomotor impairment are not dependent on others to complete daily activities for them. They can complete daily occupations, but if they experience considerable visual stress during certain activities, they will avoid participating in that activity. The occupational therapist works with the client to modify the environment and task and devise strategies that enable the client to complete the activity with the least amount of visual stress. As stated previously, most CN lesions resolve within 6 months. For these clients, the OT's role consists of working with the client and eye physicians to determine the best way to manage the double vision during recovery so the client can participate in daily occupations. For example, the OT may advocate for partial occlusion instead of total occlusion for a client who must navigate community environments.

Other conditions that accompany oculomotor impairment may persist much longer and still be present months to years after the brain injury, even with a mild TBI or concussion.[2,45,87] These conditions include photophobia (light sensitivity), headache (tension and migraine) and blurred vision.[2,45] They can cause significant discomfort, and the client may respond to the discomfort by changing routines and developing habits that limit or avoid participation in certain activities. Giving up valued occupations may lead to depression, which further reduces motivation to participate in daily activities and can lead to a debilitating and self-perpetuating cycle of depression causing activity limitations, which aggravates the depression.[64]

The occupational therapist observes and interviews the client to identify the occupations that cause visual stress, in addition to aspects of the performance patterns, context, and environments that either increase or decrease visual stress for each occupation. The sensory qualities of the physical environment often exert significant influence on the client's level of visual stress. Too much lighting, poor quality or glaring light, and fluctuating lighting may all trigger the onset of headache in clients who are light sensitive. Clients with blurred vision have difficulty seeing low-contrast features and small visual details in tasks and environments. Lots of pattern and clutter in environments force the client to spend more time searching for items. The more stressful provoking features in an environment, the more likely the client will spend as little time as possible engaging in occupations there.

The occupational therapist can suggest ways to make the environment and task less stressful by adding contrast, increasing size, reducing pattern, and finding sources of comfortable lighting. Removing the visual steps to tasks and adding structure to the environment lessen the need to use vision. Changing these parameters facilitates participation by creating an environment and a task that are less stressful and more inviting.

The occupational therapist can also work with the client to establish habits and routines to reduce stress. The client can be taught how to pace participation in a stressful activity to avoid the onset of a debilitating headache. For example, a client who experiences significant visual stress that triggers a headache when shopping for groceries might try shopping for just a few items at a time. This will require more trips to the grocery store, but it significantly reduces the amount of time spent in this stress-provoking environment, which may reduce the incidence of headache. The client also may reduce stress by shopping at a different time of day, perhaps in the early morning, when the client is more rested and the grocery store is less crowded. The use of fitover filters and wide-brimmed hats to control the light entering the eye (discussed in the earlier section on adding adequate, good-quality illumination) can be a helpful modification for clients with light sensitivity.

These interventions teach clients practical ways to manage their visual stress and continue to participate in daily occupations, and in doing so, they help build clients' sense of self-efficacy—that is, that they can control, rather than be controlled by, their symptoms.

Penny reported to the occupational therapist that she had become sensitive to bright lighting in her environment due to the macular edema she had developed from her diabetes. She was especially bothered by the lighting of her church sanctuary, which has very large windows. She stated that she often had to shut her eyes during the service because the light bothered her so much. She hated the thought that other parishioners might think she was sleeping, but if she kept her eyes open, they watered a lot and she was afraid people might think she was crying. "I can't win," she told the therapist. "Sometimes we just don't attend church on bright and sunny days." The therapist took Penny to a room with brightly lit windows and had her try out several pairs of fitover UV filters (NoIR Medical Technologies; http://www.noir-medical.com*) in different tints.*

(Fitover filters, as the name implies, fit over the individual's current glasses.) Penny felt that the filters with a light rose tint provided her with the greatest comfort in the bright light. The therapist lent Penny the filters to try out at church the next Sunday. At the following session, Penny reported that the filters worked well to reduce the glare, but she felt self-conscious wearing them because they were so bulky. The therapist and Penny explored various styles of fitover frames, and Penny ordered a more stylish pair.

Visual Field

The visual field is the external world that can be seen when a person looks straight ahead. It is analogous to the dimensions of a picture imprinted on the film in a camera (with the retina representing the film). The normal visual field extends up to approximately 135 degrees vertically and up to 160 degrees horizontally.[68] The fields of the two eyes overlap, so most of the visual field is binocular and is seen by both eyes (see Fig. 24.1). A small portion of the peripheral field on the temporal side of the face in each eye is monocular and can be seen only by one eye because the bridge of the nose occludes vision in the other eye (see Fig. 24.1). The central visual field is made up of the macula and fovea (Fig. 24.7). The fovea lies at the very center of the macula and provides the highest level of acuity. The central field is packed with cone photoreceptor cells to provide the details and color needed to complete object identification.[142] The remainder of the visual field is the peripheral field. The peripheral visual field is comprised of rod photoreceptors that detect general shapes and movement in the environment and provide background but not detailed vision.

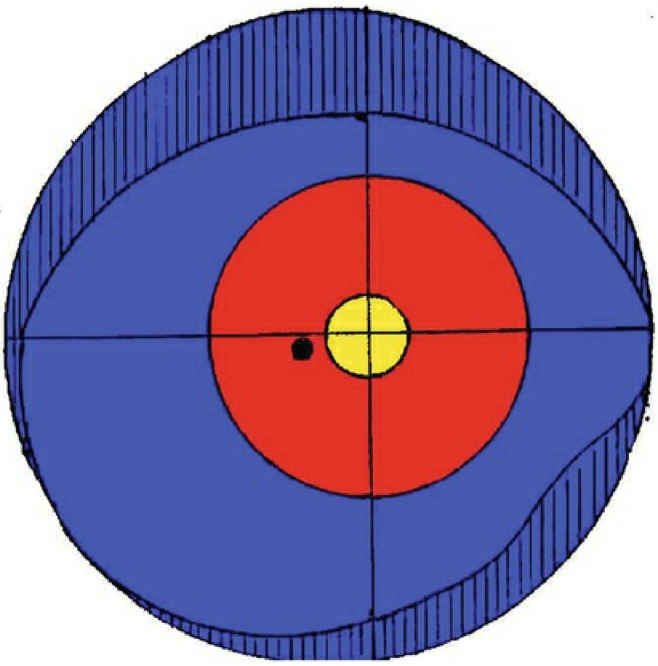

FIG 24.7 Visual field diagram showing the acuity divisions of the visual field of the right eye. The yellow circle in the center represents the fovea, the area of highest visual acuity, which contains only cone photoreceptor cells. The red area depicts the macula, which contains mostly cone photoreceptor cells. Together the macula and fovea comprise the central visual field, which provides detailed vision and color. The blue area depicts the peripheral visual field, which contains the rod photoreceptor cells and provides background vision. The black dot is the blind spot in the temporal portion of the visual field. (Courtesy Josephine C. Moore, PhD, OTR.)

Visual Field Deficits

Damage to the photoreceptor cells in the retina or to the optic pathway that relays retinal information to the cortex for image processing results in a **visual field deficit (VFD)**.[66,142] Fig. 24.1 illustrates this pathway as it changes from the optic nerve to the optic tract to the geniculocalcarine tracts. The location and extent of the VFD depends on where the damage occurs along the pathway. Although any type of VFD is possible after brain injury, homonymous hemianopia (HH) is the most common; it occurs in approximately 30% to 50% of people who have a stroke.[124] In hemianopia (*hemi-* meaning half, *-anopia* meaning blindness), a loss of vision occurs in one-half of the visual field in the eye. *Homonymous* means that the deficit is the same in both eyes. A lesion posterior to the chiasm in the right hemisphere causes a left HH; a lesion in the left hemisphere causes a right HH. Most hemianopias from stroke are caused by occlusion of the posterior cerebral artery, although a middle cerebral artery stroke, such as that experienced by Penny, can also cause this deficit.[124] Hemianopia and other forms of VFDs are also common after a TBI.[24,25,155,156]

Occupational Limitations

Although hemianopia is often considered a mild impairment compared with the dramatic loss of use of the limbs, it can create changes in visual search that significantly limit occupational performance. Research on individuals with hemianopia has shown that visual search toward the blind field is characterized by disorganization, multiple fixations, longer search time, and inability to locate relevant objects.[173] Instead of spontaneously adopting a wider search strategy by turning the head farther to see around the blind side of the field, the person typically turns the head very little and limits visual search to areas immediately adjacent to the seeing side of the body.[173] This ineffective strategy occurs because of the influence of a visual cognitive process called perceptual completion.[66] During normal visual cognitive processing, the frontal lobes visually sample the environment and predict what it looks like.[90,117] This prediction is based partially on incoming visual input from the environment, but it also relies heavily on memory of prior experiences in the environment.[117] Perceptual completion, which is a frontal lobe process, adds significant speed to information processing by enabling an individual to construct a complete visual scene based on partial visual input. As such, it plays an important role in the person's ability to adapt to fast-paced and dynamic environments.[117] However, in the case of significant visual field loss, perceptual completion makes it difficult for the client to determine how the visual field has changed.[39,84]

Because of perceptual completion, the client with a hemianopia is not immediately aware of the absence of vision because he or she perceives a complete visual field, without gaps or missing information.[39,84,132] However, the brain cannot place objects in a visual scene that it does not actually see. Therefore, the client will be unaware of an unanticipated object on the blind side; for example, he or she may run into a recently placed chair on the blind side or may be unable to locate an item unexpectedly placed in the blind field. Until the client becomes consciously aware of the HH, he or she will experience the odd perception of seeing a complete visual scene in which objects always seem to be appearing, disappearing, and reappearing, without warning, on the affected side. Uncertainty regarding the accuracy of visual input from the affected side often causes the client to adopt a protective strategy and attend only to visual input from the intact visual field.[39,173] This behavior can increase the chance of collisions and cause significant limitations in occupations that require monitoring of the entire visual field, such as driving a car or walking through a busy, crowded store.[168] Warren[163] found that 90% of participants with hemianopia from brain injury experienced collisions with unexpected objects on the affected side during ambulation.

Even when the person becomes aware of a hemianopia, visual search into the blind field often is slow and delayed.[39,102,141,173] Again, the culprit is perceptual completion, which eliminates the presence of a marker to indicate the boundary between the seeing and nonseeing fields. Unable to determine the actual border of the seeing field or where a target might be within the nonseeing field, the client naturally slows down when searching the blind field. Instead of making a single saccade to locate the target in the blind field, the person adopts the strategy of making repeated short "stair step" saccades toward the target until it is located.[141,173] Disruption of visual search toward the affected side increases the client's difficulties in navigating and in finding objects in the environment.[39,102,104,173]

When the hemianopia extends into the fovea, a client may miss or misidentify visual details when viewing objects because part of the object falls into the blind field. This can create significant challenges in reading.[a] Normally sighted readers view words through a "window" or *perceptual span* that allows them to see approximately 18 characters (letters) with each fixation of the eye.[118] The reader typically moves from the center of one word to the center of the next using a series of alternating fixations and saccadic eye movements. Each fixation last approximately 250 milliseconds (ms); generally only one fixation is required to decode each word in a text.[118] The brain uses 50 ms to decode the word and 200 ms to plan the saccade to the next word in the text.[153] The saccade of a person reading English moves fixation eight or nine characters over to the right, the typical length of English words. The remaining partially decoded letters on the right side of the perceptual span are used to plan the next saccade.[118] The left side of the span is important for accurate word identification.

Hemianopia reduces the width of the perceptual span on the side of the deficit, causing the client to view only part of a word during a fixation and even miss small words.[80,134,173] For example, a client with a left hemianopia may read the sentence, "She should not shake the juice" as "He should make juice," transforming "she" into "he" and "shake" into "make" and leaving out "not" and "the." Right HH can especially hinder reading because the restriction on the right side of the span not only causes the person to miss letters on the right, it also disrupts the ability to plan the saccade to the next word; as a result, the person lands off center and misses the next word.[80] When these reading errors occur, the client must stop and reread sentences, and this reduces reading speed and comprehension. Clients also experience difficulty accurately reading numbers in series, often with detrimental effects. Whereas context alerts the client to an error when reading because the sentence does not make sense, numbers don't have a precise context, and mistakes can go unnoticed. For example, a bill for $368 may be misread as $68, and the error may be missed until a notice of insufficient payment is received. A recipe calling for 3 tbsp (tablespoons) of sugar may be read as 3 tsp (teaspoons). Clients who make numerical errors quickly lose confidence in their ability to pay bills and balance their checkbook, prepare meals using recipes, or manage their medications, and they may turn over these important daily occupations to someone else.[163]

If the hemianopia occurs on the same side as the dominant hand, the client may have difficulty visually guiding the hand in fine motor activities. The most common performance skill limitation is reduced writing legibility.[163] The client often cannot visually locate and maintain fixation on the tip of the writing instrument as the hand moves into the blind visual field, causing handwriting to drift up and down on the line. Writing over something that was just written and improperly positioning handwriting on a form are also common mistakes. Quilting, hand sewing, pouring liquids, dialing numbers on a smart phone, and other fine motor activities are also frequently impaired.[163]

Functional mobility and reading are the primary performance skills most often disrupted by hemianopia.[163] They are components of important IADLs, including medication management, financial management, meal preparation, home management and yard work, communication management, shopping, and driving and community mobility. For individuals with hemianopia, the more dynamic the environment and the wider the field of view required to complete the occupation, the greater the limitation. Clients generally experience only minor limitations completing basic ADLs, which are performed close to the body, but they report significant difficulty completing at least one IADL.[39,91,104,163,168]

People with hemianopia may report feeling anxiousness when moving in unfamiliar environments.[39,163] Sometimes the anxiety can be so severe that the client experiences an autonomic nervous system panic reaction, becoming nauseated, short of breath, and breaking into a sweat in crowded environments. The anxiety can become debilitating, causing the person to withdraw from community activities and become socially isolated.[104] Some clients report a loss of self-confidence because of their continuous mistakes during the course of a day, and many express that they experience depression because of their limitations, especially their inability to drive and read. They may feel disoriented in community environments because they are unable to scan the moving scene fast enough to identify landmarks and comprehend the visual scene.[173] The combination of anxiety and disorientation may cause the person to avoid navigating community environments alone and to become reliant on others to guide him or her. This can significantly reduce the person's ability to independently meet daily needs, and it also restricts social participation.

Penny reported to the occupational therapist that she was able to successfully complete basic ADLs but has difficulty completing several instrumental ADLs. She states that she reads very slowly and makes frequent mistakes especially when reading numbers. She has difficulty reading bills and financial statements and disclosed that she did not pay her credit card bill correctly one month and was charged a financing fee. She also has difficulty reconciling her checkbook as she may read entries incorrectly and then be unable to find her errors. She estimates that it takes her approximately three times as long to pay bills as it did before her vision loss and she always experiences significant anxiety when completing this task and avoids it until the last minute. Her difficulty reading numbers also creates other challenges when she renews prescriptions for herself and for Pot. She frequently reads the prescription number incorrectly and because of this can no longer use the automated telephone renewal feature and must wait until she can talk to someone in person. This is very embarrassing. She also misread her blood glucometer once and injected insulin when she did not need it, which caused a reaction lasting several hours. She was an avid newspaper reader and read the metro and sports pages to Pot daily, an activity they both enjoyed, as he would recognize some of the names of local *teams and players. She can no longer engage in this daily routine, nor can she read novels to Pot, which was another routine they enjoyed and one that she felt was very therapeutic for Pot.*

Penny reported that she is able to complete meal preparation, although she spends a great deal of time scanning shelves to locate items. She also has difficulty seeing well enough to pour and measure items and occasionally misreads a recipe or sets the wrong time on the microwave. She mentioned that once, she was melting chocolate for a cake batter and set the microwave on 8 minutes, rather than 3, and burned the chocolate. After that, she decided to stop baking for the annual church bake sale, even though she is well known for her delicious chocolate chip cookies.

Penny reported that her greatest limitations involve mobility. She is unable to drive and must depend on others for transportation. When a friend takes her shopping, she has difficulty locating the items she needs and reading the labels. Because she does not want to inconvenience her friend and slow her down, she often comes home with the wrong item or without items because she could not find them. She also admits to feeling very uncomfortable in crowded environments, especially with people moving on her left side. She states that her heart pounds and she feels an overwhelming desire to leave. She is afraid she will collide with someone, as she has experienced several instances of this, and she sometimes experiences disorientation. She and Pot attended religious services regularly before her stroke and a neighbor has offered to provide transportation, but she feels too uncomfortable to make the trip.

When asked about her art, Penny became very quiet and finally stated that she felt that activity was also behind her now. She stated that she had tried drawing again but could not see well enough to complete the intricate line drawings and that she could not find the supplies she needed. Instead of a joyful occupation, drawing had become a very frustrating exercise that reminded her of her disability. She stated that she did not want to resume drawing if she could not do it well.

When asked to prioritize her goals for therapy, she stated driving as the number one goal and reading as the second goal. She wants to accurately complete financial management, meal preparation, and diabetes self-management, and she wants to be able to shop independently, take Pot to appointments, and resume attending church.

Evaluation

The visual field is evaluated using a *perimetry* test.[31] There are many types of perimetry tests, ranging from simple bedside assessments (eg, the confrontation test), which provides a gross indication of field loss, to the precise imaging of a microperimeter.[123,132,151] Availability, cost, and the client's ability to participate in testing often determine the selection of the test. For example, confrontation testing does not incur any expense and can be performed nearly anywhere, whereas microperimetry must be completed by a specially trained technician in a center that has purchased this expensive instrument. All perimetry testing includes three steps, which occur in sequence: (1) the person fixates on a central target; (2) a second target (or targets) of a specific size and luminosity is presented in a designated area of the visual field; and (3) the person acknowledges the second target without breaking fixation on the central target. A static or kinetic test strategy is used to present the target. In static presentation, the target appears in a specified area of the visual field without being shown moving to that location. In a kinetic testing strategy, the target moves in from the periphery until it is identified.[133,173] The number of targets presented during the test can vary from fewer than 10 for a quick screening test to more than 100 for a diagnostic test.

Ophthalmologists and optometrists often use a computerized bowl perimeter, such as the Humphrey Visual Field Analyzer, to obtain a definitive diagnosis of a hemianopia or other field deficit.[133] For this test the client places his or her chin on a chin rest and fixates on a central target inside the bowl-shaped device. As the person fixates on the central target, a second lighted target is displayed inside the bowl in varying locations and intensities. The client responds to each seen target by pushing a small button. For diagnosis of a field deficit, lighted targets are often presented in more than 100 locations in the field using a step-threshold sequence, in which the intensity of the light is incrementally increased if it is not identified on the first presentation. The result is an accurate measurement of the areas of absolute loss (no response) and relative loss (decreased retinal sensitivity) in the field.[133]

All perimetry tests require that the person sustain visual attention over an extended period, and it is impossible to eliminate visual attention from the evaluation process, regardless of the type of perimetry test. Individuals with brain injury commonly experience impaired and limited visual attention, especially in the acute stages of recovery. This means that for many clients with brain injury, it is not possible to successfully administer a diagnostic perimetry test and formally diagnosis the deficit until several weeks to months into the recovery period, depending on the severity of the brain injury.[25,172]

Until the client has sufficient visual attention to complete a diagnostic perimetry test, the occupational therapist can screen for field deficits using simple perimetry tests in combination with careful observation of the client performance in daily occupations. Confrontation testing provides a crude indication of visual field loss.[158] To complete a static confrontation test, the examiner sits in front of the client at a distance of 1 meter and has the client fixate on a centrally placed target (the examiner's nose). The examiner then holds up two targets in each of the four quadrants of the visual field (right upper, right lower, left upper, and left lower). The client indicates whether both targets are visible.[158] To complete a kinetic test, the examiner stands behind the client and moves a target (best target is a penlight) in from the periphery while the client fixates straight ahead on a central target, which is often held by a second examiner, who sits in front of the client and also observes for cheating (eg, breaking fixation on the central target to look for the second target). The client indicates as soon as the target appears by saying “now” or making a hand movement. The examiner moves the penlight in from the left, right, superior, and inferior fields to test these areas. Standardized versions of these tests are included in the biVABA. Because confrontation testing has been shown to be unreliable in detecting all but gross defects,[151] occupational therapists using this form of screening must be careful to correlate their findings with observations of client performance. If the confrontation test shows no deficit but clinical observations suggest that a deficit is present, the clinical observations should carry the greater weight. Client behaviors that suggest the presence of a VFD include changing head position when asked to view objects placed in a certain plane; consistently bumping into objects or missing objects on one side of the field; and making consistent errors in reading, such as missing letters and words on the side of the deficit.[158]

A simple portable perimeter, the Damato 30-Point Multifixation Campimeter provides a more precise alternative to confrontation testing of the central visual field. The campimeter is included in the biVABA and is also distributed by Good-Lite. The test shown in Figs. 24.8 and 24.9 consists of numbered targets to test 30 points in the visual field. The test stimulus is a 6-mm black dot that is shown in the center part of the card. The test uses a unique strategy that relies on moving the eye rather than the target. The client is instructed to fixate on one of the numbered targets. The black dot is then shown in the central window, and the client indicates if it was seen. If the client does not see the black dot, that point in the visual field is recorded as a loss. The test proceeds with the client successively moving the eye to view each numbered target until the entire central field is mapped. A study compared the ability of the Damato campimeter to identify central field deficits against the gold standard Humphrey Field Analyzer and found that the campimeter had a sensitivity of 81% and a specificity of 72%, suggesting good accuracy.[123]

FIG 24.8 Damato 30-point campimeter. The 30 numbers (in light blue) are arranged in a circular pattern on the board. The arm positions the client the correct distance from the chart. The black dot appears in the

window in the center of the chart. (Courtesy Good-Lite, http://www.good-lite.com.)

FIG 24.9 Positions of the therapist and the client for perimetry testing using the Damato campimeter. The therapist moves the black dot into the window in the center of the chart while the client fixates the numbered target. Without breaking fixation on the number, the client indicates when the black dot is seen.

Although spontaneous recovery of some of the visual field has been shown to occur in approximately 50% of those with hemianopia from brain injury,[172] complete recovery of the visual field is uncommon.[173] Most recovery occurs within the first 4 weeks after onset, and the likelihood of improvement significantly decreases beyond 8 weeks.[172] Because of the low rate of complete recovery, hemianopia is generally considered a permanent visual impairment.[172,173] Perimetry tests establish only whether a VFD is present and the size and location of the deficit. To know whether intervention is needed, the occupational therapist must determine whether the client is able to compensate for the field in daily occupations, in addition to the quality and consistency of the compensation. Because reading is so often affected by hemianopia, the therapist should evaluate reading performance.

The Visual Skills for Reading Test (VSRT, *http://www.lowvisionsimulators.com*) assesses the influence of a scotoma (or field loss) in the macula on the visual components of reading, including visual word recognition and eye movement control.[164] The VSRT (often known by its alternative name, the Pepper test) was developed with individuals with central field loss from macular degeneration, but it has been shown to be useful in identifying limitations in reading performance in those with hemianopia.[163] The client is asked to read single letters and words printed on a card. The card contains words that can be misread and still make sense. Because the words don't appear in the context of a sentence, the person must rely solely on vision to identify the word. Three different versions of the test card, in varying font sizes, are included to accommodate clients with reduced acuity and to permit retest. The test measures reading accuracy and corrected reading rate and provides information on the prevalent types of reading errors made by the client. Clients with hemianopia often make errors on the Pepper test consistent with the side of their field deficit.[163] For example, a client with a left hemianopia may read the word “radish” on test form I as “dish,” and a client with a right hemianopia may read the word “mustard” as “must.”

Another test, the Telephone Number Copy (which is part of the biVABA), provides information about the client's accuracy in reading numbers. In this test the client is required to copy down telephone numbers that include numbers with similar configurations, such as 6, 8, 9, and 3.[158] The therapist records the number of errors made in copying the phone numbers, provides the client with this feedback, and instructs the client to locate and correct the errors. Individuals with hemianopia typically make mistakes when reading numbers located on the affected side and often confuse numbers with similar configurations. For example, a client with a left hemianopia may misread the number 9 in the telephone number 938-2020 as an 8 and copy down 838-2020. However, it is expected that the client will be able to use the provided feedback to locate and correct the errors made on the test unless the client's ability to engage visual attention is also impaired.

To effectively compensate for the hemianopia, the client must execute an organized and thorough search of the blind field using the seeing portion of the visual field. This means that a client with a left hemianopia must use the right visual field to search both the left and right fields. Clients with hemianopia demonstrate difficulty searching both *peripersonal space* (the space immediately around the body) and *extrapersonal space* (the space extending from the body into the environment). Deficiencies in searching peripersonal space affect the performance of ADLs completed close to the body, such as grooming, dressing, reading, and writing.[91,163] Deficiencies in searching extrapersonal space have a pronounced impact on mobility and affect activities in outside and community environments, such as driving, shopping, and mowing the yard.[91,163]

To navigate dynamic and complex community environments, the client must use a wide scanning strategy that is initiated on the side of the deficit and executed quickly and efficiently. The client also must be able to rapidly shift attention and search back and forth between the central and the peripheral visual fields to keep track of objects moving within the environment. The ability to compensate for the hemianopia to search extrapersonal space is best evaluated by observing how the client searches during a task involving extrapersonal space. If the client is compensating well for the field deficit, he or she should be able to symmetrically search both the right and left halves of the visual field with equal speed whether stationary or moving.

Computerized light boards can be used to measure and compare the client's response time in searching the right and left halves of the visual field, along with the person's ability to divide attention between the central and peripheral fields.[72] The Dynavision D2 (Dynavision, *http://www.dynavisioninternational.com*) is an example of one of these devices (Fig. 24.10). The Dynavision D2 presents a random visual target (light) that the client must touch to extinguish. As soon as the client extinguishes one target, another appears in a random location on the board. The client must "hit" as many targets as possible during a specific period (called an exercise run). The computer records the client's reaction time in extinguishing the targets in each quadrant of the board to provide an objective measurement of search performance in each portion of the field. Increased reaction time to responding to targets in the blind side of the field indicates reduced compensation for the field deficit. The Dynavision t-scope feature can be added to an exercise run to evaluate the client's ability to divide attention between the central and peripheral areas of the board. The t-scope is a light-emitting diode (LED) panel in the center of the board that can be programmed to display letters, numbers, symbols, subtraction problems, words, or text at either fixed or random intervals during the run. When the t-scope is active, the client must simultaneously extinguish the light targets and identifying optotype that appears in the t-scope, and this can only be accomplished by monitoring both the central and peripheral areas of the board. Occupational therapists without a light board such as the Dynavision can create a task analysis using a laser pointer to observe the client's search capability. The therapist randomly projects the laser beam onto various locations on a blank white wall, and the client locates and touches the projected red or green dot. The therapist notes the strategy and the amount of time the client used to locate the dot.

FIG 24.10 Example of a visual search task using the Dynavision D2. The lights on the board are illuminated one at a time in random patterns. The client must locate the illuminated light and press it to turn it off. As a light is pressed, another light is illuminated. The client strikes as many lights as possible within a specified time. The activity can be used to teach and reinforce efficient search patterns to compensate for visual field deficits and visual inattention. (Courtesy Dynavision International, LLC. http://products.dynavisioninternational.com/products.)

A ScanCourse (part of the biVABA) can be used to determine whether the client executes visual scanning during ambulation.[158] The therapist constructs the course using targets created by placing a 1-inch black, stick-on letter or number on several 3 × 5-inch white index cards. The targets are placed along a hallway in various locations on the left and right sides. The therapist instructs the client to identify the targets as he or she walks through the course and observes the client's accuracy in locating the targets on each side during ambulation. The client is given two trials to complete the scan course. After the first trial, the therapist provides feedback on the client's performance, such as, "You missed three targets on the right side; remember to turn your head to make sure you see all the targets on that side." The client then completes the second trial by reversing and going through the course in the opposite direction. The therapist notes whether the client's performance improves on the second attempt. Clients who are unable to improve performance on the second trial will require substantial support within the environment to scan for safety risks.

The perimetry test performed with Penny showed a complete left hemianopia in both eyes, affecting both the central and peripheral fields. Of particular importance was the finding that the border of the hemianopia split the foveal field in half. This finding suggested to the OT that Penny's perceptual span for reading was probably significantly reduced on the left side, causing her to miss words and letters to the left of fixation. The OT used the Pepper test to confirm this hypothesis. The results of the Pepper test showed that Penny misses letters and words on the left, which reduced her reading accuracy to 83% on the test. Her reading rate was 51 words per minute (normal speed is 250 words per minute).[81] Because Penny had reported difficulty reading numbers accurately, the therapist also administered the Telephone Number Copy test from the biVABA. Penny misread three numbers on this test; she misidentified a 3 as an 8, a 4 as a 1, and a 5 as an 8. She was able to find her errors on the test and correct her mistakes.

The therapist used the Dynavision to observe Penny's ability to search for targets in her visual field. Penny demonstrated a reaction time of 2.35 seconds to locate targets in the left half of the board, compared to 1.1 seconds in the right half of the board. In observing her locate targets on the board, the OT noted that Penny moved her head very slowly to the left side of the board to locate targets and did not turn her head far enough *to see the lighted targets on the outer ring of lights.*

Penny also completed a scan course. On the first pass through the course, she missed 4 of 10 targets on the left side (60% accuracy) but easily identified 10 of 10 targets on the right side (100% accuracy). After receiving feedback on her performance, Penny turned around and walked through the course in the reverse direction. This time she identified 9 of 10 targets (90%) on the left and 10 of 10 targets (100%) on the right. Her performance also indicated that she was able to use feedback to improve her search of the left side of space, thus demonstrating good rehabilitation potential.

Intervention

The performance limitations experienced by people with hemianopia generally fall into two categories: difficulties with mobility and difficulties with reading. Because of the mobility limitation, clients experience difficulty navigating independently and safely engaging in daily occupations completed in dynamic environments, such as driving, shopping, and participating in community events.[91,104,107,163] Resumption of driving may or may not be a goal, depending on the driving laws of the state in which the client lives. The client's challenges in reading result from an inability to adapt the present saccade strategy to the width of the new perceptual span. The client experiences reduced accuracy and reading speed, which limits participation in occupations such as financial management. To overcome reading challenges, the client must develop a new saccade strategy to match the new perceptual span.

To compensate for hemianopia, the client must develop a habit of consciously using head movement to search the visual field on the blind side.[23,77,103,114,124] Because the frontal lobes perform perceptual completion, the client often initially lacks insight into the extent and boundaries of the field deficit. Successful compensation requires the client to believe firmly that the deficit exists and that the visual input from the blind side cannot be trusted. A client able to develop this level of insight usually learns to effectively compensate for the deficit. Therefore, every effort must be made through activities and education to make the client aware of the location and extent of the deficit.

Mobility limitations.

The limitations experienced in mobility occur primarily because the client does not turn the head far enough, fast enough, or often enough toward the blind field to take in the information needed for safe mobility. If the inferior visual field has been affected, as occurs with a hemianopia, the client may also experience difficulty monitoring the support surface on the deficit side. This can result in hesitancy in walking and a tendency to keep the head down and the eyes fixed on the floor directly in front of the client. Although this strategy may keep the client from colliding with objects, it also prevents the client from monitoring the surrounding environment and can add to disorientation during ambulation.

To compensate effectively for the hemianopia, the client must learn to turn the head quickly and completely search the blind visual field. The following are desired outcome behaviors.

1. Initiation of a wide and fast head turn toward the blind field

2. Anticipation of visual input from the blind field, as evidenced by an increase in the number of head and eye movements toward the blind field

3. Execution of an organized and efficient search pattern that begins on the blind side

4. Attention to and detection of visual detail on the blind side

5. Ability to quickly shift attention and search between the central visual field and the peripheral visual field on the blind side

Combining preparatory methods and tasks with occupation-based intervention can be an effective way to elicit these behaviors and develop compensatory strategies. Preparatory tasks focus on increasing the speed, width, and efficiency of the search pattern toward the blind side.[a] Occupational therapists use light boards (eg, the Dynavision) to develop the components of efficient search patterns.[6,72,75] The size of the board automatically elicits the wide head turn needed to search the blind side. The light buttons are identical, which eliminates the need for discrete identification and elicits a more automatic visual search response. Drills on the light board are presented as games of skill, as the client tries to strike as many lighted buttons as possible in the allotted time. This challenges clients to give their best effort each time. The device records and analyzes performance, identifying where deficiencies exist to enable the client to improve performance on the board. The lights can be programmed to move at high speeds, and it is impossible to beat the board, which draws out the competitive nature of the user. In clinics without a Dynavision or similar light board, practitioners can use a laser pointer projected onto the wall and play “tag” games, in which the client attempts to locate the red dot as quickly as possible.

As the basic components of the search strategy are developed, the OT should incorporate them into activities that require combining search with ambulation. Indoor and clinic activities can include completing scan courses (described earlier); activities such as “find red,” in which the client points out every red item in the surrounding environment while navigating toward a destination; and “narrated walks,” in which the client points out landmarks and changes in the environment while navigating toward a destination. These activities reinforce keeping the head up during ambulation to improve orientation and avoid collisions. As skill is developed, practice in dynamic and unfamiliar environments should be added. The client completes activities in stores and malls; for example, he or she turns toward the blind side to identify the number of people standing in an aisle or inside a store while walking by; also, the client locates stores in a mall and specific items in stores using landmarks and organized search strategies.

It is important that the client develop habits and routines to support performance, especially in high-risk community environments. One very important habit is to stop before entering an unfamiliar environment and slowly scan the environment for potential travel hazards, such as temporary and fragile displays and low-contrast features (eg, curb cuts and other subtle changes in the support surface). This habit helps the client build a mental representation of the space before entering and engaging it; it also should increase the client's confidence and reduce the likelihood of an unexpected collision. Another habit is to closely observe unique landmarks. such as a picture on a wall or a change in wall color, to assist in maintaining orientation. Supportive routines include shopping at times of day when the stores are less crowded, choosing well-lighted walkways with minimal obstacles, and arriving early for concerts and other events.

Reading limitations.

The client's primary challenges in reading occur because the client is trying to read using a saccade strategy designed for a wider, unrestricted perceptual span. To improve reading speed and accuracy, the client must learn to adapt the saccade strategy to the new perceptual span. This requires significant practice and can be extremely frustrating for the client. The occupational therapist can help the client put in the required practice time by breaking the reading task down into manageable components. Preparatory interventions using prereading exercises (such as those designed by Warren[161] or by Wright and Watson[169]) and commercially available word and number searches can be used to provide this practice. These exercises are designed so that the client searches for specified letters, numbers, or words on worksheets (Fig. 24.11). The low cognitive requirements of the exercises enable the client to focus on perfecting the saccade strategy. As the client's reading performance improves, the OT should switch to an occupation-based approach and help the client select a large-print book on a familiar topic to transition to reading continuous text. The large-print format reduces the density of the text, requiring less saccade precision, and the familiar subject reduces the cognitive demands on the client. Typically the client is instructed to read a chapter a day. Modifications, such as drawing a bold red line down the margin of the text, can be used as adjuncts to help the client with a left hemianopia find the beginning of a line of text, or to help a client with a right hemianopia find the end of a line of text. Clients who have difficulty staying on line or moving from line to line can use a ruler or card to maintain their place, but such aids should be relinquished as reading performance improves because they slow reading speed. As the client regains skill in reading, the occupational therapist should introduce the materials the client needs to complete reading-dependent occupations, such as financial management, meal preparation, and medication management.

Cross out all of the double numbers 1.5M

8 1 2 6 7 2 3 1 2 2 4 5 6 8 8 7 5 6 8 8 4 5 3 2 6 7 8 5 6 7 7 4 5 6 6
5 8 8 3 4 5 2 8 8 3 4 5 8 8 2 1 9 9 4 5 2 3 8 8 5 6 7 6 5 9 9 7 6 5 4
8 9 8 6 3 4 5 8 8 2 3 4 5 2 7 7 9 9 8 7 8 9 5 6 8 8 3 4 5 7 6 8 5 5 4
8 8 6 5 3 4 2 3 7 8 8 6 9 0 3 4 8 8 4 5 2 3 4 5 6 7 8 8 4 6 6 5 4 6 9
3 2 8 8 9 3 4 2 8 8 4 5 7 2 3 5 5 7 8 9 0 0 3 8 3 9 2 3 3 4 3 2 2 1 5
4 8 5 7 3 6 6 7 4 3 2 5 5 3 4 7 8 9 9 2 3 4 2 2 4 5 6 4 3 6 7 8 8 5 4
1 1 2 3 4 5 6 6 5 4 4 4 5 6 7 7 8 8 9 0 0 6 5 6 7 7 4 5 3 4 5 3 3 2 5
4 5 6 6 5 4 4 4 3 3 2 2 5 6 4 7 2 3 4 5 5 9 8 7 6 7 8 8 8 4 5 6 2 2 1
3 4 5 6 5 5 4 6 6 5 4 6 5 6 7 8 4 2 4 5 2 2 4 4 9 9 8 8 7 7 8 6 6 4 3
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5 5 3 3 2 5 7 3 1 1 1 4 4 6 6 8 4 3 5 5 6 6 7 7 3 6 8 5 7 6 5 4 3 2 2
2 3 4 4 5 6 6 7 5 8 7 7 9 8 9 0 0 1 1 1 2 3 4 4 4 3 3 5 6 3 5 4 3 2 2
3 3 4 4 5 4 6 3 7 5 5 7 8 9 0 1 1 8 7 6 5 4 4 1 1 4 5 3 9 6 8 5 4 7 3
4 4 5 3 7 5 5 7 9 9 7 0 9 6 4 5 6 6 8 0 8 0 1 2 2 3 4 4 5 7 8 9 0 1 1
5 5 6 4 5 5 5 4 3 2 2 1 2 4 9 8 9 9 0 0 7 6 5 5 6 7 5 8 4 8 4 4 3 8 3
2 3 4 2 2 1 3 2 5 7 6 8 5 4 4 5 7 3 4 3 2 1 3 5 6 7 7 8 0 0 6 3 2 3 2
3 3 4 4 2 2 5 7 7 8 9 9 0 7 6 5 5 4 4 3 7 7 5 4 3 3 2 2 1 2 3 3 4 5 6
3 3 4 4 4 5 5 6 6 7 4 2 2 5 8 0 7 6 8 6 5 3 3 3 3 7 8 0 6 4 2 4 5 6 6
6 6 4 6 3 7 8 8 5 3 3 3 6 7 7 5 5 4 4 1 1 6 6 9 5 5 3 3 7 1 4 2 3 4 4
5 5 3 3 2 5 7 3 1 1 1 4 4 6 6 8 4 3 5 5 6 6 7 7 3 6 8 5 7 6 5 4 3 2 2
2 3 4 4 5 6 6 7 5 8 7 7 9 8 9 0 0 1 1 1 2 3 4 4 4 3 3 5 6 3 5 4 3 2 2
8 8 6 5 3 4 2 3 7 8 8 6 9 0 3 4 8 8 4 5 2 3 4 5 6 7 8 8 4 6 6 5 4 6 9
3 2 8 8 9 3 4 2 8 8 4 5 7 2 3 5 5 7 8 9 0 0 3 8 3 9 2 3 3 4 3 2 2 8 5

FIG 24.11 Example of a prereading exercise. The client is instructed to cross out all the double numbers on the page. (From Warren M: Pre-reading and Writing Exercises for Persons with Macular Scotomas. visAbilities Rehab Services, http://www.visabilities.com.)

The OT addresses handwriting by teaching the client to slow down and monitor the pen tip as the hand moves across the page and into the blind side. Preparatory tasks that require the client to trace lines and shapes are effective in helping the client learn how to position the paper and pen so that the pen tip stays visible on the line. Practice completing blank checks, addressing envelopes, and filling in a check register helps the client learn to apply handwriting to daily occupations.

It is important that the occupational therapist also modify environments and tasks to increase visibility and structure as described in the overview on intervention at the beginning of this chapter. Adding color and contrast to the key structures in the environment needed for safe navigation and orientation (eg, door frames and furniture) will help the client locate these structures more quickly. Using black felt-tip pens and bold-line paper to heighten the contrast in writing materials will help the client more accurately monitor the pen tip in handwriting. The simple addition of high-quality light often increases speed and reduces errors in reading and improves mobility. Reducing pattern in the environment by eliminating clutter and using solid-colored objects enhances the client's ability to locate items more quickly. Creating a structured, predictable environment reduces the need for constant scanning. All these modifications reduce the amount of effort the client must generate to compensate for the VFD, and they increase the likelihood that the client will participate in the occupation—the ultimate goal.

Penny received 10 1-hour sessions of outpatient OT intervention over a 10-week period. To address her limitations in reading, Penny was given prereading exercises involving letters, numbers, and words to help her modify her saccade strategy to match her reduced perceptual span. She completed the exercises at home for 45 minutes a day. The Pepper test was repeated at 5 weeks; it showed that her reading accuracy had increased to 92% and her reading rate had increased to 72 words per minute. The Telephone Number Copy test was also repeated, and Penny scored 100% accuracy.

As Penny's performance improved, the therapist introduced reading of large-print books with familiar content to begin the transition to reading continuous text. Penny and Pot are fans of the Harry Potter books, so Penny's friend took her to the local library to check out a large-print copy of one of the books she had read before. She read the book daily to Pot for 1 hour. At discharge, the therapist repeated the Pepper test; Penny demonstrated 100% accuracy and a reading rate of 124 words per minute.

The OT made a home visit during the third therapy session to evaluate Penny's environment and to meet Pot. Penny's friend and fellow artist who had been taking her to therapy also attended the session. The assessment showed that Penny's home generally had sufficient lighting, contrast, and organization. However, the small kitchen had only a single small, round ceiling light, which left the countertops and work surfaces poorly lit. In addition, she had deep cupboards packed with food and cookware, and her countertops were cluttered with appliances and food items. Penny's studio, located in a bedroom, was also cluttered and had only overhead lighting and a small table lamp. The OT suggested replacing the small overhead lighting fixture in the kitchen with a large fluorescent fixture and adding fluorescent undercounter lighting. The OT also suggested cleaning out the cupboards and removing rarely used items and expired food from the shelves and then adding a two-tiered cabinet organizer so that foods could be stored one-item deep to make them more visible. The OT demonstrated how this could be accomplished with one of Penny's shelves. The OT also recommended that Penny remove all items from the countertops except those that she used daily. Although Penny was still resistant to resuming her art, the OT made suggestions to improve the lighting in her studio by adding a 50-watt halogen task lamp on her worktable, along with increasing organization and reducing clutter. A low-power magnifying lamp was also recommended to help her see details more clearly. Penny expressed doubt that she could make the recommended modifications, but her friend stated that she would help her, and within 2 weeks, all the recommendations had been implemented. The friend also expressed interest in getting Penny to resume her art and asked for suggestions on how to accomplish this. The OT practitioner suggested that if the detailed drawings Penny had previously completed were still too difficult, even with the studio modifications, maybe she could explore other forms of artistic expression that were not so visually demanding. The next week Penny reported in therapy that she and her friend had attended an art fair over the weekend, and she thought she might experiment with watercolor landscapes, something she had done early in her career. Her friend was coming over to assist her that week.

Penny's ability to complete meal preparation, financial management, and diabetes self-management was addressed through improvement of reading and visual search skills, task and environmental modification, and adaptive equipment. Using a talking calculator to verify numbers helped her reconcile her checkbook. Because of the critical need for accuracy in monitoring blood glucose levels and drawing insulin, she was trained to use a talking glucometer and a nonvisual adaptive device to draw her insulin. The environmental modifications implemented after the home assessment greatly improved her ability to complete meal preparation.

To address mobility, the OT practitioner began by having Penny complete a series of exercises on the Dynavision for the first 20 minutes of each session. The exercises focused on increasing the speed and efficiency of the search pattern she executed to the left and on her ability to shift attention between the center and peripheral areas of the board and complete scanning with cognitive distractions. The OT also used scan courses with targets taped along the hallways of the center, along with "find red" and narrated scanning. As Penny improved on indoor activities, the OT moved outdoors and had Penny navigate sidewalks and areas adjacent to the clinic. The OT taught her that, prior to navigating an unfamiliar environment, she must consciously turn her head widely and survey her surroundings, locating any potential obstacles and identifying landmarks. As her comfort in these environments increased, she was taken on a community outing to her local grocery store to practice the skills she had learned and receive instruction in how to quickly and efficiently scan shelves to locate needed items. Additional community outings were completed in her local mall and in her church. Two weeks prior to discharge, Penny excitedly reported that she and Pot had attended church and afterward had had lunch with friends, with no difficulty.

Driving was addressed throughout the intervention period. The Dynavision exercises Penny completed improved the visual skills she needed for driving, especially speed, flexibility, and width of the search strategy to the left. Limitations experienced by drivers with hemianopia were discussed in conjunction with strategies to compensate for these limitations and vehicle modifications. When Penny had shown sufficient improvement, the 4-minute test on the Dynavision was administered. This test has been shown to be predictive of a person's performance behind the wheel.[73] *A person who scores above 195 on the test is likely to successfully complete an on-road driving assessment. Penny scored 230 on the test and was referred to a driver's program for an evaluation administered by an OT credentialed as a certified driver's rehabilitation specialist (CDRS). Penny passed the driving evaluation and was released to resume driving during daylight hours over familiar routes.*

Visual Attention and Visual Scanning

Visual attention is the ability to observe objects closely to discern information about their features and their relationship to oneself and other objects in the environment. It requires the ability to ignore irrelevant sensory input and random thought processes and to sustain focus for several seconds to several minutes.[117] Visual attention also entails being able to shift visual focus from object to object in an organized and efficient manner. Engagement of visual attention is accomplished through visual scanning or search (these two terms are used interchangeably). Although these two processes are separated in the visual perceptual hierarchy so that they are easier to understand, they cannot be separated in evaluation and intervention. Any change in visual attention will be observed in the client as a change in the scanning pattern used for visual search.

Visual attention is divided into two broad categories: focal (or selective) visual attention and ambient (or peripheral) visual attention. Focal/selective attention enables the person to accurately distinguish visual details such as differences between letters, numbers, and faces. It is used to recognize and identify objects.[53] Ambient/peripheral attention focuses on the location of objects in the environment and their proximity to the person. Its job is to ensure that a person is able to move safely through space and maintain orientation in space; it depends on seeing "the big picture" rather than the details.[53] If humans did not have the capacity for peripheral attention, collisions with objects and disorientation when moving would be the norm. To be able to fully engage and learn from the environment, a person must use these two modes of visual attention simultaneously at all times. The contribution of each is equally important to perceptual processing. Adults without brain injury use an organized, systematic, and efficient pattern to complete visual search.[154,160,162,166] The type of search pattern used depends on the demands of the task.[79] For example, a person would use a linear search strategy to read a book or search for an item on a shelf.

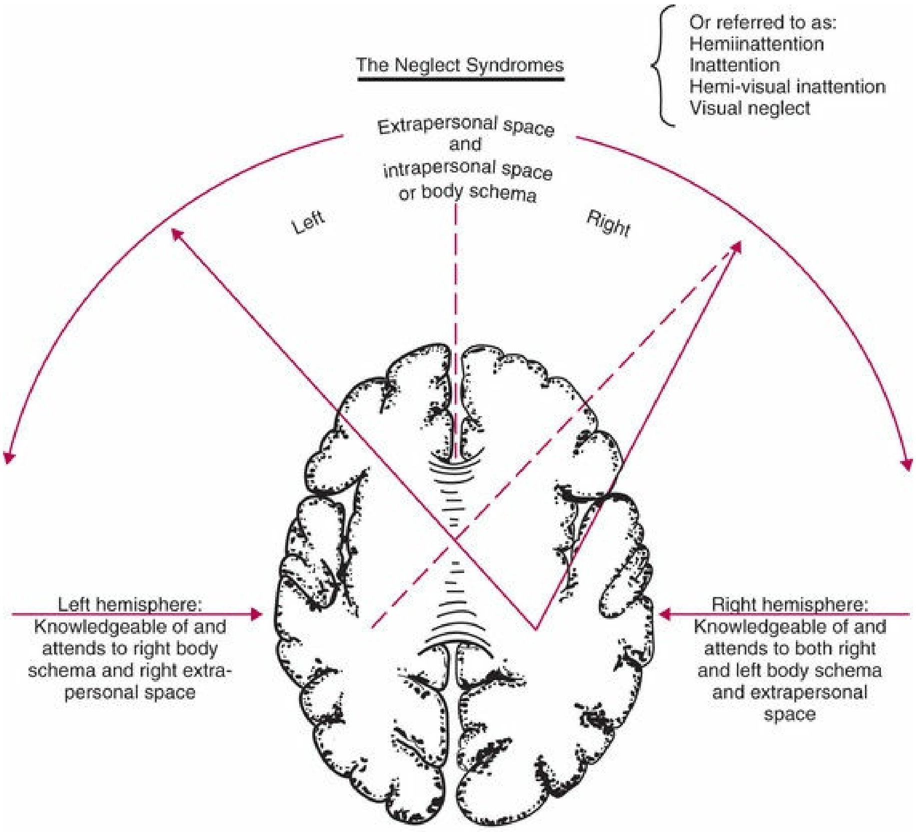
Hemiinattention

Deficits in visual attention commonly occur after brain injury.[53,94] **Hemiinattention** and its most severe form, visual spatial neglect, is one of the most common attention deficits observed in individuals with acquired brain injury from a stroke or head trauma.[12,29,71]

Kerkhoff and Schenk[71] defined hemiinattention as the "impaired or lost ability to react to or process sensory stimuli (visual, auditory, tactile, olfactory) presented in the hemispace contralateral to a lesion of the human right or left cerebral hemisphere." Several key words in this definition delineate the features of hemiinattention. First, ability can be "impaired" or "lost," implying that there are degrees of severity of the condition, ranging from a milder form (impaired) to a severe form (lost). Second, people can have difficulty "reacting" to stimuli (ie, noticing and responding to it) or difficulty "processing" stimuli (ie, using the sensory information to complete a task). Third, people can experience inattention to different kinds of sensory input, not just visual. Finally, people experience impaired attention to incoming sensory input "contralateral" to (on the opposite side of) the location of the lesion. This means that individuals with right hemisphere lesions experience difficulty attending to visual stimuli on the left side of the body midline, and vice versa.

The consensus now is that hemiinattention represents a heterogeneous disorder characterized by a complex and diverse set of behaviors.[a] These behaviors can be generally grouped into three broad categories of impairment: (1) a lateralized bias in attending to and searching space; (2) a nonlateralized impairment in arousal and ability to focus, shift, and sustain attention; and (3) a lateralized inability to map and build internal mental representations of space on the left side of the body.[1,15,58,92,136] The diversity of behaviors associated with hemiinattention results from disruptions in the large distributed network that controls visual attention.[b] The network comprises the frontal, prefrontal, temporal, parietal, and occipital lobes in the cortex and the brainstem, thalamus, and cerebellum. The diverse areas of the network communicate extensively with each other through the long white matter pathways (fasciculi) that connect areas of the brain.[48] Brain injuries can disconnect areas and disrupt network actions at multiple sites, including sites that may not have been directly damaged by the brain injury.[42] This means that hemiinattention is not caused by damage in just one brain area.[1,42]

Hemiinattention is predominantly caused by brain injuries affecting the cortical areas of the right hemisphere.[8,12,58,119] Left hemisphere lesions in the cortex can cause right hemiinattention, but the condition occurs less frequently and with less severe and consistent changes in behavior.[15] Hemiinattention is associated with right hemisphere injuries and probably occurs because of a difference in the way the hemispheres direct visual attention.[48] As Fig. 24.12 shows, the left hemisphere directs attention toward the right half of the visual space surrounding the body, and the right hemisphere directs visual attention toward *both* the right and left halves of space. If a lesion occurs in the left hemisphere, visual attention and search toward the right side are diminished, but some attentional capability is still provided by the right hemisphere. A similar lesion in the right hemisphere may completely eliminate attentional capability toward the left because no other area directs attention toward the left side.



In relation to **movement** and **sensory perceptions** such as vision (visual-spatial and visual-object awareness and recognition), auditory and somesthetic (including body image or schema) cognition and awareness, it appears that the left hemisphere primarily attends to the right extrapersonal space and/or body image parameters while the right hemisphere attends to both right and left extrapersonal space and body image. Thus **left hemisphere lesions** of the 1°, 2° or 3° areas of the cerebral cortex or associated subcortical fiber tracts concerned with visual, auditory, somesthetic, or motor functions rarely result in a neglect syndrome because the right hemisphere can attend to and compensate for the left hemisphere deficit. However, **right hemisphere lesions** of one or more of these functional areas leave the brain unable to attend to or be aware of the left extrapersonal space and body schema. visual field deficits (especially left homonymous hemianopia) always compound the neglect syndrome.

FIG 24.12 Difference between the right and left hemispheres in the direction of visual attention and the relationship of hemisphere lesions to hemiinattention and neglect syndrome. (Courtesy Josephine C. Moore, PhD, OTR.)

Spatial Bias

Spatial bias is the classic behavior associated with hemiinattention.[12] The presence of spatial bias toward the right side changes visual search and creates difficulty exploring the left side of the body. Instead of initiating a symmetrical search pattern beginning on the left and moving to the right, the client with hemiinattention begins on and confines search to the right side of a visual array. This rightward bias creates an asymmetric search pattern, depriving the client of needed information on the left side of objects and visual arrays.

Nonlateralized Attention Deficit

Individuals with persistent (chronic) hemiinattention have difficulty generating adequate levels of alertness and sustaining attention.[120,140,149] The impairment of attention is nonlateralized, meaning that it does not affect attention to one side differently from the other, but instead affects the brain's overall ability to receive and process visual information. The generalized diminishing of attention impairs the ability to attend to specific tasks, and the client often drifts off and loses focus while completing activities.[120]

In addition to difficulty sustaining attention, people with hemiinattention have difficulty disengaging from the object they are focusing on and shifting attention to another object.[44] People with right hemisphere lesions have greater difficulty disengaging from viewing targets located on the right (ipsilesional) side and also experience difficulty engaging attention on targets located to the left.[1] They make fewer visual fixations and slower eye movements to the left, and the result is slowed and incomplete search toward the left half of the body space.[89]

Mental Representation of Space

Mental representations of space are internally generated maps of the space that surrounds the body. The maps are continuously updated as the body moves through environments. People with hemiinattention experience a disruption of the mental representation of space in which objects to the client's left side simply disappear from the client's conception of space. According to Becchio and Bertone,[15] it is as though the mental map of space on the left side did not exist in the past, doesn't exist in the present, and will never exist in the future. As a result, the client doesn't attend to landmarks on the left side and does not build a map of environments on the left side. This diminishes the ability to orient to and maintain orientation in space, and clients are often observed at times to be literally “lost in space” as they try to navigate environments.

Inability to conceptualize space may explain the consistency of the inattentive behavior so often observed in clients with hemiinattention and also the client's lack of insight regarding the missing space.[15] It may also explain another commonly observed behavior associated with hemiinattention, called revisiting, in which the person repeatedly reexamines objects on the right side of a visual array while ignoring objects on the left. For example, if asked to locate a cup of pudding on the left side of the dinner tray, the client will repeatedly search the right side of the tray, even though the pudding cannot be found there.

Hemiinattention often is confused with the presence of left hemianopia. Although both may cause the client to miss visual information on the left side, they are distinctly different conditions and do not have the same effect on performance. When left hemianopia occurs, the client attempts to compensate for the loss of vision by engaging visual attention. The client directs eye movements toward the blind left side in an attempt to gather visual information from that side. Because of the field deficit, however, the client may not move the eyes far enough to acquire the needed visual information from the left side and as a result may miss objects on that side and appear inattentive. In contrast, the client with hemiinattention has lost the cortical attentional mechanisms that drive the search for visual information on the left. The client will make little attempt to search for information on the left side of the visual space. Visual search is most significantly impaired when the two conditions occur together. In this case, the client does not receive visual input from the left side because of hemianopia and does not compensate for the loss of visual input by directing attention toward the left side. The combination of hemiinattention and left hemianopia creates the most severe form of hemiinattention, **visual neglect**.[30] Clients with this condition show exaggerated inattention toward the left half of the visual space surrounding the body and often do not move the eyes past midline toward the left or turn the head toward the left side.[1] Visual neglect may be compounded by neglect of the limbs on the left side of the body or neglect of auditory input from the left side.[71]

Occupational Limitations

Because visual attention is modulated through an extensive neural network involving the entire brain, some capacity for visual attention generally is retained even in cases of severe brain trauma.[53] Conversely, because so many neural structures contribute to attention, changes in visual attention occur even with mild injury. Hemiinattention creates asymmetry and gaps in the visual information gathered through visual search. The incomplete search pattern can create challenges completing tasks that require symmetric attention and search. The client misses needed details on the left, and this can result in confusion when reading and dangerous behavior, such as colliding with objects on the left while navigating through environments.[16,116,152,165] How much the diminishment of visual attention affects occupational performance depends on the circumstances and requirements of tasks. For example, enormous amounts of selective and sustained visual attention are required when the person reads a highly technical textbook, but less when the individual reads an advertisement. Driving requires continuous global attention to monitor the speed and position of other vehicles and objects, in addition to sporadic selective attention to identify landmarks, street signs, and traffic lights.

Evaluation

As a process found at the intermediate level of the visual perceptual hierarchy, visual attention is affected by deficits in the lower level visual functions of visual acuity, oculomotor function, and visual field. Aphasia and motor impairment can also affect performance on visual attention assessments. Therefore, these client factors must be evaluated first, before visual attention is addressed. Because visual search is the outward motor expression of visual attention, it is assessed by observing how the client initiates and carries out visual search on a task. The occupational therapist seeks to answer these questions:

1. Does the client initiate a left-to-right and top-to-bottom search strategy?

2. Does the client execute the search strategy in an organized and efficient manner?

3. Does the client search symmetrically and obtain complete visual information from both sides of the array?

4. Is the client able to sustain visual search, or is there evidence the client drifts off during search?

5. Does the client accurately locate targets?

6. Does the client's ability to search for information decrease as the visual complexity of the task increases?

Cancellation tests are frequently used to evaluate changes in visual search and have been shown to be sensitive to uncovering the spatial bias caused by hemiinattention.[94,154] Cancellation tests are usually paper and pencil tests consisting of rows of single letters, numbers, or symbols. The therapist instructs the client to search through the rows and cross out or cancel a specific target (Fig. 24.13). The therapist records the time required to complete the test and the accuracy of target detection. Adults without brain injury demonstrate specific characteristics of search strategies on cancellation tests that ensure good accuracy and speed completing the test.[162] These characteristics include strategies that are linear, organized, symmetrical, thorough, and consistent. Warren et al.[162] found that the most commonly used strategy on cancellation tasks was a left-to-right and top-to-bottom linear reading strategy, followed by a back-and-forth (left to right then right to left), top-to-bottom strategy. They also found that most people consistently use the same strategy throughout a single cancellation test and a series of cancellation tests.

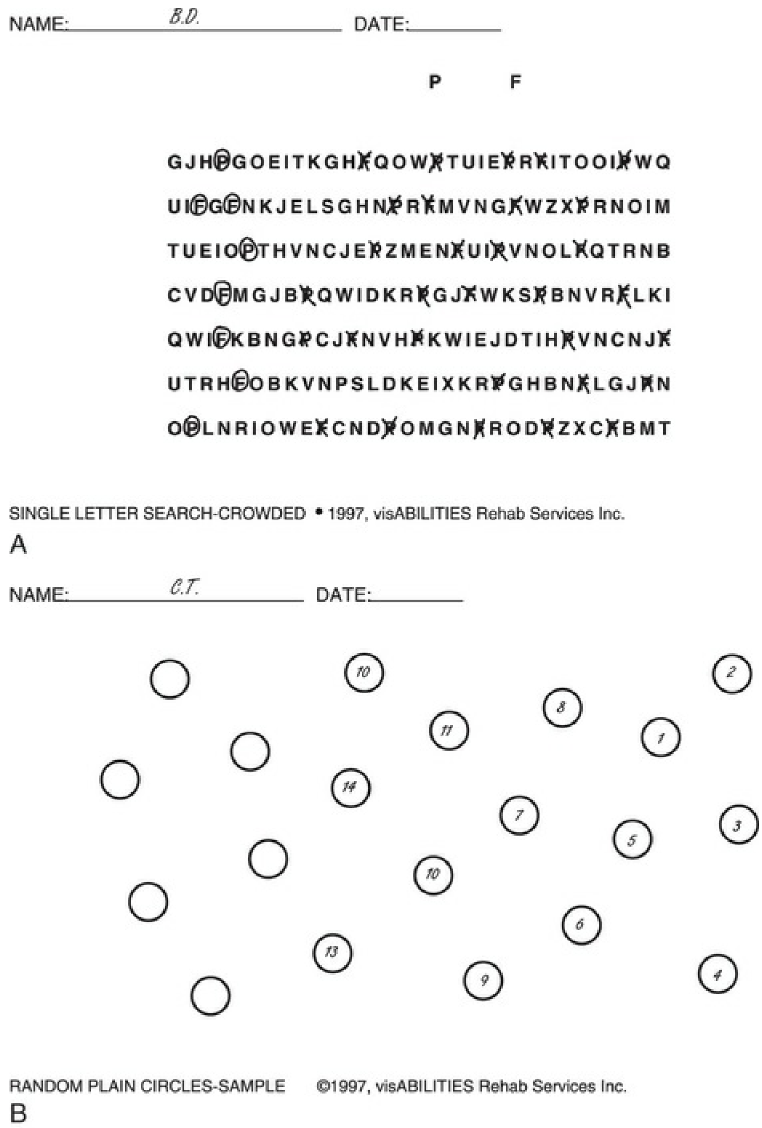


FIG 24.13 Examples of ineffective search patterns used by clients to complete two visual search subtests of the Brain Injury Visual Assessment Battery for Adults. A, An abbreviated search pattern used by a client with left hemianopia when crossing out the letters P and F on the subtest. The client executed an organized left-to-right linear search pattern but failed to locate the beginning of the line on the left side, and consequently failed to cross out targets on that side *(circled letters).* B, An asymmetric and abbreviated search pattern executed by a client with hemiinattention and left hemianopia. The client was asked to number the circles consecutively, choosing any pattern desired. The client began numbering the circles from the right, rather than from the left, and failed to number circles on the left side of the array.

The client with hemianopia may demonstrate an abbreviated search pattern toward the blind side, resulting in omissions of targets on that side of the test. The search pattern may also be executed slowly, especially toward the blind field. However, unless the client's visual attention is diminished, the search pattern should be organized and consistent and the client should thoroughly search and accurately identify the targets in the seen field. The client should also be able to respond to a cue (eg, "Be sure to search the left side") to improve performance. In contrast, individuals with hemiinattention demonstrate an abbreviated search toward the left side with target omissions, but they also often search in a random, unpredictable fashion, reflecting their difficulty in selectively focusing and sustaining attention (see Fig. 24.12).[1,14,26] The organization and accuracy of the search pattern also may deteriorate when they scan more complex visual arrays. Thus, one way to differentiate between left hemianopia and hemiinattention is to observe the search strategies the client uses to complete a cancellation test. Observing the client copy a design also provides information about the ability to conceptualize space on the left side.[1] On a design copy test, the client is shown a simple figure (eg, a house, clock, or flower) and asked to reproduce it.[158] Clients with hemiinattention frequently omit details on the left side of drawings and skew the drawing toward the right side; this suggests both bias against and impaired mental representation of left space.[18]

Determining how the client applies a search strategy to extrapersonal space requires the use of tests that force the client to scan a wider visual field. The ScanBoard (part of the biVABA) consists of a large board (20 × 30 inches) on which 10 numbers are displayed in an unstructured pattern. The board is placed at eye level and centered at the client's midline. The client is asked to scan the board and point out all the numbers he or she sees. The therapist records the pattern the client follows in identifying the numbers. Research using this test has shown that adults without brain injury use an organized, sequential search pattern, beginning on the left side of the board and proceeding in either a clockwise or counterclockwise fashion until all the numbers have been identified.[160] In contrast, adults with deficits in visual attention from brain injury demonstrate disorganized, random, and often abbreviated search strategies, frequently missing numbers on one side of the board.

Light boards (eg, the Dynavision) and the biVABA ScanCourse also assess the client's ability to attend to and search extrapersonal space. Divided attention tasks on the Dynavision using the t-scope feature, or asking the client to complete a cognitive task (eg, reciting the names of states or countries) while striking the lights, provide opportunities to observe the client's ability to rapidly shift attention between divergent tasks. Exercise runs on the light board can also be extended over several minutes, testing the person's ability to sustain attention. On the Dynavision, the computer printout breaks down the client's performance into 1-minute increments, allowing the therapist to determine whether the client is able to consistently sustain attention and performance throughout the 4-minute period.

The information gathered from observing the client complete visual search tests should reveal a pattern of deficiencies in attention and search that affect the client's ability to acquire visual information when completing everyday activities. For example, the client who demonstrates an asymmetric search pattern on a cancellation test, initiating and confining search to the right side, often demonstrates the same asymmetric pattern while searching for grooming items in the bathroom. The client's level of performance depends on the severity of the attention deficit. Clients with mild inattention generally are able to complete basic and habitual daily activities and experience difficulty only on tasks that are unfamiliar or require search of a complex visual array. In contrast, clients with neglect may have difficulty with basic tasks, such as locating all the food on their plate. Combining information from the visual search and ADL assessments enables the therapist to obtain a complete picture of how inattention has affected the client's performance of daily activities.

The physician who referred Penny to the low-vision center noted that she had possible hemiinattention in addition to the left hemianopia. Because hemiinattention can significantly interfere with completion of ADLs, especially driving, it was important to determine how much, if any, of Penny's difficulty scanning was due to inattention. To assess this, Penny was given the visual search subtests from the biVABA, which uses a cancellation format. On the first subtest, Penny missed several of the targets located on the left side of the sheet, demonstrating an abbreviated search pattern toward the left. The therapist provided a verbal cue, "Be sure to look far enough toward the left to see the border of the test." Penny acknowledged the cue and located the rest of the targets on the left; she also made sure to begin her search on the far left side on each of the remaining subtests. She consistently used an organized left-to-right and top-to-bottom search strategy on all seven subtests. She also carefully looked at each target and rechecked her work for accuracy. These observations suggested normal attention capability, which was verified by her performance on other assessments. For example, although she made mistakes in copying numbers on the Telephone Number Copy test, she was able to search and correct her mistakes without assistance. She also missed targets on the left side during her first pass through the ScanCourse, but after receiving feedback, made no errors on her second trial on the course. On the Dynavision she was also able to switch attention easily between the left and right sides of the board, and her ability to search the left side of the board rapidly improved with practice. After analyzing Penny's performance on these assessments, the occupational therapist concluded that because of the severity of her hemianopia, Penny may have appeared to be inattentive toward the left side during the first several weeks after her stroke, when she was unaware of the VFD. However, as she gained awareness of the deficit, she was able to use attention to help compensate for the loss of vision on the left. If Penny's performance had suggested the presence of the hemiinattention, it would not have been appropriate to set a goal to resume driving, and it would have been necessary to explore alternative forms of transportation.

Intervention

The incidence of hemiinattention and neglect has been reported to be as high as 70% in the early stages of recovery from a right hemisphere brain injury.[69] However, most hemiinattention resolves with time and is significantly diminished by 3 months after injury in two-thirds of clients.[29,69] Disruption of the white matter network that connects the frontal, temporal, parietal, and occipital lobes may account for the initially high incidence of neglect right after injury and the good potential for recovery.[48] Individuals with neglect that persists beyond 3 months may have significant and persistent deficits that reflect the presence of structural rather than pathway damage in the brain.[69]

Individuals with hemiinattention/neglect experience difficulty locating and using resources from the environment to complete daily activities. Performance limitations may include difficulty with the following: locating items on the left side; sustaining attention long enough to complete an activity; dividing and shifting attention to be able to multitask; and rapidly and accurately assessing situations in dynamic contexts (eg, the community) because of limitations in working visual memory. Generally, the more dynamic and ambiguous the environment, the greater the limitations experienced by the client because of the demand on visual attention.

Intervention addresses the challenges of spatial bias in attending to and searching space and the impairment in arousal and ability to focus, shift, and sustain attention. Intervention focuses on modifying the environment and task to reduce the contextual demands on the client's visual attention and on enabling the client to engage and sustain attention through the use of compensatory strategies and occupation. Sensory input strategies may also be used as adjuncts to increase attention. These approaches are combined with education delivered to the client through feedback during performance to increase the client's insight into how hemiinattention has affected the ability to complete daily occupations.[74,143,144] Insight is an important prerequisite to developing compensatory strategies because before a client can learn to reorganize visual search, he or she must understand how visual search and attention have changed.[74,143,144] Education begins during the evaluation process, when the occupational therapist alerts the client to deficiencies in the search pattern or through cueing, as the client completes the visual search tests (as was done with Penny), and by providing feedback on the strengths and weaknesses of the client's search pattern on conclusion of the test. The therapist should continue to use every opportunity to educate the client during intervention, using the client's difficulties or mistakes as teachable moments to help the client develop an understanding of capabilities and limitations.[144]

Modification.

All clients benefit from modification of the environment to help them use limited attention capabilities. The environment can be made more visible by reducing factors that place stress on visual processing. These environmental modifications, discussed in the overview on intervention, include reducing pattern, increasing contrast, and maximizing lighting. Minimizing pattern is a key intervention for a client with limited attention. The more densely packed the background pattern, the greater the amount of selective attention needed to locate the desired object. Clients with severe brain injuries may not be able to sustain the effort needed to complete this level of processing and may view their environments as filled with “visual noise” rather than meaningful objects. Reducing the number of distractors in an environment has been shown to improve effectiveness of the search pattern in individuals with neglect.[59,88,139] Improving the quality of lighting and adding contrast to increase the visibility of key features and objects in the environment also make it easier for the client to locate items. Increasing the discriminability of targets has been shown to elicit a more efficient and faster search pattern in those with neglect by creating a “pop out” effect that grabs the person's attention.[95,139] An example of using contrast to create a pop-out effect could be as simple as wrapping a piece of bright orange fluorescent tape around a call button to distinguish it from the bed rail. Adding structure to the environment by finding a place for everything and keeping everything in its place is the final critical piece in creating an attention-promoting environment. All together, these modifications create a more explicit context for the client that enables him or her to make maximum use of limited attentional capabilities to complete occupations. They also create a more inviting context for the client that encourages participation.

Compensation.

Visual scanning training (VST) has been shown to have the strongest evidence for effectiveness in reducing the effect of spatial bias by teaching the client specific compensatory strategies to reorganize and restructure the search pattern.[a] VST uses language and cognition to help the client learn to use a structured search pattern that begins on the left side of a visual array and progresses left to right and top to bottom. This structured pattern helps counteract the client's tendency to restrict visual search to the right side and increases the symmetry of the search pattern. The OT practitioner selects preparatory tasks, activities, and occupations that provide the client an opportunity to practice this compensatory pattern. The following guidelines are helpful in selecting the best visual scanning activities to teach and reinforce use of this structured search pattern.

1. *Select activities that require the client to scan as broad a visual space as possible.* Many daily activities require a person to orient to and work within a broad visual space. To help the client learn to initiate and complete a wide visual search, the working field of the activity should be large enough to require the client either to turn the head or to change body positions to accomplish the task. Many activities and games can be enlarged to require head turning to complete visual search. For example, the therapist can lay out a deck of playing cards face up in rows 3-feet wide and ask the client to use another deck of playing cards to match the cards on the table, turning the pairs over as the match is made. The practitioner ensures that the client initiates a left-to-right, top-to-bottom, organized scanning pattern when searching for the matching cards to complete the task. An occupation approach might involve planting a row of flowers or bulbs along a wide hedgerow in a garden or hanging up sheets on a clothesline.

2. *Select activities that require the client to interact physically with the target*. Attention is more focused when the person must act on what is seen. Games such as solitaire and dominoes, or those played on the Nintendo Wii, along with Dynavision or other light board exercises, are examples of activities with interactive qualities. Occupations such as cooking and laundry require physical interaction and interaction within a wide space.

3. *Select activities that require conscious attention to visual detail and careful inspection and comparison of targets*. To facilitate selective attention, clients should be taught to consciously study objects for their relevant features. Games such as solitaire, double solitaire, Concentration, Connect Four, checkers, Scrabble, and dominoes have these qualities. Large 300- to 500-piece puzzles, word or number searches, crossword puzzles, and needlecrafts (eg, latchet hook) also require selective attention. Throughout performance of these tasks, clients should be encouraged to recheck their work to make sure critical details are not missed.

4. *Use visualization to reinforce the correct search pattern*. Niemeier[98] demonstrated that clients with severe chronic neglect could be taught to search left space through the use of a clever visual imagery technique called the “lighthouse strategy.” A simple line drawing of a lighthouse was positioned in the client's view. The client was told that whenever he or she needed to search for something, to imagine being a lighthouse like the one in the picture and to scan widely from left to right. The lighthouse picture (cue) was always available to the client as he or she practiced scanning activities. The client would be cued to look at the picture and imagine being the lighthouse before completing an activity. Participants in the study required various amounts of rehearsal to learn the strategy, but a statistically significant increase in search performance was found after the training. The findings were replicated in a second study that showed statistically significant improvements in route finding, navigation (with or without a wheelchair), and problem-solving tasks.[99]

In addition to difficulty using a structured, symmetric search pattern, people with hemiinattention often have limited ability to sustain attention. The therapist should engage the client in activities that *require continuous attention over an extended period*. Interventions that use continuously challenging and interactive activities have been shown to increase alertness and the ability to sustain attention.[109,137,140,148,149] A 4-minute run on the Dynavision, combined with the t-scope feature in which a number appears periodically in the center of the board, is an example of a preparatory task that meets this criterion. The client is required to shift attention across the board to strike the light target when it appears, while simultaneously monitoring the center of the board to call out the number when it appears in the t-scope. The client receives auditory feedback each time a light target is successfully struck and visual feedback from a printed analysis of reaction time performance in each quadrant of the board on completion of the run. Fast-paced video games and computer programs that extend over several minutes, such as those played on the Nintendo Wii, are also examples of task that permit the client to practice the ability to sustain and shift attention.

Almost all IADLs require sustained attention for extended periods and can be graded in attentional demand. For example, the therapist might start with preparation of a simple breakfast and progress to preparation of a four-course meal. Tham et al.[143] found that teaching clients with hemiinattention to consciously reflect on how to proceed before beginning an activity, and then to continue to consciously reflect while completing the activity to monitor performance, sustained attention and increased the likelihood of a successful outcome. An example of this approach would be to instruct a client to describe the steps for putting on a shirt, then to describe each step out loud as he or she put on the shirt, and finally to assess his or her own performance to determine whether the shirt had been put on correctly.

Occupation.

It is important to remember that the OT role is to enable the client with hemiinattention and neglect to complete daily occupations and that this goal is often best achieved using occupation. The research on the effectiveness of using motivating activities to improve attention is still limited, but it is growing as researchers are finding that engaging individuals with neglect in emotionally relevant and motivating activities improves attention.[22,74,130,143] Tham et al.[143] found that participation in everyday activities that were personally relevant and meaningful made it easier for clients with neglect to learn compensatory strategies because the client was *interested* in using the strategy to complete the task. Klinke et al.[74] confirmed the importance of using daily activities in a qualitative study of 12 people with chronic neglect. Participants reported that it was easier to attend to concrete and meaningful tasks and tasks that held high emotional relevance. For example, one participant reported how much easier it was to hold her baby and make formula to feed the child than making coffee and holding a coffee cup. Bodack et al.[22] showed improved attention to the left in participants with chronic neglect after having them practice playing scales on a keyboard. The social environment in which the person practices daily activities can also facilitate compensation for neglect.[74,144] Tham and Kielhofner[144] and Klinke et al.[74] found that nurturing and positive responses from staff and family can increase motivation to learn compensatory strategies to increase awareness of the left side.

Participants in the study by Tham et al.[143] also reported that it was easier to apply compensatory strategies when activities involved the use of familiar objects and that repetition (completing the occupation on a daily basis) was important. Practice in applying compensatory search strategies can be easily incorporated into completion of basic ADLs and IADLs. For example, the client might be required to use a left-to-right search strategy when selecting clothes from a closet, searching for items in a refrigerator, or shopping for groceries. The more often the strategy is repeated under varied circumstances, the more the skill is generalized and transferred to new situations.[150] Cafeterias, gift shops, and office areas within the hospital and fast food restaurants and shops surrounding the hospital can be used to expose the client to more demanding visual environments.

Sensory input strategies.

Sensory input strategies attempt to reduce the rightward spatial bias observed in neglect by altering sensory input into the brain.[71] The person responds to the altered sensory input by increasing orientation to the left space. Small studies have shown that, along with constraint-induced therapy and patching, applications of caloric, galvanic, optokinetic, and neck muscle vibration can increase orientation toward the left side in people with neglect.[71,170,174] However, additional research is needed to determine the most appropriate clinical application of these interventions before they can be widely used in rehabilitation.[71] Prism adaptation is the one sensory input strategy that has received significant attention as an intervention to reduce spatial bias. More than 40 studies, including randomized controlled trials, have been published on the use of this intervention in clients with neglect.[97] Although 90% of the studies have shown positive results for ameliorating spatial bias, many of the studies have been criticized because of small sample size, absence of a control group and blinding, and questionable outcome measures.[97] Prism adaptation is considered a promising intervention for reducing spatial bias, but further research is needed to establish the correct protocols to achieve the optimal outcome.[97]

Complex visual processing.

In everyday living, complex visual processing is applied to solve a problem, formulate a plan, or make a decision about a specific situation. The therapist's understanding of the client's visual processing limitations, developed through standardized assessments and observation, is helpful, but it can't predict how the person will actually perform in the context of a practiced and valued occupation. Typically tasks that require complex visual processing also demand complex cognitive processing. To determine the right course and complete a task, a person relies not just on vision, but also on a variety of sensory inputs and memories. The more experience a person has had completing a complex task, the better he or she is at recognizing the pertinent, salient features of a visual scene and recalling and formulating a successful plan when returned to the familiar context of the occupation.[53]

An experienced driver like Penny, who has lived in the same area for many years, would likely drive more competently over the familiar roads she has traveled hundreds of times than in a driving simulator.

Because of the contextual nature of complex visual processing, the best way to evaluate it is to observe the client complete daily tasks requiring this level of processing. Thus, if the client is a teacher planning to return to work, the occupational therapist should assess his or her ability to develop teaching lessons and plans, teach a concept, grade a paper, or perform other aspects of his or her job, preferably at the client's place of employment. The occupational therapist should also simulate as closely as possible the client's natural context for the task. This will require some creativity and effort, but it is the only way to ensure a fair assessment of the client's abilities to determine whether the client is able to resume the desired occupation.

This approach was used to determine whether Penny was safe to resume driving. The occupational therapist and the CDRS who evaluated Penny's ability to resume driving conducted a behind-the-wheel evaluation that required Penny to drive for 60 minutes in various types of traffic. During the evaluation the therapist asked Penny to drive to destinations that she typically traveled to in completing errands, including the grocery store, her church, the physician's office, the library, and the senior center where her painting guild met.

Summary

The brain relies on visual information to anticipate and plan adaptation to the environment and complete daily occupations. Brain injury or disease disrupts the processing of visual information, creating gaps in the visual input sent to the brain. The quality of a person's occupational performance decreases because the brain does not have sufficient or accurate visual information to make decisions.

Penny's left hemianopia, for example, caused her to misread words and sentences because she did not always see letters and words on the left side. This limited her ability to complete daily occupations that relied on reading, such as medication management, shopping, financial management, and meal preparation. Because of her inability to quickly and efficiently scan toward her blind field, she collided with people and objects on the left and experienced disorientation. This affected her ability to navigate environments safely and to drive.

Whether a person's deficit in visual perceptual processing necessitates intervention depends on the person's lifestyle and whether the visual deficit prevents successful completion of daily living activities.

As the primary caregiver for an ailing husband, Penny needed to be able to complete the family finances, drive, and shop; if her husband had been fit, she may not have needed to complete these activities. As a caregiver, she also needed the creative outlet and release that her art provided to help her cope with her additional responsibilities.

The framework for assessment and intervention rests on the concept of a hierarchy of visual perceptual processing levels that interact with and subserve one another. Because of the unity of the hierarchy, a process cannot be disrupted at one level without an adverse effect on all visual processing. Assessment must be directed at measuring function at all process levels, with particular emphasis on the foundation of visual functions and visual attention and scanning.

The absence of visual input on the left side caused Penny to appear to ignore visual stimuli on the left, giving the impression of hemiinattention. Assessment demonstrated that she had normal attentional capability but had not yet learned to compensate for the hemianopia.

The role of the occupational therapist on the rehabilitation team is to ensure that the client is able to participate in daily occupations. That goal may be achieved through interventions that focus on modification, compensation, adaptation and, when appropriate, remediation.

Penny benefitted from a variety of compensatory and remediation strategies aimed at improving her ability to use her remaining right visual field to compensate for the left VFD and to adapt and structure her environment to help her use her remaining vision to complete daily activities.

It is important to remember the most powerful tool in the OT toolkit is modification of the task and environment, to ensure that the client can clearly see and access the key aspects of the task and environment required for successful completion of the occupation. There is no guarantee that the client's visual capabilities will recover, and much more research is needed to determine the most efficacious interventions to restore visual processing capabilities after acquired brain injury. This means that we must work with what the client has and maximize his or her ability to use current visual processing to successfully complete valued occupations—keeping in mind that engagement in daily activities promotes neuroplasticity in the brain and improves the health-related quality of life.[47,64,74,143] It also is important to remember that a team approach is required to address visual impairment from brain injury. The occupational therapist works closely with vision specialists (ophthalmologists and optometrists) and other vision rehabilitation specialists to ensure that the client's vision problems are comprehensively addressed, so that the optimal therapy outcomes can be achieved.

Review Questions

1. What determines whether intervention is needed for a client with a visual impairment?
2. What three aspects of an environment or a task can be modified to increase its visibility for the client with a visual impairment?
3. What prevents a client from automatically compensating for a hemianopia by turning the head farther to see around the blind field?
4. What is the primary compensatory visual search strategy taught to the client with hemiinattention?
5. What is the most crucial lower level visual process that contributes to the ability to perform visual cognitive processing?
6. What changes occur in the visual search pattern of a client with hemiinattention?
7. When would partial occlusion be used with the client? Describe the technique for partial occlusion.
8. How does convergence insufficiency affect reading performance?

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Product Information

Brain Injury Visual Assessment Battery for Adults

Warren Pre-reading and Writing Exercises for Persons with Macular Scotomas

visAbilities Rehab Services

http://www.visabilities.com

Dynavision D2

Dynavision International

http://www.dynavisioninternational.com

Learn to Use Your Vision for Reading Workbook, Wright & Watson

Pepper Visual Skills for Reading Test

http://www.lowvisionsimulators.com

Lea Low Vision Test Charts/Damato Campimeter

http://www.good-lite.com

UV fitover filters

NoIR Medical Technologies

http://www.noir-medical.com

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25

Evaluation and Intervention for Perception Dysfunction

Shawn Phipps

CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Describe how perceptual dysfunction affects participation in occupational performance.
2. Identify standardized and functional evaluation tools for visual perception, visual-spatial perception, tactile perception, body schema perception, and perceptual motor skills.
3. Differentiate between remedial and adaptive approaches to intervention for perceptual dysfunction and how they facilitate engagement in occupation.
4. Describe specific occupational therapy interventions for targeted perceptual motor deficits that facilitate improved performance skills, client factors, and participation in occupation.

KEY TERMS

Adaptive approaches
Agnosia
Agraphesthesia
Apraxia
Astereognosis
Body scheme
Color agnosia

Color anomia
Constructional disorder
Dressing apraxia
Figure-ground discrimination
Finger agnosia
Form constancy
Graphesthesia
Ideational apraxia
Ideomotor apraxia
Metamorphopsia
Perception
Praxis
Prosopagnosia
Remedial approaches
Right-left discrimination
Simultanagnosia
Spatial relations
Stereognosis
Stereopsis
Visual-spatial perception

Threaded Case Study

Walt, Part 1

Walt is a 38-year-old male who sustained a traumatic brain injury from a motor vehicle accident, resulting in right frontal, parietal, temporal, and occipital lobe lesions. His occupational profile included a complex and varied occupational history that consisted of full-time work as a graphic artist in a prestigious architectural firm. Walt is a husband and the father of two young children, as well as an accomplished painter.

After the brain injury, Walt's roles as worker, husband, father, and architect were affected because of impairments with motor and process performance skills and client factors, such as perceptual and cognitive dysfunction. Walt was unable to participate in his most valued areas of occupation, including painting, using a computer, sketching, and playing catch with his children. During the evaluation process, his visual foundation skills, including visual acuity, oculomotor control, and visual field function, were found to be intact. However, he demonstrated difficulty initiating motor actions when playing with his children and interpreting visual information for meaningful visual-spatial relationships when painting, sketching, or using the computer. In addition, he exhibits clinical signs of unilateral neglect to the left half of his body and is unable to discriminate between different types of materials through touch alone.

During the initial assessment, the occupational therapist elected to use the Canadian Occupational Performance Measure[64] to obtain client-centered goals that would assist Walt in achieving his occupational performance goals. Walt identified his primary goals in occupational therapy: to submit a painting to a local art gallery, to play with his children, to drive, and to regain computer skills in preparation for resuming part-time work as an architect.

Critical Thinking Questions

1. How would you best evaluate Walt's occupational performance?

2. How would you best evaluate the impact of Walt's perceptual dysfunction on occupational pursuits?

3. How would you assist Walt in achieving his occupational performance goals using remedial and adaptive approaches for his perceptual dysfunction?

"Perception is the gateway to cognition."[15]

Perception is the mechanism by which the brain interprets sensory information received from the environment. This perceived information is then processed by the various cognitive centers in the brain (described in Chapter 26). The individual may then choose to respond with a motor act or a verbal expression. For example, when waiting in a checkout line in a grocery store, a person may observe the array of brightly wrapped candy lining the aisle, may remember the sweet taste of the chocolate, may remember a recent resolution to lose weight, and may choose to resist adding any candy bars to the grocery cart. The person may look over to the next aisle, recognize a neighbor, and begin a conversation. In a few minutes, the person may notice that another register has a shorter line and may choose to move over to that line to be able to complete grocery shopping in a shorter amount of time. Perception of the environment provides the information to enable these response options.

In early development, tactile, proprioceptive, vestibular, and visual perception provide an internalized sense of **body scheme**, which is basic to all motor function.[7,69,109] Highly developed spatial skills are critical to the successful occupational performance of an architect, plumber, designer, or artist.[40] The process of interpreting visual stimuli is a learned skill, as evidenced by blind individuals who, when sight is restored later in life, have difficulty interpreting what they see.[90]

Acquired perceptual deficits are noted in persons with cerebrovascular accident (CVA), traumatic brain injury (TBI), and other neurologic disorders, such as multiple sclerosis and Parkinson's disease.[65,82] Spatial disorders and apraxia of a progressive nature are also seen in Alzheimer's disease.[6,14]

Severe visual perceptual deficits, frequently combined with cognitive impairments, can affect every area of occupation (e.g., activities of daily living [ADLs], instrumental activities of daily living [IADLs], education, work, play, leisure, and social participation) and can present grave safety concerns.[56] For example, an individual who is not able to judge distance and the spatial relationship of his or her foot to the top step of a stairwell may be in danger of a serious fall. Another person who cannot judge the position of the dial on the stove when preparing a meal may cause a fire. It is often the occupational therapy practitioner's role to evaluate safe and independent functioning in valued occupations and to assess visual and perceptual skills using standardized instruments along with observations of occupational performance in context.

This chapter describes the client factors of visual perception, visual spatial perception, tactile perception, body schema perception, motor perception, and the potential deficits in occupational performance that result from impairment to these client factors. Suggestions for standardized and functional assessments are provided, and general occupational therapy (OT) approaches to intervention are reviewed.

General Principles of the Occupational Therapy Evaluation

When evaluating visual perception skills, several assessment tools may be required. The optimal battery of standardized assessment tools requires a verbal response (eg, naming a picture) or a motor response (eg, drawing or constructing) or has flexible response requirements of either mode (multiple choice indicated by verbalizing the number or letter or by pointing to the chosen item). This enables the OT practitioner to assess visual perceptual dysfunction in a client with severe cognitive or communication limitations. With a variety of assessments, the OT practitioner is able to gather information to discriminate between an impairment in the reception of information and an impairment in the motor or verbal output.[25] This information will influence the occupational therapy intervention approach. Observation of the client's occupational performance in context along with analysis of the perceptual-motor demands of functional activities further complement the analysis of perceptual dysfunction obtained from the administration of standardized assessment tools. These data are then integrated to provide a more comprehensive understanding of the deficits in occupational performance. Evaluation methods should be conducted in the specific context of the occupation being performed.

Warren emphasized the importance of using a bottom-up approach to evaluate impairments in visual foundation skills,[99,100] such as visual acuity, oculomotor function, visual field function, visual attention, and visual scanning, prior to evaluating the higher-level visual perceptual skills covered in this chapter. For example, a deficit in visual acuity could be the underlying cause of poor performance on a test of perceptual processing. The normal aging process also results in impairments related to visual foundation areas, and a variety of age-related eye diseases such as macular degeneration, glaucoma, diabetic retinopathy, and cataracts can affect visual acuity or visual field function.[62] It is also possible that performance on global perceptual tests may be affected by deficits in cognitive areas such as attention, memory, or executive function (see Chapter 26). For example, an individual with severely limited attention is unlikely to perform well on many standardized assessments, regardless of the modality or nature of the task. Tsurumi and Todd also analyzed the cognitive skills involved in the commonly used assessments of visual perceptual function and warned that an individual's performance using two-dimensional representations of visual stimuli may not predict the person's performance in a dynamic three-dimensional world.[98]

Arnadottir recommended the observation of ADLs in context to evaluate neurobehavioral dysfunction, including visual perceptual dysfunction and its effect on the performance of tasks essential to functional independence.[5] She maintained that it is preferable for occupational therapists to assess neurobehavioral deficits directly from the ADL evaluation. She developed the Arnadottir OT-ADL Neurobehavioral Evaluation (A-ONE), which evaluates perceptual and perceptual-motor dysfunction in the context of ADLs and functional mobility tasks, including ideational apraxia, ideomotor apraxia, unilateral neglect, body scheme disorders, organization/sequencing dysfunction, agnosia, and spatial dysfunction.[3-5]

Toglia's multicontext treatment approach focuses on remediating and compensating for perceptual and cognitive impairments by generalizing functional skills across multiple contexts.[96] Visual processing strategies, task analysis, incorporating the specific learning needs of the client, establishing a criterion for the transfer of learning, metacognitive training, and practicing in multiple environments are key components of Toglia's approach. This approach also assists the client with TBI or stroke to gain self-awareness of perceptual and cognitive strengths and weaknesses to promote the use of strategies for remediation or compensation of skills across multiple contexts.[97] Toglia's Dynamic Object Search Test is one assessment that can be used to determine a client's abilities in visual processing, visual scanning, and visual attention.[96]

Another occupation-based assessment tool that can be used to determine the impact of deficient performance skills on functional tasks is the Assessment of Motor and Process Skills (AMPS).[38] This standardized assessment evaluates the performance skills necessary for engagement in areas of occupation by assessing 16 motor skills and 20 process skills (eg, temporal organization, organizing space and objects). Each performance skill is evaluated in the context of client-identified and culturally relevant IADLs from a list of standardized activities at various levels of difficulty. The AMPS has a high rate of reliability and validity, and the evaluator must be an occupational therapist who has received advanced training and certification to administer this assessment.

The Loewenstein Occupational Therapy Cognitive Assessment (LOTCA)[57] and Rivermead Perceptual Assessment Battery[32,103] provide a comprehensive profile of visual perceptual and motor skills and involve both motor-free and constructional functions. Various other assessment tools require either a verbal or a simple pointing response. The Motor-Free Visual Perception Test, 4th Edition (MVPT-4)[16,24,70], assesses basic visual perceptual abilities. An alternative version of the test presents the multiple choices in a vertical format (MVPT-V) to reduce the interference of hemianopsia or visual inattention.[73] The MVPT-V has been shown to predict on-the-road driving performance and can be used as a screening tool to identify persons who would not be safe drivers.[71] The Test of Visual Perceptual Skills-Upper Level (TVPS-UL)[42] also provides a multiple-choice format and has been normalized for adults. Test items require a higher level of visual analysis compared with the MVPT, and the test is untimed.[16-18] The Hooper Visual Organization Test[53] requires that the individual mentally assemble fragmented drawings of common objects. The Minnesota Paper Form Board Test[66] is a high-level assessment of visual organization, requiring mental rotation of fragmented geometric shapes.

General Approaches to Occupational Therapy Intervention

An underlying assumption about perceptual-motor function is that perceptual deficits will adversely affect occupational performance. Further, it is assumed that remediation of or compensation for perceptual deficits will improve occupational performance.[74] In her critical analysis of approaches for treating perceptual deficits, Neistadt described two general classifications: the adaptive and the remedial.[74] **Adaptive approaches** provide training in occupational performance to facilitate the client's adaptation to unique contextual environments.[2] In contrast, **remedial approaches** seek to produce some change in central nervous system (CNS) functions.[74] The effectiveness of the various approaches to the remediation of perceptual deficits has not been well documented and requires further scientific investigation.[33,74,89]

The OT practitioner may use one approach or a combination of approaches when designing an intervention plan to address the effects of visual perceptual dysfunction. The remedial and adaptive approaches can be used along a continuum, beginning with remediating basic visual perceptual skills and gradually incorporating compensatory techniques as the deficits persist.[58] The occupational therapy literature suggests specific activities for the intervention of perceptual deficits, but protocols for the use of such activities require further research.[109] For measuring the effectiveness of occupational therapy intervention, criteria are needed for successful performance, task grading, objective methods of evaluating performance, and guidelines for task modification.[75] In the absence of objective criteria, the occupational therapist relies on empirical methods to measure and document functional improvement. Several studies have demonstrated the relationship between perceptual deficits and functional performance.[8,32,88,89]

Remedial Approaches

Remedial, or transfer of learning, approaches assume that multiple practice opportunities with a particular perceptual skill will produce carryover of performance to similar activities or tasks requiring comparable perceptual skills.[74] For example, practice in reproducing pegboard designs for spatial relations training could carry over to dressing skills that require spatial judgment (such as orienting a blouse sleeve to an arm and discriminating between right and left shoes). The capacity for persons to improve their performance on perceptual tests following perceptual training has been documented.[47] However, additional research has also shown that remedial strategies for optimizing perceptual skills may not be as effective as using occupation-based interventions in context to promote changes in perceptual awareness and abilities.[33,68,76,77,109]

Adaptive Approaches for Perceptual Dysfunction

Adaptive approaches are characterized by the repetitive practice of targeted occupational performance tasks that help the person with neurologic dysfunction gain independence by utilizing alternate strategies to compensate for perceptual impairments.[74] The therapist does not retrain specific perceptual skills when utilizing an adaptive approach. Rather, the person is made aware of the problem and is instructed on adaptive strategies to compensate for the perceptual deficit during occupational performance. For example, if the client has difficulty with dressing due to impaired body schema, the therapist may set up a regular dressing routine and provide cues with repetitive practice on how to compensate for the perceptual challenges in context. With these adaptations, the client may learn to dress independently. Adaptation of the physical environment or the specific activity demands (eg, objects used in the environment and their properties) is another way to compensate for a perceptual deficit. For example, if an individual has difficulty discriminating a white shirt against the white sheets of the bed, the therapist may encourage the person to select a patterned shirt or may lay the white shirt on a colored towel or bedspread to provide a contrasting background.

Evaluation and Intervention of Specific Perceptual Impairments

Visual Perception Disorders

Visual perception disorder impairs the person's ability to recognize and identify familiar objects and people.[108] Although these individuals may have intact visual anatomic structures, objects and people may appear distorted, or larger or smaller than they actually are due to neurologic damage. These individuals also have difficulty interpreting the meaning of objects in their environment, such as signs and maps. In addition, they can have difficulty recognizing, identifying, or remembering the names of colors in their environment. These visual perception disorders can lead to safety problems in dynamic environments and may affect social skills, as the person has difficulty recognizing family members, friends, and coworkers.

Threaded Case Study

Walt, Part 2

Walt presents with a visual perception disorder. He has difficulty recognizing and differentiating the faces of his two children; he also has difficulties identifying the differences in the brushes he uses for painting. He requires verbal cues to identify the unique features that distinguish the faces of his two children and to identify the appropriate paintbrush to use during an art project. He also has difficulty identifying and recognizing the significance of various traffic signs, which would prevent him from driving safely.

Agnosia

Visual object recognition refers to the ability to verbally identify objects via visual input. An impairment in this area is called **agnosia**, and it is caused by lesions in the right occipital lobe or posterior multimodal association area.[54,65] The individual with agnosia can demonstrate normal visual foundation skills. The inability to name objects is not caused by a language deficit, as noted in aphasic disorders. Rather, the person is unable to recognize and identify an item using only visual means. If the person holds the object, he or she can identify it via tactile input or by olfactory means if the object has a distinguishable odor, such as a flower or an onion.[91]

Agnosia is assessed by asking the individual to identify five common objects by sight, such as a pencil, a comb, keys, a watch, and eyeglasses. If the client demonstrates word-finding difficulties, the occupational therapist can offer a choice of three answers and ask the client to indicate the correct choice through a head nod (yes or no). If the client is unable to name four out of the five objects, visual agnosia may be indicated.

OT intervention for visual agnosia focuses on adaptive or compensatory methods of keeping frequently used objects, such as a hairbrush, in consistent locations and teaching the client to rely more heavily on intact sensory modalities, such as stereognosis and tactile discriminatory touch, to seek and find desired items for functional use.[54] Remedial approaches can include having the client practice identifying objects that are needed for occupational performance, such as a paintbrush for Walt, or using nonverbal, tactile-kinesthetic guiding during occupations.[108] Following the activity, the occupational therapist can have the client practice naming the items that were used. Current research has found that efforts to remediate object recognition have met with limited success.[55]

Color Agnosia and Color Anomia

Color agnosia refers to the client's inability to remember and recognize the specific colors for common objects in the environment.[50] For example, Walt was unable to recognize the color of the paints he was using during his landscape painting. He confused the green paint he was using to paint the grass with the blue paint he intended to use for the sky. Alternatively, **color anomia** refers to the client's inability to name the color of the objects. Although these clients understand the differences between the colors of objects, they are unable to name the object accurately. For example, Walt was able to recognize the color red but was not able to name it as such.

To assess color agnosia, the occupational therapist can present the client with two common objects that are accurately colored and two objects that are not accurately colored and then ask the client to pick out the objects that are not accurately colored. If the client is unable to choose the objects that are inaccurately colored, color agnosia may be clinically present.

To assess color anomia, the occupational therapist can ask the client to name the color of various objects in his or her environment. If the patient has aphasia, the therapist will ask him or her to nod yes or no after offering the patient choices of colors. If the client is unable to correctly name the colors of various objects, color anomia may be present.

OT intervention for color agnosia and color anomia will focus on providing the client with opportunities to recognize, identify, and name various colors of objects in his or her environment. Intervention is best provided in a familiar context and can be incorporated functionally during occupational performance. For example, while Walt is painting a landscape, the therapist would provide verbal cues that assist him in recognizing, identifying, and naming the various colors of paint he is using.

Metamorphopsia

Metamorphopsia refers to the visual distortion of objects, such as the physical properties of size and weight.[108] For example, when Walt was playing sports with his two children, he could not distinguish among the basketball, the football, the baseball, or the volleyball. Each of the balls appeared heavier, lighter, larger, or smaller than they actually were, making it difficult to distinguish the differences between them through observation alone.

Assessment for metamorphopsia includes presenting the client with various objects of different weights and sizes (e.g., balls, drinking glasses filled with water, puzzle pieces). The client is asked to place each object in order according to size or weight through observation alone. Metamorphopsia may be indicated if the client is unable to determine the weight and size of the various objects.

OT intervention for metamorphopsia includes providing the client with opportunities to practice distinguishing objects in the natural environment through intact sensory modalities (eg, tactile-kinesthetic-proprioception). The functional use of objects during occupational performance will provide the client with feedback about the sizes and shapes of different objects. The occupational therapist should also provide specific verbal descriptors of the object when using this approach. Other treatment modalities include puzzles, board games, and computer games that help the client to gain experience distinguishing the sizes and shapes of different objects.

Prosopagnosia

Prosopagnosia refers to an inability to recognize and identify familiar faces caused by lesions of the right posterior hemisphere.[19,54,91] The individual with prosopagnosia may have difficulty recognizing his or her own face, the faces of family members and friends, or the faces of recognizable public figures because the person cannot recognize the unique facial expressions that make each face different. When attempting to identify family members and acquaintances, the person may compensate by relying on auditory cues such as the sound of the family member's voice or a distinctive feature such as long, wavy hair.

Brain lesions can also impair the ability to interpret facial expressions, which can have significant social consequences.[21,106] For example, one client tended to be very suspicious of others. He was observed to have difficulty describing the expressions of various persons depicted in photographs. Because he had immigrated to the United States from another country, his difficulty was originally thought to be a result of cultural differences. He was asked to bring in a newspaper that he regularly received from his native country. The captions of the photographs were occluded, and he was asked to describe the emotional expressions of the persons shown. He was then asked to translate the photo captions and became aware that he was unable to discriminate the emotions apparent on the faces.

A standardized test of facial recognition[12] is available, which presents a multiple-choice matching of faces presented in front view and side view and under various lighting conditions. Informal functional assessments could include having the client identify the names of the people in photographs, with family members at a dinner table (eg, Walt's two children side by side), or by having the client identify his or her own face in a mirror. Photographs of famous public figures could also be used during the assessment. If aphasia is present, the client can communicate through gestures, such as head nodding (eg, yes or no) in response to a multiple-choice format. If the client is unable to identify him- or herself or family members, prosopagnosia may be present. A formal test of facial expression discrimination is not available in the literature,[65] but an informal assessment is possible using pictures and photographs of familiar people.

OT interventions for prosopagnosia include remedial approaches such as providing face-matching exercises.[108] Adaptive approaches include providing pictures of family members and famous people with names and assisting the client to associate the family member's face with other unique characteristics and features, such as weight, height, mannerisms, accents, and hairstyle.

Simultanagnosia

Simultanagnosia refers to the inability to recognize and interpret a visual array as a whole, and it is caused by lesions to the right hemisphere of the brain.[35] Clients with simultanagnosia are able to identify the individual components of a visual scene, but they are unable to recognize and interpret the gestalt of the scene. For example, Walt is able to identify the flowers and the trees in one of his paintings, but he is not able to recognize and interpret this painting as the landscape surrounding the family home where he grew up.

Assessment includes presenting the client with a photograph that has a detailed visual array (eg, Walt's family photograph at the beach), asking the client to describe the scene in detail, and assessing whether the client can describe the scene as a whole. Many clients will be able to identify specific features of the visual array (eg, the sand castle) but cannot describe the context or meaning of the whole scene (eg, a family trip to the beach). Simultanagnosia is clinically significant when the client cannot recognize and interpret a visual array as a whole.

OT intervention focuses on helping the client to construct the meaning of a visual array through verbal cues and therapeutic questions to facilitate abstract reasoning. Intervention is best provided in familiar contexts, such as a client's home, work setting, or during a community outing to the shopping mall.

Visual-Spatial Perception Disorders

Visual-spatial perception refers to the capacity to appreciate the spatial arrangement of one's body, objects in relationship to oneself, and relationships between objects in space. Various efforts have been made to subdivide spatial skills into components, but authors acknowledge that spatial skills cannot be isolated easily from one another.[22] It is generally acknowledged that the right hemisphere, which controls spatial abilities, tends to function in the gestalt, whereas the left hemisphere tends to focus on discrete details.[65]

Visual-spatial perception occurs instantaneously to support safe and effective occupational performance. Because of this rapid simultaneous processing of visual and spatial information, it is possible to react quickly to another driver's actions to avoid a collision when operating a motor vehicle. An individual with a mild visual-spatial perception impairment may need additional time to perform a task but processes the information correctly, possibly by compensating with verbal analysis of the perceptual components. Severe impairment may result in an incorrect response despite additional time used in attempting to solve the problem.

Visual-spatial skills are not limited to the visual domain.[63] Sounds can be localized in space, and the mobility and daily occupations of blind individuals are heavily dependent on the tactile appreciation of the spatial arrangements of objects.[83] For example, a blind person's ability to navigate through a familiar room requires awareness of the layout of each piece of furniture in the physical environment and continual shifting of the individual's *cognitive map* while changing positions in the room.

As a pencil rolls across a desktop, it is the skill of visual-spatial perception that enables a person to appreciate the relative orientation of the pencil to the table surface as the pencil nears the edge and is about to fall to the floor. Fig. 25.1 illustrates the complexity of visual-spatial perceptual function.

Threaded Case Study

Walt, Part 3

Walt presents with visual-spatial perception dysfunction. He has difficulty distinguishing the right and left sides of his body and often confuses right and left when given directions. He frequently gets lost and requires a family member to be with him at all times when he is in unfamiliar community environments. When painting, Walt has also been observed to have difficulty distinguishing the foreground and the background in his paintings and is unable to determine the differences between the amounts of paint in each of the cups next to him. In addition, he is often observed missing the canvas in front of him when attempting to apply the paint.

FIG 25.1 Visual-spatial functions in real life. Note that all components of spatial functions can be found in this scene.

Figure-Ground Discrimination Dysfunction

Figure-ground discrimination allows a person to perceive the foreground from the background in a visual array.[108] For example, Walt is unable to locate a particular painting utensil from the other writing utensils in the pencil holder, thereby demonstrating difficulty distinguishing the targeted object from the background.

Figure-ground discrimination can be assessed functionally in a variety of contexts. During a dressing activity, you may ask the client to identify the white undershirt located on top of his or her white sheets. In the kitchen, you can ask the client to pick out all of the spoons from a disorganized utensil drawer. Figure-ground discrimination dysfunction may be indicated if the client is unable to discriminate the foreground from the background in a complex visual array.

Using a remedial approach, intervention for figure-ground discrimination dysfunction should focus on challenging the client to localize objects of similar color in a disorganized visual array.[108] The task could be incorporated contextually into meaningful occupation. For example, the therapist working with Walt may have him localize the exact pencil he would like to use for his sketch drawings. The task can be downgraded by making the visual array less complex and upgraded by making the visual array more complex.

An adaptive approach to intervention would focus on modifying the environment to increase the organization of common functional objects (eg, placing only the most necessary objects needed for self-care), decreasing the complexity of the visual array that the client has to discriminate (eg, have only one paintbrush in front of Walt at a given time), or marking common objects with colored tape so that objects are easily distinguished from one another, particularly when the objects are of a similar color.[107]

Toglia's multicontextual approach may be used to help the client gain self-awareness of his or her figure-ground discrimination dysfunction and develop effective organizational and visual scanning strategies for discriminating the foreground and background in the environment.[96] This intervention approach also focuses on the generalization of skill to multiple functional contexts by using strategies that the client has identified as effective in locating objects in the environment.

Form-Constancy Dysfunction

Form constancy is the recognition of various forms, shapes, and objects, regardless of their position, location, or size.[108] For example, a person can perceive all of the pencils on a desk, in various sizes or in various positions in the pencil holder.

To assess form constancy, ask the client to identify familiar objects in his or her environment through observation alone when those objects are placed upside down or on their side. For example, in the kitchen, you may ask Walt to identify a cup that is turned upside down or a toaster oven that is placed on its side. Form-constancy dysfunction may be indicated if the client is unable to identify objects in a position that varies from the norm.

Intervention for form-constancy dysfunction includes using tactile cues that will help the client to feel objects in various positions and thereby learn their constancy despite their position, size, or location. Activities can be graded from positioning all objects in an upright position to placing objects in odd positions. Intervention is best provided with common objects that the client utilizes in everyday occupational performance.

Position in Space

Position in space, or **spatial relations**, refers to the relative orientation of a shape or object to the self. It is this component of perception that allows a person to recognize that the tip of the pencil is pointed away from him, and so directs the hand to effectively grasp the pencil.

To assess position in space, have the client place common objects in relation to the self or other objects using the following directional terms: top/bottom, up/down, in/out, behind/in front of, and before/after. For example, the occupational therapist can ask Walt to place his paintbrush on top of his computer or his basketball behind his back. Position-in-space dysfunction may be indicated if the client is unable to discern the relationships of objects to the self or other objects through directional terms.

Intervention for position in space includes providing the client with opportunities to experience the organization of objects in the environment to the self. For example, Walt could practice placing various objects in relation to one another in a graphic design program on the computer so that directional concepts of up/down, in/out, behind/in front of, and before/after can be reinforced.

Right-Left Discrimination Dysfunction

Right-left discrimination is the ability to accurately use the concepts of right and left.[108] An individual with right-left discrimination dysfunction may confuse the right and left side of his or her body or confuse right and left in directional terms when navigating through the environment.

To assess right-left discrimination, the occupational therapist asks the client to point to various body parts (eg, left ear) or assess the client's ability to accurately navigate the environment through verbal commands using right and left (eg, turn right at the end of the hallway). Right-left discrimination dysfunction may be indicated if the client is unable to differentiate between right and left in relation to his or her body and the environment.

Intervention for right-left discrimination focuses on assisting the client to practice reciting right and left while interacting with his or her own body (eg, "I am now placing my right arm into the shirt sleeve") or the environment (eg, "I am now turning left at the stop sign"). Remediation of right-left discrimination can significantly improve topographical orientation as the client learns to navigate in a more dynamic home and community environment.

Stereopsis

Stereopsis is the inability to perceive depth in relation to the self or in relation to various objects in the environment.[108] Depth perception is critical to function in a three-dimensional world and to safety in driving and community mobility. Clients with visual dysfunction in one eye or who wear an eye patch to compensate for double vision may demonstrate stereopsis, because binocular visual input from both eyes is required to perceive depth.

To assess depth perception, the occupational therapist places a variety of common objects on a table surface and asks the client to identify which object is closer and which object is farther away.

In a community context, the client may also be assessed functionally by asking him or her to identify buildings or landmarks that are closer or farther away. Stereopsis may be indicated if the client is unable to judge the distance between objects in the environment.

Computer-assisted software has been created that can help the client to develop depth perception by judging the relative distance of objects in relation to one another on a computer screen.[108] Tactile-kinesthetic approaches also help the client judge distances through the use of tactile input.[1]

Tactile Perception Disorders

Impairment in tactile perception involves tactile discriminative skills of the second somatosensory area of the parietal lobes.[72] These skills require a higher level of synthesis than the basic tactile sensory functions of light touch and pressure described in Chapter 23.

Threaded Case Study

Walt, Part 4

Walt presents with an impairment in tactile perception. He is unable to identify the objects he uses for painting by touch alone. He is unable to discriminate between different types of materials or different forms and shapes by tactile means and must compensate visually to determine the objects he is using during occupational performance.

Stereognosis

Stereognosis, also known as tactile gnosis,[27] is the perceptual skill that enables an individual to identify common objects and geometric shapes through tactile perception without the aid of vision. It results from the integration of the senses of touch, pressure, position, motion, texture, weight, and temperature and is dependent on intact parietal cortical function.[44] Stereognosis is essential to occupational performance because the ability to "see with the hands" is critical to many daily activities. It is the skill that makes it possible to reach into a handbag and find a pen and to find the light switch in a dark room. Along with proprioception, stereognosis enables the use of all fine-motor activities without the need to concentrate visually on the objects being manipulated. Examples of stereognosis are knitting while watching television, reaching into a pocket for house keys, and using a fork to eat while engaged in conversation.

A deficit in stereognosis is called **astereognosis**. Persons who have astereognosis must visually monitor the use of their hands during activities. Thus they must be slow and purposeful in their movements and generally tend to be less active.

The purpose of a stereognosis test is to assess a client's ability to identify common objects and perceive their tactile properties.[10,26,49,60] A means to occlude the person's vision is needed, such as a curtain, patch, or folder as described in Chapter 23. Typical objects that could be used for assessment include a pencil, pen, a pair of sunglasses, a key, nail, safety pin, paper clip, metal teaspoon, quarter, nickel, and a button. Any common objects may be used, but it is important to consider the client's social and ethnic background to ensure that he or she has had previous experience with the objects. Three-dimensional geometric shapes (eg, a cube, sphere, or pyramid) can also be used to assess shape and form perception.

The evaluation should be conducted in an environment that has minimal distractions. The therapist should sit across from the client being tested. The client's vision is occluded, with the dorsal surface of the hand resting on the table. Objects are presented in random order. Manipulation of objects is allowed and encouraged. The therapist assists with the manipulation of items in the client's hand if the person's hand function is impaired. The client should be asked to name the object, or, if he or she is unable to name the object, to describe its properties. Clients with aphasia may view a duplicate set of test objects after each trial and point to a visual choice. The person's response to each of the items presented is scored. The therapist notes if the object is identified quickly and correctly, if there is a long delay before the object is identified, or if the individual can describe only properties (eg, size, texture, material, and shape) of the object. The therapist also notes if the person cannot identify the object or describe its properties.

Eggers has described a graded intervention program for astereognosis.[34] Initially, the client manipulates the object while looking at it and making noise with the object such as tapping it on the tabletop. This approach allows the client to see and hear an object while feeling it for the benefit of intersensory facilitation; then vision is occluded during the tactile exploration. Finally, a pad is placed on the tabletop so that both auditory and visual clues are eliminated and the person relies on tactile-kinesthetic input alone. The program for tactile-kinesthetic reeducation begins with gross discrimination of objects that are dissimilar—for example, smooth and rough textures or round and square shapes. Next, the client is asked to estimate quantities (such as the number of marbles in a box) through touch. Then the client must discriminate between large and small objects hidden in sand and progress to discriminating between two- and three-dimensional objects. Finally, the client is required to pick a specific small object from among several objects.

Farber also described a treatment approach to retrain stereognosis for adults and children with central nervous system dysfunction.[37] First, the client is allowed to examine the training object visually as it is rotated by the therapist. The client is then allowed to handle the object in the less affected hand while observing the hand. In the next step, the client is allowed to manipulate the object with both hands while looking. Then the object is placed in the affected hand and the client manipulates the object while looking at it. The individual may place the hand in a mirror-lined, three-sided box to increase visual input during these manipulations. This sequence is then repeated with the client's vision occluded. Once several objects can be identified consistently, two of the objects may be hidden in a tub of sand or rice. The client is then asked to reach into the tub and retrieve a specific object. If the sensation of the sand or rice is overstimulating or disturbing, the objects can be placed in a bag.[37]

Graphesthesia

An additional assessment of tactile perception that measures parietal lobe function is the test for **graphesthesia**, or the ability to recognize numbers, letters, or forms written on the skin.[23,44,80] The loss of this ability is called **agraphesthesia**. To assess graphesthesia, the examiner occludes the client's vision and traces letters, numbers, or geometric forms on the fingertips or palm with a dull-pointed pencil or similar instrument. The client tells the occupational therapist which symbol was written.[80] If the client has aphasia, pictures of the symbols may be provided for the individual to indicate a response after each test stimulus. Agraphesthesia is clinically indicated if the client is unable to state or identify the symbol written on the palm of the hand.

OT intervention for agraphesthesia focuses on providing the client with opportunities for tactile discrimination through the use of his or her hands. The therapist can grade the intervention from tracing letters and numbers to words and geometric forms on the palm of the hand. With vision occluded, the client can also practice writing his or her name in the opposite palm.

Body Schema Perception Disorders

Following a CVA or TBI, a person's sense of his or her body's shape, position, and capacity frequently is distorted. This is known as a disorder of body schema, or autotopagnosia.[11] This condition can be noted in attempts to draw a human figure (Fig. 25.2) or in a person's unrealistic expectations of performance abilities.[65] The disorder can affect the egocentric perception of one's own body or of another person's body.[79,82] A person may neglect one side of the body or demonstrate generally distorted impressions of the body's configuration. The person may confuse his or her body with that of another, such as the person who thought that the therapist had stolen her wedding ring, not realizing that the hand she was viewing was her own. **Finger agnosia**, or the inability to discriminate the fingers of the hand, can also be part of the disorder.[11] An impaired body scheme will also affect participation in occupation and performance skills.[89]

FIG 25.2 Example of a body schema perception disorder. Drawing on the left is the person's first attempt to draw a face. The occupational therapist asked the person to try again. The second effort is the drawing on right.

Body schema perception disorders can be assessed by asking the individual to draw a human figure (see Fig. 25.2) or point to body parts on command (eg, "Touch your left hand" and "Touch your right knee"). Finger agnosia is evaluated by occluding the person's vision and asking him or her to name each finger as the therapist touches it. Unilateral body neglect can be observed functionally during occupational performance as the client ignores the affected limb or states that a body part is not his or her own. A body schema perception disorder may be clinically indicated if the client is unable to correctly identify parts of his or her body.

A remedial approach to intervention for body schema perception disorders should focus on providing the client with opportunities to reinforce body knowledge through tactile and proprioceptive stimulation.[108] For example, while Walt is dressing or painting, the occupational therapist can have him incorporate his affected left upper extremity into the activity and verbally acknowledge that this is in fact his left arm and hand being used. Tactile-kinesthetic guiding or constraint-induced movement therapy strategies can also be used if the client has difficulty initiating the use of the affected limb. As the client incorporates the use of the affected limb into occupational performance, he or she will begin to gain perceptual awareness of his or her body and the relationship between various body parts.

Threaded Case Study

Walt, Part 5

Walt demonstrates unilateral inattention to the left side of his body and his environment. He demonstrates asymmetric visual scanning to the left side of his environment, misses details in his drawings on the left, and routinely neglects the functional use of his left upper extremity during functional tasks. He often states that his left arm is owned by someone else and has difficulty holding a painting utensil because of impairments with spatial relationships between his fingers.

Motor Perception Disorders

Praxis is the ability to plan and perform purposeful movement. **Apraxia** has been classically defined as a deficit in "the execution of learned movement which cannot be accounted for by either weakness, incoordination, or sensory loss, or by incomprehension of or inattention to commands."[43] The disorder can result from damage to either side of the brain or to the corpus callosum,[51,105] but it is more frequently noted with left hemisphere damage.[52] Apraxia is often seen in persons with aphasia; however, not all aphasic persons are apraxic, nor are all apraxic persons aphasic.[48,51] This type of dysfunction may occur after CVA or TBI. Progressive apraxia is also noted with degenerative disorders such as Alzheimer's disease.[45,51,81] (See also Chapters 33, 34, and 35.)

Apraxia has been strongly correlated with dependence in areas of occupation.[93,101] For example, in a severe case of apraxia, Ms. S initially required total assistance with basic activities of daily living (BADLs). Ms. S was fully cognizant of ongoing events but could not direct her arm and leg movements in a way that would assist the nursing staff during dressing. When asked to pick up a pencil, Ms. S walked around all four sides of the table in an attempt to position her hand correctly to grasp the object. She could describe the desired action in words ("I want to pick up the pencil between my thumb and index finger, with the lead point of the pencil close to the tips of my fingers") but reported after returning to her seat that her hand never "looked like it was in the right position" to take hold of the pencil.

The categories of apraxia are difficult to differentiate, and authors differ in their use of terms.[94] The principal types recognized in the literature are ideational apraxia, ideomotor apraxia, dressing apraxia, and constructional disorder. Because the distinction between ideational and ideomotor apraxia is often perplexing, some authors recommend simply using the term *apraxia*.[61,65]

Threaded Case Study

Walt, Part 6

Walt presents with a motor perception disorder that affects his motor planning. When given a shirt to don, Walt attempts to put his legs through the sleeves of the shirt. During drawing and painting activities, he seems to hesitate and is unable to initiate a motor plan without physical cues. He knows that he is painting and knows what he would like to paint, but he is unable to translate this idea into a motor action. Walt is also unable to operate the mouse on the computer for a graphic design activity because of his difficulty with motor planning. In addition, when given a three-dimensional craft project, he is unable to use effective problem-solving strategies during the construction of the design.

Ideational Apraxia

Ideational apraxia is a conceptual deficit seen as an inability to use real objects appropriately.[28,31,48] More recent authors suggest the use of the term *conceptual apraxia*.[52,81] The individual also may have difficulty sequencing acts in the proper order,[51] such as folding a sheet of paper and inserting it into an envelope. The individual may use the wrong tool for the task or may associate the wrong tool with the object to be acted on, such as by attempting to write with a spoon.[51] This deficit has significant functional implications in a variety of areas of occupation.

Ideomotor Apraxia

Ideomotor apraxia is an inability to carry out a motor act on verbal command or imitation. However, the person with ideomotor apraxia is able to perform the act correctly when asked to use the actual object.[30,51,84] For example, a person is unable to mime the action of brushing his or her teeth on request but is observed using a toothbrush correctly when performing grooming activities in context. Observation of the person in areas of occupation is critical to the identification of ideomotor apraxia. Impairments are demonstrated only in the testing environment and appear to have little functional impact, as compared with ideational apraxia.[94]

Dressing Apraxia

Another category of motor perception disorders recognized in the literature is **dressing apraxia**. Dressing apraxia contributes to the inability to plan effective motor actions required during the complex perceptual task of dressing one's upper and lower body. The classification of dressing impairment as a form of apraxia has been questioned because the difficulties in ADLs are considered to be caused by perceptual or cognitive dysfunction[20,101,109] (if apraxia is not noted in other activities) or are seen as an extension of an ideational or ideomotor apraxic disorder.

General Principles in the Assessment and Treatment of Apraxia

It is important that assessments of sensory function, motor control, and dexterity are completed before the test of praxis because deficits in these areas would complicate any assessment of apraxia. If a person has a hemiplegia, the unaffected hand is used for testing. Input from the speech-language pathologist is important for establishing an individual's capacity for basic comprehension via words or gestures. Because of the frequent association of apraxia with aphasia and left hemisphere brain damage, an apraxia screening is included.

The literature[20] offers several apraxia assessments used in research, such as the Florida Apraxia Screening Test (FAST),[87,88] the Movement Imitation Test,[29,30] and the Use of Objects Test.[29] The Loewenstein Occupational Therapy Cognitive Assessment (LOTCA)[57] includes a praxis subsection, as does the Rivermead Perceptual Assessment Battery,[103] both of which serve as screening tools for the disorder. The Santa Clara Valley Medical Center Praxis Test and the Solet Test for Apraxia are two additional evaluation tools developed by occupational therapists.[108]

A thorough assessment includes functional items presented, such as those shown in Table 25.1,[51] and involves both transitive movements (actions involving both tool and use, such as writing with an imaginary pen) and intransitive movements (movements for communication, such as waving farewell). Lists of gestures used in assessment are noted in several studies.[20,51,85,87,104]

TABLE 25.1

Elements of a Comprehensive Apraxia Assessment

Test Condition	Example
Gesture to command	"Show me how you would take off your hat." (transitive)
	"Show me how you would throw a kiss." (intransitive)
Gesture to imitation	"Copy what I do." *Therapist shrugs shoulders.* (intransitive) *Therapist flips an imaginary coin.* (transitive)
Gesture in response to seeing the tool	"Show me how you would, seeing the tool, use this object." *Therapist provides screwdriver for display.*
Gesture in response to seeing the object upon which the tool works	"Show me how you would use this object." *Therapist provides screwdriver and block of wood with screw partially inserted.*
Actual tool use	"Show me how you would use this object." *Therapist provides screwdriver for use.*
Imitation of the examiner using the tool	"Copy what I do." *Therapist makes stirring motion, using a spoon.*
Discrimination between correct and incorrect pantomimed movements	"Is this the correct way to blow out a match?" *Therapist pantomimes holding a match in an unsafe manner (eg, match held upside down, with the head of the match near the palm of hand).*
Gesture comprehension	"What object am I using?" *Therapist pantomimes shaving face with a razor.*
Serial acts	"Show me how you would open an imaginary can of soda, pour it into a glass, and take a drink."

From Heilman KM, Rothi LJG: Apraxia. In Heilman KM, Valenstein E, editors: *Clinical neuropsychology*, New York, 1993, Oxford University Press.

Returning to the case of Ms. S, she was first treated for her severe apraxia by being instructed to practice basic motor movements, then she followed a developmental sequence to more advanced functional motor activities. For example, following repetition of basic movement patterns, the client with apraxia progressed to coloring geometric shapes on note cards (felt-tip markers were initially placed in a vertical stand for easy grasp) and gradually to writing exercises. Independent telephone use was important to Ms. S, so a large calculator was used for keystroke practice. She gradually progressed to a disconnected telephone and then to a functional telephone. By the termination of the intervention program, Ms. S was independent in most areas of occupation, although additional time was needed for each activity.

For another client with apraxia, the clinical reasoning process was used in planning the treatment, beginning with spoken instruction for each sequence in the task, written or pictorial instructions, and visual monitoring of her limbs throughout each aspect of the task.[20] Another case study of apraxia treatment involved conductive education—that is, breaking the task into smaller units and verbally guiding the sequence.[76] The individual improved on targeted tasks, but minimal generalization was noted in everyday occupations across various contexts.

OT interventions for dressing apraxia involve problem solving with the client on effective dressing strategies, such as distinguishing between right and left or from front to back on specific clothing items. An effective strategy is to have the client position the garment the same way each time (eg, positioning a shirt with the buttons faceup and pants with the zipper faceup). Labels, small buttons, or ribbons can be used as cues to differentiate the front from the back of the garment.[108,109]

Constructional Disorder

The term **constructional disorder** is now favored over the previously used term *two- and three-dimensional constructional apraxia* because the deficit does not clearly fall within the definition of apraxia.[13,20,65] Many occupations depend on visuoconstructional skills, or the ability to organize visual information into meaningful spatial representations. Constructional deficits refer to the inability to organize or assemble parts into a whole, as in putting together block designs (three dimensional) or drawings (two dimensional). Constructional deficits can result in significant dysfunction in occupations that require constructional ability, such as dressing, organizing food in a refrigerator, following instructions for assembling a toy, and loading a dishwasher.[78,95] Fig. 25.3, which shows evidence of left inattention, also demonstrates constructional deficits. An individual acts on his or her contextual environment based on the information he or she perceives. Therefore deficits in perception become more apparent when a person interacts with the environment in maladaptive ways.

FIG 25.3 Example of a two-dimensional constructional disorder and left-sided inattention in a drawing of a house by a retired architect who suffered a right CVA.

Traditional tests of constructional abilities in a two-dimensional mode are the Test of Visual-Motor Skills for Adults,[41] the administration of the Benton Visual Retention Test,[92] and the Rey Complex Figure assessment.[65] The latter two tests also are used to evaluate visual memory skills. Use of the Rey Complex Figure has been suggested for a quick screening of visual perceptual function.[67] The Three-Dimensional Block Construction[8] involves the use of various blocks to copy a design from a three-dimensional model. Nonstandardized tests that may be used are drawing, constructing matchstick designs, assembling block designs, or building a structure to match a model.[108] In daily living, occupations such as dressing or setting the table require constructional skills. To perform such tasks successfully, an individual must have integrated visual perception, motor planning, and motor execution.[9,46,75,102,109]

Several studies have gathered data on the constructional skills of unimpaired subjects for use as a normative reference for persons with CVA and TBI.[36,75] In a study of constructional abilities in the well elderly, Fall demonstrated that results are influenced by the type of test administration.[36] Subjects tended to score higher on tests that used three-dimensional models as guides for construction than on those that used photographs or drawings. The implications of this finding for occupational therapists are that (1) the type of test administration affects scores, and (2) in teaching persons with constructional disorders, models or demonstrations of desired performance are likely to produce better results than would photographs or drawings.[36]

The remedial approach to intervention involves the use of perceptual tasks such as paper and pencil activities, puzzles, and three-dimensional craft projects to improve constructional skills. The adaptive approach includes participating in occupational performance and developing compensatory approaches to the functional performance skill impairments. Many areas of occupation are suitable for the treatment of constructional deficits, such as folding towels, setting the dinner table, and weeding the garden.

Behavioral Aspects of Perceptual Dysfunction

Some degree of accurate self-awareness and recognition of the effect of the disability on one's functioning is needed if the person is to invest energy in the therapy process.[39] An individual who is unaware of perceptual deficits may be a serious safety risk and may attempt occupations that are well beyond present physical abilities. Denial is often noted in early stages of recovery from CVA or TBI and may serve as a protective coping mechanism that allows the individual to gradually absorb the effect of the injury on his or her functioning. A person's innate trust in the accuracy of perceptions often is a basis for unrealistic self-confidence; demonstrating to the individual that his or her perceptions are now distorted and no longer trustworthy can profoundly affect the person's sense of self. An occupational therapist needs to be respectful and sensitive to the individual's sense of self and be prepared to aid the client in understanding the changes in perceptual capacity and in reestablishing an accurate sense of self. Several questionnaires are available to assess an individual's self-awareness.[59] The questionnaires typically are issued to the person with deficits as well as to a family member or close acquaintance. The discrepancies in the two questionnaires are used as a measure of the accuracy of the individual's insight and serve as the basis for intervention. The individual's behavior may also be the result of a disorder in executive function.[59] (See Chapter 26 for additional discussion of this possibility.)

An individual who has some degree of awareness of the disability often is depressed, which seems an appropriate response given the effect of perceptual impairments on participation in occupational roles. The occupational therapist needs to recognize and appreciate this emotional response and assist the individual in achieving an emotional balance to reestablish quality of life through celebrating progress in therapy while acknowledging the impact of the perceptual impairments on participation in occupation.[39,86] (See also Chapter 6 on the social and psychological aspects.)

Threaded Case Study

Walt, Part 7

1. How would you best assess Walt's occupational performance?
   Walt's performance in his most valued occupations has been affected because of visual perceptual impairment. A combination of skilled observation and formal assessments, such as the A-ONE[3-5] and the AMPS,[38] could be used to assess Walt's occupational performance in a variety of functional contexts. In addition to evaluating occupational performance, these assessments can also appraise Walt's specific perceptual functioning. The Canadian Occupational Performance Measure can also be used to evaluate the client's primary goals in occupational therapy and set the stage for an occupation-based and client-centered approach to intervention.

2. How would you best assess Walt's perceptual function?
   Throughout the chapter, a variety of assessment tools have been presented to evaluate visual perception, visual-spatial perception, tactile perception, body schema perception, and motor perception. In addition, other comprehensive perceptual tests—such as the Motor Free Visual Perceptual Test, Revised,[24] the Dynamic Object Search Test,[96] the TVPS-UL,[42] the Lowenstein Occupational Therapy Cognitive Assessment,[57] the Rivermead Perceptual Assessment Battery,[32,103] the Minnesota Paper Form Board Test,[66] and the Hooper Visual Organization Test[53]—could be used to assess global areas of visual processing and perceptual functioning.

3. How would you assist Walt in achieving his occupational performance goals using remedial and adaptive approaches for his perceptual dysfunction?
   To assist Walt in achieving his occupational performance goals of submitting a painting to a local art gallery, playing with his children, driving, and regaining computer skills in preparation for resuming part-time work as a graphic artist at an architectural firm, the therapist would need to use a combination of remedial and adaptive approaches to treat his perceptual impairments. This chapter outlines a variety of intervention possibilities for Walt. The evidence shows that the most successful outcomes for treating visual perceptual impairments are through occupation-based

activities that have meaning and offer the client the opportunity to generalize functional skills to multiple contexts through the remediation and adaptation of perceptual dysfunction.[33,68,76,77,109]

Review Questions

1. Describe the effects of visual perception, visual-spatial perception, tactile perception, body schema perception, and motor perception on occupational performance.
2. Compare the advantages and disadvantages of formal perceptual testing and functional assessment in the context of occupational performance.
3. Describe one assessment used to test perceptual impairments in the following areas: visual perception, visual-spatial perception, tactile perception, body schema perception, and motor perception.
4. Describe the two approaches to treatment of perceptual deficits, and give one example of an occupational therapy intervention for each.
5. Describe an intervention for each of the following types of perceptual dysfunction: visual perception, visual-spatial perception, tactile perception, body schema perception, and motor perception.

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26

Evaluation and Treatment of Limited Occupational Performance Secondary to Cognitive Dysfunction

Glen Gillen

CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Understand the interplay between cognition and performance in areas of occupation.
2. Choose appropriate standardized, reliable, and ecologically valid tools to measure baseline cognitive status and client progression.
3. Understand the impact of impaired client factors and performance skills on performance in areas of occupation.
4. Develop an evidence-based treatment plan to maximize participation in chosen occupations for individuals with cognitive dysfunction.

KEY TERMS

Anterograde amnesia
Areas of occupation
Arousal
Attention
Attentional switching or alternating attention
Awareness deficits
Client-centered approach
Cognitive Orientation to Daily Occupational Performance (CO-OP)
Cognitive rehabilitation/retraining model
Declarative memory
Distractibility
Divided attention
Dynamic Interactional Model
Dysexecutive syndrome
Ecological validity
Episodic memory
Explicit memory
Field-dependent behavior
Implicit memory
Long-term memory (LTM)
Metacognition
Metamemory
Neurofunctional approach
Nondeclarative memory
Procedural memory
Prospective memory
Quadraphonic approach
Retrograde amnesia
Selective attention
Self-awareness
Semantic memory
Short-term memory
Sustained attention (vigilance)
Task-oriented approach
Unilateral neglect
Working memory

Threaded Case Study

Jane, Part 1

Jane, age 28, is 6 months from completing her master's degree in social work. She was recently married and lives in a ranch-style house in the suburbs. Approximately 1 week ago, she told her husband, Gary, that she was feeling "off." Later in the day she told him that she had the worst headache of her life (ie, a "thunderclap headache"). She began vomiting and, according to Gary, became confused, so he took her to the hospital. The medical team determined that Jane had sustained a subarachnoid hemorrhage secondary to a ruptured cerebral aneurysm. She had emergency surgery, which involved a craniotomy and clipping of the aneurysm. On postoperative day 8, she was transferred to the brain injury rehabilitation unit at the hospital.

Jane's occupational profile was determined her first day on the rehabilitation unit through interviews with Jane (who was quite drowsy and distracted), Gary, and Jane's sister, Paula. Gary described Jane as “fiercely independent” and reluctant to ask for help. It was determined that, in addition to being a “grade A graduate student,” Jane had shared housekeeping responsibilities with Gary, maintained the family garden, was an avid reader of fiction, was responsible for paying the monthly bills online, and loved to cook. Currently Jane could not participate fully in any of these occupations. Her biggest goal has been graduating on time. She has spent a tremendous amount of time and money getting through graduate school. Also, since high school she has been a volunteer working with impoverished children in urban areas. Gary stated that Jane was pursuing a social work degree to build her skills and “give her credibility,” so that she could continue to serve these children.

Gary and Paula expressed concern that Jane did not know what day it was, did not remember who had visited earlier in the day, and was slow to respond to questions, to which she sometimes gave inaccurate answers. During the interviews, Jane spent much of the time sleeping. She did not know why she could not “just go home.”

Critical Thinking Questions

1. How would you structure Jane's initial evaluation to determine the reasons she cannot currently engage in the occupations meaningful to her? What assessments would you choose, and how would you prioritize them?

2. What are appropriate goals for Jane?

3. What interventions would you use to ensure that Jane meets her initial goals? What is the starting point for intervention?

Cognition and Occupational Therapy

The American Occupational Therapy Association (AOTA) asserts that occupational therapists and occupational therapy assistants, through the use of occupations and activities, facilitate individuals' cognitive functioning to enhance occupational performance, self-efficacy, participation, and perceived quality of life. Cognition is integral to effective performance across the broad range of daily occupations such as work, educational pursuits, home management, and play and leisure. Cognition also plays an integral role in human development and in the ability to learn, retain, and use new information in response to changes in everyday life.

American Occupational Therapy Association[4]

Occupational therapy is one of several professions (eg, psychology, psychiatry, neuropsychology, speech-language pathology, and neurology) involved in working with those who are cognitively impaired. However, the approach of occupational therapy to this area of practice is unique and differentiated from other disciplines.[4] The clinical focus of what most professions call cognitive rehabilitation or working on cognition is better described by occupational therapists (OTs) as the process of improving participation and quality of life for individuals with cognitive impairments. In terms of maintaining this unique focus, the reader should consider the following points related to the process and domain of the practice of occupational therapy as they relate to this area of practice.

- Evaluations and assessments should focus on clients' performance of relevant occupations. Simultaneously (as described later), the OT documents what impairment or patterns of impairment in client factors and performance skills are interfering with occupational performance and participation.[11]
- Goals should be related to improving performance in **areas of occupation**, as described by the current version (2014) of the OT Framework, "Occupational Therapy Practice Framework: Domain and Process," third edition (OTPF-3).[3]
- Interventions should consist of primarily graded relevant occupations being performed in natural contexts.
- The outcomes of OT intervention for individuals with cognitive impairment should document improved performance in areas of occupation.

Although these points may seem obvious, until recently this area of OT practice focused primarily on impairments in client factors, and the focus of intervention involved the use of contrived "cognitive tasks." Outcomes were measured on the basis of tests of cognition that were not related to daily performance. It was assumed that remediation of an identified impairment or impairments would generalize into the ability to perform meaningful, functional activities. In general, this assumption has not been supported by empirical research.[43] It has become clear that this approach is not consistent with current approaches to occupational therapy.[3] Current practice embraces interventions that focus on strategies for living independently, with a purpose, and with improved quality of life, despite the presence of cognitive impairments. Likewise, outcome measures that focus on documenting improved functioning outside a clinic environment and those that include test items focused on performing functional activities are being embraced.[43] This chapter focuses on areas of occupation, client factors, and performance skills[3] and their relationships (Table 26.1).

TABLE 26.1

Summary of the OTPF-3 Domains Related to Cognition and Occupation

Domain	Examples
Performance in areas of occupation	Activities of daily living (ADLs), instrumental activities of daily living (IADLs), education, work, play, leisure, rest and sleep, and social participation
Client factors (body functions)	**Specific Mental Functions**
	• Higher level cognitive: Judgment, concept formation, executive functions, metacognition, cognitive flexibility, insight • Attention: Sustained, selective, and divided • Memory: Short-term, long-term, working memory • Perception: Discrimination of sensations • Thought: Control and content of thought, awareness of reality versus delusions, logical and coherent thought
	Global Mental Functions
	• Consciousness: State of awareness and alertness

	• Orientation: Orientation to person, place, time, self, and others • Temperament and personality: Extroversion, introversion, agreeableness, conscientiousness, emotional stability, openness to experience, self-control, self-expression, confidence, motivation, impulse control, appetite
Performance skills	*Process skills:* Observed as a person (1) selects, interacts with, and uses task tools and materials; (2) carries out individual actions and steps; and (3) modifies performance when problems are encountered. Examples include pace, heeds, attends, chooses, uses, handles, inquirers, initiates, continues, sequences, terminates, search/locates, and gathers.

Adapted from the American Occupational Therapy Association: Occupational therapy practice framework: domain and process, ed 3, *Am J Occup Ther* 68:S1–S48, 2014.

Overview of Models Guiding the Practice of Occupational Therapy

Various models that guide this OT practice area have been described in the literature. (The reader is referred to Katz for a comprehensive description of these models.[54])

A common theme in OT practice addressing cognitive impairment is maintaining a client-centered approach when providing rehabilitation services. As Law et al.[61] noted, such an approach "embraces a philosophy of respect for, and partnership with, people receiving services. A **client-centered approach** fosters an active partnership where the client joins with the OT to design and implement an intervention program to best meet the client's unique needs."

Van den Broek[117] specifically recommended using a client-centered approach as a way to enhance rehabilitation outcomes. He stated that treatment failure may occur secondary to practitioners focusing interventions on what they *believe* the client needs, rather than what the client *actually* wants. Another argument for using a client-centered approach to guide the focus of intervention in cognitive impairment is that the interventions typically used for individuals with cognitive dysfunction are notoriously difficult to generalize to other real-world settings and situations. For example, strategies taught to accomplish a specific task (eg, using an alarm watch to maintain a medication schedule for those with memory loss) will not necessarily generalize or "carry over" to another task, such as remembering therapy appointments. Finally, in a large number of clients, the level of brain damage precludes generalizing of learned tasks.[74] This issue of task specificity related to treatment interventions must always be considered by practitioners working with clients who have cognitive dysfunction. A client-centered approach helps ensure that the outcomes, goals, and tasks used as the focus of therapy are at least relevant, meaningful, and specific to each *client,* in addition to the *caretaker* or *significant others,* despite their potential lack of generalizability in individuals with cognitive impairment.

Dynamic Interactional Model

The **Dynamic Interactional Model** views cognition as a product of the interaction among the person, activity, and environment.[113] Therefore, performance of a skill can be promoted by changing either the demands of the activity, the environment in which the activity is carried out, or the person's use of particular strategies to facilitate skill performance.[113,114] Toglia described several constructs associated with this model, including the following:

- Structural capacity, or physical limits in the ability to process and interpret information
- Personal context, or characteristics of the person, such as coping style, beliefs, values, and lifestyle
- **Self-awareness**, or understanding one's own strengths and limitations, in addition to metacognitive skills, such as the ability to judge the demands of tasks, evaluate performance, and anticipate the likelihood of problems
- Processing strategies, or underlying components that improve the performance of tasks, such as attention, visual processing, memory, organization, and problem solving
- The activity itself with respect to its demands, meaningfulness, and how familiar the activity is
- Environmental factors, such as the social, physical, and cultural aspects

Toglia summarized her conclusions in this way:

To understand cognitive function and occupational performance, one needs to analyze the interaction among person, activity, and environment. If the activity and environmental demands change, the type of cognitive strategies needed for efficient performance changes as well. Optimal performance is observed when there is a match between all three variables. Assessment and treatment reflect this dynamic view of cognition.[113]

This approach may be used with adults, children, and adolescents.

Toglia used the Dynamic Interactional Model to develop the Multicontext Treatment Approach.[113,114] Combining remedial and compensatory strategies, this approach focuses on teaching a particular strategy to perform a task and practicing this strategy across different activities, situations, and environments over time. Toglia summarized the components of this approach:

- Awareness training or structured experiences should be used in conjunction with self-monitoring techniques so that clients may redefine their knowledge of their strengths and weaknesses.
- A personal context strategy should be used. The choice of treatment activities is based on the client's interests and goals. Particular emphasis is placed on the relevance and purpose of the activities. Managing monthly bills may be an appropriate activity for a single person living alone, whereas crossword puzzles may be used as an activity for a retiree who previously enjoyed this activity.
- Processing strategies should be practiced during a variety of functional activities and situations. (Toglia defines processing strategies as strategies that help a client control cognitive and perceptual symptoms such as distractibility, impulsivity, inability to shift attention, disorganization, attention to only one side of the environment, or a tendency to overly focus on one part of an activity.)
- Activity analysis should be used to choose tasks that systematically place increased demands on the ability to generalize strategies that enhance performance.
- Transfer of learning occurs gradually and systematically as the client practices the same strategy during activities that gradually differ in physical appearance and complexity.
- Interventions should occur in multiple environments to promote generalization of learning.

Quadraphonic Approach

The **quadraphonic approach** was developed by Abreu and Peloquin[1] for use with individuals who were cognitively impaired after brain injury. This approach is described as including both a “micro” perspective (a focus on the remediation of subskills, such as attention and memory) and a “macro” perspective (a focus on functional skills, such as activities of daily living [ADLs] and leisure activities). The approach supports the use of remediation and compensatory strategies.

The micro perspective incorporates four theories:

1. The *teaching-learning theory* describes how clients use cues to increase cognitive awareness and control.

2. The *information processing theory* describes how an individual perceives and reacts to the environment. Three successive processing strategies are described, including detection of a stimulus, discrimination and analysis of the stimulus, and selection and determination of a response.

3. The *biomechanical theory* explains the client's movement, with an emphasis on integration of the central nervous system (CNS), musculoskeletal system, and perceptual-motor skills.

4. The *neurodevelopmental theory* addresses the quality of movement.

The macro perspective involves the use of narrative and functional analysis to explain behavior based on the following four characteristics:

1. Lifestyle status or personal characteristics related to performing everyday activities

2. Life stage status (eg, childhood, adolescence, adulthood) and marriage

3. Health status (eg, presence of premorbid conditions)

4. Disadvantage status, or the degree of functional restrictions resulting from impairment

Cognitive Rehabilitation/Retraining Model

The **cognitive rehabilitation/retraining model** is used for adolescents and adults with neurological and neuropsychological dysfunction.[12] Based on neuropsychological, cognitive, and neurobiologic rationales, this model focuses on cognitive training by enhancing clients' remaining skills and teaching cognitive strategies, learning strategies, or procedural strategies.

Neurofunctional Approach

The **neurofunctional approach** is applied to those with severe cognitive impairments secondary to brain injuries.[38,39] This approach focuses on training clients in highly specific compensatory strategies (not expecting generalization) and specific task training. Contextual and metacognitive factors are specifically considered during intervention planning. The approach does not target the underlying cause of the functional limitation, but rather focuses directly on retraining the skill itself.

Task-Oriented Approach

Although usually discussed in relation to motor control dysfunction, the **task-oriented approach** has potential application for individuals with cognitive dysfunction.[84] Mathiowetz[69] has discussed this approach in detail. Summary points related to the adoption of a framework for this approach include evaluating the following areas in the order shown[69,70]:

1. Role performance (social participation): Identify past roles and whether they can be maintained or need to be changed; determine how future roles will be balanced

2. Occupational performance tasks (areas of occupation)

3. Task selection and analysis: Determine the client factors, performance skills and patterns, and/or contexts and activity demands that limit or enhance occupational performance

4. Person (client factors, performance skills and patterns): Cognitive (orientation, attention span, memory, problem solving, sequencing, calculations, learning, and generalization); psychosocial; and sensorimotor

5. Environment (context and activity demands): Including physical, socioeconomic, and cultural

In terms of intervention, Mathiowetz and Bass-Haugen[70] and Mathiowetz[69] recommended the following:

- Help clients adjust to their role and to limitations in performing tasks.
- Create an environment that uses the common challenges of everyday life.
- Practice functional tasks or close simulations to find effective and efficient strategies for performance.
- Provide opportunities for practice outside therapy time.
- Remediate a client factor (impairment).
- Adapt the environment, modify the task, or use assistive technology.

Cognitive Orientation to Daily Occupational Performance

The **Cognitive Orientation to Daily Occupational Performance (CO-OP)** model was developed for children with developmental coordination disorder. More recently, it has been used with neurological and adult clients with various types of dysfunction.[81] CO-OP is a:

- client-centered problem-solving and
- performance-based intervention

The goal is performance acquisition through a process of guided discovery of strategies that enable learning of skills. Strategies may be global and provide a general method of approaching any problem (ie, *goal, plan, do, check*), or they may be domain specific (ie, relating to one area of dysfunction only, such as attention to doing).

Choosing Appropriate Assessments

It is important to reiterate that OT outcomes should be focused on areas of occupation. We will use Jane's case to illustrate this point.

Potential (noninclusive) outcomes for Jane, based on the OT Framework, may include the following[3]:

- Outcome 1: After occupational therapy, Jane has improved her scores on a standardized memory scale (decreased impairment in client factors), but the changes are not detected on measures of instrumental activities of daily living (IADLs) and quality of life (stable performance in areas of occupation).
- Outcome 2: After occupational therapy, Jane has no detectable changes on the standardized memory scale (stable impairment in client factors), but changes are detected on measures of IADLs and quality of life (improved performance in areas of occupation).
- Outcome 3: After occupational therapy, Jane has detectable changes on the standardized memory scale (decreased impairment in client factors), and changes are detected on measures of IADL and quality of life (improved performance in areas of occupation).

Of the three outcome scenarios, outcome 1 is the least desirable. In the past this type of outcome may have been considered successful (ie, "Jane's memory has improved"). This outcome may be indicative of an intervention plan that is overly focused on attempts to remediate memory skills (eg, memory drills, computerized memory programs) without consideration of generalization to real-life scenarios. If a change at the impairment level of function does not translate or generalize to improved ability to engage in meaningful activities, participate successfully in life roles, or enhance quality of life, the importance of the intervention needs to be reconsidered. Outcomes 2 and 3 are more clinically relevant and arguably more meaningful to Jane and her family, and they represent more optimal results of structured OT services. Outcome 2 may have been achieved by focusing interventions on Jane's chosen tasks. Interventions such as teaching compensatory strategies, including the use of assistive technology, may have been responsible for this outcome. Jane is able to engage in chosen tasks despite stable impairments in memory.

Outcome 3 represents improvement (decreased impairment, improved performance of activities, and improved quality of life) across multiple health domains. Although this outcome may be considered the optimal result, the relationships among the three measures are not clear. Clinicians may assume that the improved status detected by the standardized measure of memory was also responsible for Jane's improved ability to perform household chores and child care. This reasoning is not necessarily accurate, however. The changes in the health domains may in fact occur independently of each other. In other words, Jane's improved ability to manage her household after participating in treatment may be related to the fact that the interventions specifically included teaching Jane strategies to manage her household. Similar to outcome 2, this positive change may have occurred with or without a documented improvement in memory skills.

When choosing assessments, the OT should place particular emphasis on the **ecological validity** of an instrument. This term refers to the degree to which the cognitive demands of the test theoretically resemble the cognitive demands in the everyday environment (this is sometimes called *functional cognition*). A test with high ecologic validity identifies difficulty performing real-world functional and meaningful tasks. Ecologic validity also refers to the degree to which existing tests are empirically related to measures of everyday functioning through a statistical analysis.[22]

In terms of a starting point (ie, which areas of occupation should serve as the basis for assessment), as stated earlier, a client-centered approach is necessary. This can be assessed formally by using the Canadian Occupational Performance Measure[61] (COPM) or informally through an interview with the client and/or significant others. The clinical context must also be considered. OTs working in an acute care setting may be focused on areas such as basic mobility (moving in bed and transfers), bedside self-care, IADLs that can be performed at the bedside (eg, money management, medication management), and sedentary leisure activities (eg, reading fiction, doing crossword puzzles). Those working in the home setting may focus on intervention related to community reintegration, more complex IADLs, and returning to work. The OT uses observation skills to determine which underlying cognitive (and other) deficits are interfering with functional performance by using error analysis. In other words, errors in performance (occupational errors[8]) are allowed to occur as long as they are safe and not severe enough to halt performance. Árnadóttir[9] gives the following example of this technique related to observing errors during grooming and hygiene:

Dysfunctions of global and specific mental functions with an effect on grooming and hygiene tasks include ideational apraxia, organization and sequencing problems related to activity steps, impaired judgment, decreased level of arousal, lack of attention, distraction, field dependency, impaired memory, and impaired intention. Ideational apraxia may appear during grooming and hygiene activities; an individual may not know what to do with the toothbrush, toothpaste, or shaving cream or may use these items inappropriately (eg, smear toothpaste over the face or spray the shaving cream over the sink). An individual with organization and sequencing difficulties only may have the general idea of how to perform but may have problems timing and sequencing activity steps. Such a client may not complete one activity step before starting another or may perform activities too quickly as a result of problems in timing activity steps, resulting in a poor performance.

Lack of judgment may appear as an inability to make realistic decisions based on environmental information, providing that perception of those impulses is adequate. An individual so affected may leave the sink area without turning off the water taps or may leave the washcloth in the sink, not noticing that the water level is increasing and threatening to overflow.

Field dependency has an attention component and a perseveration component. Individuals with this dysfunction may be distracted from performing a particular task by specific stimuli that they are compelled to act on or incorporate into the previous activity. For example, if an individual with field dependency sees a denture brush while washing the hands, that person may incorporate the brush into the activity and scrub the hands with the denture brush.

An individual with short-term memory problems may not remember the sequence of activity steps or instructions throughout activity performance. The therapist may have to remind an individual several times to comb the hair, even though the individual does not have comprehension problems.

Lack of initiation may occur during performance of grooming and hygiene tasks; the individual may sit by the sink without performing, even after being asked to wash. With repeated instructions to begin, the individual may indicate that the activity is about to start, yet nothing happens. After several such incidents and if the therapist asks for a plan, the individual may state a detailed plan of action in which the water will be turned on, the washcloth will be picked up and put under the running water, soap will be put on the cloth, and washing will begin. The individual has a plan of action but cannot start the plan. This impairment also may be associated with ideational problems.

Traditionally, practitioners and researchers involved in working with those who are cognitively impaired use standardized measures of cognitive impairment (ie, standardized tests to determine impairments in attention, memory, executive functions, and so on) as the primary outcome measure to document the effectiveness of interventions. These measures tend to be categorized as "pen and paper" or "tabletop" assessments, and they have low ecologic validity compared to assessments that use relevant occupations in naturalistic contexts. Although standardized assessments are one important level of measurement, it is critical that clinical programs and research protocols not only include, but also *focus on* measures of activity, participation, and quality of life as key outcomes. As stated, positive changes in these measures are more relevant than an isolated change in an impairment measure; the change in impairment must be associated with a change in other health domains. The individual receiving services, family members, and third-party payers are all likely to be more satisfied with changes in these arguably more meaningful levels of function. Table 26.2 suggests instruments for documenting successful clinical and research outcomes related to improving function in those with functional limitations secondary to the presence of cognitive impairments. (For a thorough review of performance-based measures, see Law et al.[62])

TABLE 26.2

Examples of Instruments for Documenting Improved Participation in Individuals With Functional Limitations Secondary to Cognitive Impairments and Ineffective Performance Skills

Instrument	Description
Standardized, valid, and reliable measures of quality of life	Measures life satisfaction and well-being. Examples include the Medical Outcomes Study 36-Item Short-Form Health Survey, World Health Organization Quality of Life Scale, and Reintegration to Normal Living.
Standardized, valid, and reliable	Measures performance in areas of occupation. Examples include the Functional Independence Measure (FIM), the (Modified) Barthel Index, and

measures of areas of occupation (eg, BADLs, IADLs, leisure, work)	the Lawton Instrumental Activities of Daily Living Scale.
Standardized, valid, and reliable measures of participation	Measures involvement in life situations. Examples include the Activity Card Sort, Community Integration Questionnaire, and the Canadian Occupational Performance Measure.
Comprehensive Measures to Simultaneously Assess Activity/Participation and Underlying Impairments or Subskills	
Árnadóttir OT-ADL Neurobehavioral Evaluation (more recently referred to as the ADL-Focused Occupation-Based Neurobehavioral Evaluation [A-ONE])[8-11]	A performance-based tool that uses structured observations of upper and lower body dressing, grooming, hygiene, feeding, transfers, mobility, and communication to detect underlying impairments that interfere with function. Examples of impairments include decreased organization and sequencing, short- and long-term memory loss, decreased alertness and arousal, impaired attention, performance latency, confusion, perseveration, distractibility, and impaired initiation, insight, and judgment.
Assessment of Motor and Process Skills (AMPS)[33]	A client-centered performance assessment of both BADLs and IADLs with emphasis on IADL tasks. The AMPS entails the client choosing to perform two or three tasks in collaboration with a therapist from a list of 125 standardized tasks. It evaluates motor and processing skills that affect function. Processing skills are observable actions that a person uses to (1) select, interact with, and use tools and materials; (2) carry out individual actions and steps; and (3) modify performance when problems are encountered. Processing skills should not be confused with cognitive skills.
Brief Measure of Cognitive Functional Performance	
Kettle Test[51]	A brief, performance-based assessment of an IADL task designed to tap into a broad range of cognitive skills. The task consists of making two hot beverages that differ in two ingredients (one for the client and one for the therapist). The electric kettle is emptied and disassembled to challenge problem-solving skills and safety/judgment, and additional kitchen utensils and ingredients are placed as distracters to increase demands on attention.
Assessing Executive Function Impairments	
Executive Function Performance Test (EFPT)[14]	Assesses deficits in executive function during the performance of real-world tasks (cooking oatmeal, making a phone call, managing medications, and paying a bill). The test uses a structured cueing and scoring system to assess initiation, organization, safety, and task completion and to develop cueing strategies. More recently tasks were added to create the Alternate EFPT (aEFPT). These include making pasta, calling a doctor's office, sorting medication into a 7-day pill sorter, and ordering a specific item from a catalog.[48]
Weekly Calendar Planning Activity[116]	The calendar planning activity is a higher level simulated IADL task that involves entering 17 appointments and errands into a weekly schedule. It was designed to be sensitive to the effects of executive dysfunction in that it requires planning, organization, and multitasking abilities. In addition to entering appointments, the person must monitor time, keep track of rules, inhibit distractions, and deal with schedule conflicts.
Multiple Errands Test[2,27,59,100]	A multitasking assessment that challenges multiple executive functions. Tasks include purchasing three items, picking up an envelope from reception, using a telephone, mailing the envelope, writing down four items (eg, price of a candy bar), meeting the assessor, and informing the assessor that the test has been completed.
Executive Function Route-Finding Task[18]	Uses naturalistic observations of route finding to detect dysexecutive symptoms.
Complex Task Performance Assessment[127,128]	An assessment that simulates the task of working in a library. The two primary work tasks are (1) Current Inventory Control and (2) Telephone Messaging. These tasks are administered simultaneously.
Behavioural Assessment of the Dysexecutive Syndrome (BADS)[124]	This battery is designed to assess capabilities typically required in everyday living. It includes six subtests that represent different executive abilities, such as cognitive flexibility, novel problem solving, planning, judgment and estimation, and behavioral regulation. It uses *simulated* everyday tasks.
Assessing Memory Loss	
Rivermead Behavioral Memory Test—Third Edition[126]	An ecologically valid test of everyday memory. Uses *simulations* of everyday memory tasks. Modifications are available for those with perceptual, language, and mobility impairments.
Cambridge Behavioural Prospective Memory Test/Cambridge Prospective Memory Test[47]	An objective test of prospective memory
Assessing Impairments in Attention	
Test of Everyday Attention[94]	Considered an ecologically valid test for various types of everyday attention, such as sustained attention, selective attention, attentional switching, and divided attention. Includes several subtests. It is one of the few tests of attention that *simulates* everyday life tasks. The test is based on the imagined scenario of a vacation trip to the Philadelphia area of the United States.
Moss Attention Rating Scale[50,123]	An observational test of disordered attention that currently includes 22 items. It produces three factor scores and a total score.
Rating Scale of Attentional Behaviour[82]	A short assessment of attention-based impairments that is rated through practitioners' observations of the client's behavior.

BADLs, Basic activities of daily living; *IADLs*, instrumental activities of daily living.

It also is clinically useful to use self-reporting or caregiver reporting measures for clients with cognitive dysfunction. The rationale for this type of assessment is multifold:

- Comparing self-reports with observed performance provides the OT with critical information on the awareness of the severity of impairment and functional status.
- Comparing self-reports and caregiver reports is helpful for getting a "snapshot" of how clients perform in their own environments, which may or may not be congruent with observed performance in an OT clinic.
- It is important that clients and caregivers see benefit from the OT services provided. It is problematic if the OT is documenting improvements that cannot be detected by those to whom services are provided (Table 26.3).

TABLE 26.3

Examples of Self-Reporting and/or Caregiver Reporting Measures

Instrument	Description
Attention Rating and Monitoring Scale[23]	A self-report measure of the frequency of everyday problems related to impairments in attention.
Cognitive Failures Questionnaire[19]	A self-report measure of the frequency of lapses in attention and cognition in daily life. It includes items related to memory, attention, and executive dysfunction.
Prospective Memory Questionnaire[49]	A behaviorally anchored, self-rated evaluation of prospective memory.
Comprehensive Assessment of Prospective Memory[89,95-112,119]	An assessment of prospective memory related to BADLs and IADLs.
Everyday Memory Questionnaire[97,109,110]	A subjective report of everyday memory; a metamemory questionnaire. It is self-reported or reported through a proxy.
Prospective and Retrospective Memory Questionnaire[57,102]	A measure of prospective and retrospective failures in everyday life. It is self-rated or proxy rated. Published norms.
Dysexecutive Questionnaire (part of the Behavioral Assessment of the Dysexecutive Syndrome [BADS] test battery)[20,125]	A 20-item questionnaire sampling everyday symptoms associated with impairments in executive functions. Versions for self-rating and rating by significant others are available.
Behavior Rating Inventory of Executive Function—Adult Version[96]	A measure that documents an adult's executive functions or self-regulation in his or her everyday environment. It includes both a self-report and an informant report.

BADLs, Basic activities of daily living; *IADLs*, instrumental activities of daily living.

Returning to the case study: the OT had access to Jane's acute care medical record. He noted that the day before Jane was transferred to the in-client rehabilitation unit, the neurology resident administered the Mini-Mental State Examination (a brief, 30-item questionnaire used by multiple disciplines to screen for cognitive impairment). She scored 20 of 30, which is indicative of moderate cognitive impairment. Jane had difficulty on the specific items of orientation, attention and calculation, and recall. An assessment required in most in-client rehabilitation units is the Functional Independence Measure (FIM). This tool measures the client's ability to complete specific self-care and mobility tasks, and scoring is based on caregiver burden related to these tasks. The FIM provides information related to *what* tasks Jane requires assistance with. Jane's OT used this opportunity to also document *why* Jane requires assistance with the FIM tasks. He used the error analysis approach described earlier and objectified his findings with the ADL-Focused Occupation-Based Neurobehavioral Evaluation (A-ONE). Jane required minimal physical assistance to *initiate* each FIM task but needed consistent verbal cues to *organize and sequence* the FIM tasks. Additional verbal cues were required to maintain *alertness,* to stay on task secondary to *distractibility,* and to compensate for *short-term memory deficits,* most notably keeping in mind and remembering the tasks the OT had asked her to demonstrate.

Managing Cognitive Dysfunction That Limits Occupational Performance: Assessment and Interventions

The American Occupational Therapy Association (AOTA) has organized the interventions that OTs may use for clients with performance deficits secondary to cognitive impairment into categories, discussed in the following sections.[4]

Global Strategy Learning and Awareness Approaches

Global strategy learning focuses on improving awareness of cognitive processes and assisting clients to develop higher order compensatory approaches (eg, internal problem solving and reasoning strategies), rather than attempting to remediate basic cognitive deficits. This approach enables clients to be able to generalize the application of these compensatory strategies to novel circumstances.

Domain-Specific Strategy Training

Domain-specific strategy training focuses on teaching clients particular strategies to manage specific perceptual or cognitive deficits, rather than being taught the task itself.

Cognitive Retraining Embedded in Functional Activity

In **cognitive retraining**, cognitive processes are addressed in the context of the activity. An example would be working on attention skills while relearning how to use a computer program. The retraining is context specific.

Specific-Task Training

Specific-task training assists clients to perform a specific functional behavior. In specific-task training, the therapist attempts to circumvent the cognitive deficit that hampers performance by teaching an actual functional task. The person can perform the occupation despite having a cognitive impairment.

Environmental Modifications and Use of Assistive Technology

OT intervention involves addressing the complexity of activity demands and altering environmental contexts to enhance the match between the client's abilities and the environmental demands. This includes technology such as cognitive prosthetics (eg, smart phones, pagers, and alarm watches).

Impact of Awareness Deficits on Daily Function

Management of **awareness deficits** may be considered a *foundational* intervention for clients with cognitive dysfunction.[43] Findings from standardized assessments of awareness may dictate the overall management of a client's functional limitations (discussed later). Different terminology and definitions related to limited self-awareness are used in the literature, including lack of insight, lack of or impaired self-awareness or unawareness, anosognosia, and denial. Nonimpaired self-awareness has been defined as "the capacity to perceive the self in relatively objective terms, while maintaining a sense of subjectivity."[87-89] The terms *impaired self-awareness* and *anosognosia* are used interchangeably; Prigatano[86] defined this condition as a clinical phenomenon in which a person "does not appear to be aware of impaired neurological or neuropsychological function, which is obvious to the clinician and other reasonably attentive individuals. The lack of awareness appears specific to individual deficits and cannot be accounted for by hyperarousal or widespread cognitive impairment."

Other authors reserve the term *anosognosia* for describing unawareness of physical deficits only (ie, not including cognitive impairments), such as "anosognosia for hemiplegia" or "anosognosia for hemianopia."

Although impaired self-awareness and anosognosia have clearly been used as overlapping terms in the literature, the term *denial* must be considered separately. Crosson et al.[26] defined psychological denial as “a subconscious process that spares the client the psychological pain of accepting the serious consequences of a brain injury and its unwanted effects on his or her life.” Complicating the matter is the fact that impaired self-awareness and denial may occur together. Differentiation between denial (a psychological method of coping) and neurologically based lack of awareness is difficult because some individuals have both types of clinical manifestations.[88]

The pyramid model of self-awareness was developed by Crosson et al.[26] This model includes three interdependent types of awareness:

1. *Intellectual awareness:* The ability to understand at some level that a function is impaired. At the lowest level, one must be aware that one is having difficulty performing certain activities. A more sophisticated level of awareness is to recognize commonalities between difficult activities and implications of the deficits; it refers to knowing that you have a problem. In the case study, Jane was demonstrating substantial impairment in intellectual awareness on the acute service. Her family reported that she kept repeating, “Why can't I go home? I'm fine.” The OT on the rehabilitation service noted that Jane consistently reported that she understood she had had a “stroke.” In addition, Jane was reporting that “simple” tasks seemed to take a long time and that she keeps “losing her train of thought.” Jane is showing signs of emerging (albeit still severely impaired) intellectual awareness.

2. *Emergent awareness:* The ability to recognize a problem when it is actually happening. Intellectual awareness is considered a prerequisite to emergent awareness in this model because one must first recognize that a problem exists (knowing that you are experiencing a problem when it occurs). Emergent awareness is included in the concept of online awareness or monitoring of performance during the actual task.

3. *Anticipatory awareness:* The ability to anticipate that a problem will occur as the result of a particular impairment in advance of actions. Anticipatory awareness is included in the concept of online awareness.

Individuals with brain injury or cognitive deterioration may be impaired across all three awareness domains[75] or may have better skills in one or more domains of awareness. Crosson et al.[26] further applied this model to the selection of compensatory strategies and categorized compensations appropriate to each type of awareness. They classified compensatory strategies according to the way their implementation is triggered:

- *Anticipatory compensation:* Applied only when needed. This term refers to implementation of a compensatory technique by anticipating that a problem will occur (ie, requires anticipatory awareness). An example is a person who needs groceries for the week and who is aware that busy environments present a greater challenge to his existing memory and attention deficits; therefore, he decides to defer shopping until 7 p.m., when the local store is not as busy.
- *Recognition compensation:* Also applied only when needed. This term refers to strategies that are triggered and implemented because a person recognizes that a problem is occurring (ie, requires emergent awareness). An example is a client who asks a person to speak more slowly because she realizes she is not processing information quickly enough and is having difficulty following the conversation.
- *Situational compensation:* Applies to compensatory strategies that can be triggered by a specific type of circumstance in which an impairment may affect function. The client is taught to use these strategies consistently, every time a particular event occurs. An example is a student with memory impairments after a traumatic brain injury (TBI) who tape-records all lectures in class. Although recording may not be necessary at times (eg, for a particularly slow-moving lecture with limited content), the strategy is used anyway because this type of compensation does not rely on the client's judgment. Intellectual awareness is necessary to use this strategy because one must be aware that a deficit exists to integrate a strategy for overcoming it.
- *External compensation:* Triggered by an external agent or involves an environmental modification. Examples include alarm watches, posted lists of steps related to meal preparation, and so on.

This pyramid model was constructively criticized and expanded on by Toglia and Kirk.[115] Their model, the Dynamic Comprehensive Model of Awareness, suggests a dynamic rather than a hierarchic relationship. The model proposes a dynamic relationship among knowledge, beliefs, task demands, and the context of a situation based on the concept of **metacognition**. This model differentiates between metacognitive knowledge, or declarative knowledge, and beliefs about one's abilities before performing the task (incorporating aspects of intellectual awareness) and online monitoring and regulation of the performance of a task (ie, during task performance), which integrates aspects of emergent and anticipatory awareness.

Fleming and Strong[35] discussed a three-level model of self-awareness:

1. Self-awareness of the injury-related deficits themselves, such as cognitive, emotional, and physical impairments (ie, knowledge of deficits)

2. Awareness of the functional implications of deficits for independent living

3. The ability to set realistic goals; the ability to predict one's future state and prognosis

Most authors recommend that self-awareness be evaluated *before* an intervention program is initiated that focuses on retraining living skills. The findings from standardized evaluations of self-awareness will clearly guide the choices of intervention. For example, a person who exhibits insight into an everyday memory deficit may be a candidate for teaching compensatory strategies, such as using a diary or notebook (discussed later). However, a person who does not realize that he or she has severe unilateral neglect (a lateralized attention deficit) may not be able to learn compensatory strategies and thus may require environmental modifications (eg, all clothing hung on the right side of the closet) to improve everyday function.

In addition, ascertaining the level of insight into a disability is one factor that may determine how motivated a client is to participate in the rehabilitation process. In the most simplistic interpretation, the client must be aware and concerned about a deficit in everyday function to be motivated to participate in what may be a long and difficult rehabilitation process. Returning to the case study, Jane has goals of returning to school and engaging in complex ADLs on returning home. It is imperative that Jane continue to gain insight so that she can implement strategies to compensate for her persistent deficits. Examples of strategies to return to school may include tape-recording lectures, having a note-taker assigned so Jane can fully attend to the lecture, switching to a part-time school schedule, and using electronic aids to organize her day and assignments.

A variety of assessment measures are typically recommended for ascertaining a person's level of self-awareness, including questionnaires (self or clinician rated); interviews; rating scales; functional observations; comparisons of self-ratings and ratings made by others (eg, significant others, caretakers, or rehabilitation staff); and comparisons of self-ratings and ratings based on objective measures of function or cognitive constructs. No method is universally accepted for assessing the construct of awareness or lack thereof. In addition, naturalistic observations can provide further information related to how decreased awareness is interfering with the performance of everyday tasks. Table 26.4 presents examples of standardized assessments of awareness.

TABLE 26.4

Examples of Standardized Tests of Awareness

Test	Description
Assessment of Awareness of Disability[60]	An assessment based on a semistructured interview that is used in conjunction with the Assessment of Motor and Process Skills (AMPS). It consists of general and specific questions related to the activity of daily tasks, and the interview is conducted after performance of the AMPS.
Awareness Interview[7]	A tool used to evaluate awareness of cognitive and motor defects after cerebral infarction, dementia, or head trauma. Operationally, the authors defined unawareness as a discrepancy between the client's opinion of his or her abilities in the interview and his or her abilities as measured by neuropsychological and neurological examinations.
Awareness Questionnaire[101]	A measure of impaired self-awareness after traumatic brain injury (TBI). The instrument consists of three forms (one form is completed by the client, one by a significant other, and one by a clinician). The self-rated and family/significant others forms contain 17 items, and the clinician form contains 18 items. The client's ability to perform various tasks after the injury, compared with before the injury, is rated on a 5-point scale.
Driving Awareness Questionnaire (DriveAware)[55]	A tool consisting of five questions; the client's responses are compared with the clinician's ratings according to a structured marking guide. The clinician's rating is based on information in the referral and observation of performance on other off-road tests.
Client Competency Rating Scale (PCRS)[85]	A tool that evaluates self-awareness after TBI. It is a 30-item self-report instrument that uses a 5-point Likert scale (1 = can't do and 5 = can do with ease) to self-rate the degree of difficulty in a variety of tasks and functions. More recently, Borgaro and Prigatano[17] developed a modified yet still psychometrically sound version of the PCRS for use in an acute in-client neurorehabilitation unit. This version retains 13 items from the original PCRS.
Self-Awareness of Deficits Interview[35]	An interviewer-rated structured interview is used to obtain quantitative and qualitative data on the status of self-awareness after brain injury. Specifically, it assesses a client's level of intellectual awareness (the ability to understand that a function is decreased from the premorbid level and to recognize the implications of the deficits).
Self-Regulation Skills Interview[78]	A semistructured, clinician-rated interview based on the model by Crosson et al.[26] discussed earlier. The tool includes six questions that assess metacognitive or self-regulation skills.

Although most researchers and scholars agree that interventions focused on improving awareness are critical for maximizing rehabilitation and that greater awareness of deficits is associated with better treatment outcomes,[76] others have documented functional changes through task-specific treatment without concurrent improvement in awareness. Overall, there is a lack of empirical studies that have examined the effectiveness of various interventions aimed at improving awareness. In addition, many of the published studies have not included functional outcomes. As a starting point in managing awareness, the entire team should encourage clients to predict their level of performance before any observed performance in areas of occupation. Those with brain injury or cognitive deterioration most often *underestimate* their level of cognitive impairment and *overestimate* their level of function. Practitioners should leave time at the end of each session to compare actual performance with predicted performance. This comparison of predicted versus actual performance is critical and should be done with all functional tasks. Examples of predictions include questions such as, "How long will the task take?" "How many times will you need to ask for help?" "How many times will the therapist need to physically help you?" and "How many times will the therapist need to verbally help you?" The goal is to reduce the discrepancy between the prediction and the actual performance.

It is important for the OT to remember that the verbal or physical cues used to support participation in meaningful occupations are not provided simply to support the completion of tasks. Cues are used to facilitate insight and to encourage the client to solve problems by developing new strategies to overcome deficit areas (Table 26.5).

TABLE 26.5
Prompts to Promote Awareness of Errors During Functional Activities

Prompt	Rationale
"How do you know this is the right answer/procedure?" or "Tell me why you chose this answer/procedure."	Refocuses the client's attention to task performance and error detection. Can the client self-correct with a general cue?
"That's not correct. Can you see why?"	Provides general feedback about an error but is not specific. Can the client find the error and initiate correction?
"It is not correct because …"	Provides specific feedback about an error. Can the client correct the error when it is pointed out?
"Try this [strategy]" (eg, going slower, saying each step aloud, verbalizing a plan before starting, or using a checklist)	Provides the client with a specific, alternative approach. Can the client use the strategy given?
The task is altered. "Try it another way."	Modifies the task by one parameter. Can the client perform the task? Begin again with grading of prompting described previously

From Brockmann-Rubio K, Gillen G: Treatment of cognitive-perceptual impairments: a function-based approach. In Gillen G, Burkhardt A, editors: *Stroke rehabilitation: a function-based approach,* ed 2, St Louis, 2004, Mosby, pp 427–446. Also, modified from Toglia JP: Attention and memory. In Royeen CB, editor: *AOTA self-study series: cognitive rehabilitation,* Rockville, MD, 1993, American Occupational Therapy Association; and Toglia JP: Generalization of treatment: a multicontext approach to cognitive perceptual impairment in adults with brain injury, *Am J Occup Ther* 45:505, 1991.

Tham et al.[111] developed an intervention to improve awareness related to the effect of neglect (a lateralized attention deficit) on functional performance. Purposeful and meaningful (for the participant) daily occupations were used as therapeutic change agents to improve awareness of disabilities. Specific interventions included encouraging participants to choose motivating tasks as the modality of intervention and discussions about task performance. Examples included the following:

- Encouraging participants to describe their anticipated difficulties
- Linking their earlier experiences of disability to new tasks
- Planning how they would handle new situations
- Asking participants to evaluate and describe their performance
- Asking participants to think about whether they could improve their performance by performing the task in another way
- Providing feedback about the difficulties observed, including verbal feedback, discussion, and the use of compensatory techniques that could improve performance of the task
- Providing opportunities for further practice of the task by using newly learned compensatory techniques
- Using video feedback to improve awareness
- Using interviews to reflect on and heighten awareness

With this approach, awareness of disabilities and ADL ability improved in all four participants; unilateral neglect decreased in three participants; and sustained attention improved in two participants. The authors concluded that training to improve awareness of disabilities might improve the ability to learn the use of compensatory techniques for performing ADLs by clients with unilateral neglect.

Fleming et al.[34] completed a pilot study examining the effect of an occupation-based intervention program on the self-awareness and emotional status of four men after acquired brain injury. Each participant received an individualized program that focused on the performance of three client-chosen occupations (eg, writing a job application, budgeting, meal preparation, playing lawn bowling, cooking with one hand) for which they had decreased awareness, according to significant others. The intervention was based on Toglia's multicontextual approach, described earlier.[112] Techniques included providing a nonthreatening environment to build positive therapeutic alliances; having the participants analyze their underlying skills, self-predict, and self-evaluate before and after the occupation; setting "just the right challenge"; supported and structured occupational performance; education on brain injury; timely and nonconfrontive verbal feedback in a sandwich format (negative comments are preceded and followed by positive feedback); and video feedback.

Repeated measures of participants' self-awareness and emotional status were performed before and after intervention and analyzed descriptively. The authors found that their results indicated preliminary support for the effectiveness of the program in facilitating participants' self-awareness, although baseline and follow-up data indicated a complex and inconsistent picture. Of note is that slightly increased anxiety was found to accompany improvements in participants' self-awareness in all four cases, and slight increases in depressive symptoms were noted in three participants. These findings are consistent with the literature discussed earlier that focused on the relationships between emotional status and awareness and on the interconnections between denial and self-awareness (Box 26.1).

Box 26.1

Suggestions for Improving Awareness

- Have clients perform tasks of interest and then provide them with feedback about their performance. The goal is to have clients monitor and observe their behavior more accurately so that they can make more realistic predictions about future performance and also gain insight into their strengths and weaknesses.
- Encourage self-questioning during a task and self-evaluation after a task (eg, "Have I completed all of the steps needed?").
- Provide methods of comparing functioning before and after injury to improve awareness.
- Use prediction methods. Have the client estimate various task parameters (eg, difficulty, time needed for completion, number of errors, and/or amount of assistance needed before, during, or after a task) and compare those estimates with the actual results.
- Help clients develop and appropriately set their personal goals.
- Allow clients to observe their own performance during specific tasks (ie, via videotape) and compare the actual performance with what the client had stated he or she could do.
- Use group treatments and peer feedback, which allow one person to receive feedback on performance from multiple individuals.
- Use role reversals: the therapist performs the task and makes errors, and the client must detect the errors.
- Develop a strong therapeutic alliance that is open and based on trust—this is critical in managing both denial and lack of self-awareness. Coach clients to make better choices and understand how defensive strategies affect daily function.
- Use familiar tasks, graded to match the client's cognitive level ("just the right challenge"), to develop self-monitoring skills and error recognition.

- Educate both the client and family members or significant other about the client's deficit areas.
- Integrate experiential feedback experiences. This method (also called "supported risk taking" and "planned failures") is used during daily activities to gently demonstrate impairments. The therapist must provide high levels of support during this intervention.
- Monitor for increased signs of depression and anxiety as awareness increases.
- Increase mastery and control during performance of daily tasks to increase awareness.
- Use emotionally neutral tasks to increase error recognition.
- Use tasks that offer "just the right challenge" to increase error recognition/correction.
- Provide feedback in a sandwich format; that is, negative comments are preceded and followed by positive feedback.

Data from Fleming JM, Strong J, Ashton R: Cluster analysis of self-awareness levels in adults with traumatic brain injury and relationship to outcome, *J Head Trauma Rehabil* 13:39–51, 1998; Klonoff PS, et al: Cognitive retraining after traumatic brain injury and its role in facilitating awareness, *J Head Trauma Rehabil* 4:37–45, 1989; Lucas SE, Fleming JM: Interventions for improving self-awareness following acquired brain injury, *Aust Occup Ther J* 52:160–170, 2005; Prigatano GP: Disturbances of self-awareness and rehabilitation of clients with traumatic brain injury: a 20–year perspective, *J Head Trauma Rehabil* 20:19–29, 2005; Sherer M, et al: Assessment and treatment of impaired awareness after brain injury: implications for community re-integration, *NeuroRehabilitation* 10:25–37, 1998; Tham K, Tegner R: Video feedback in the rehabilitation of clients with unilateral neglect, *Arch Phys Med Rehabil* 78:410–413, 1997; Toglia J: A dynamic interactional approach to cognitive rehabilitation. In Katz N, editor: *Cognition, occupation and participation across the life span*, ed 3, Bethesda, MD, 2011, AOTA Press; Toglia JP: Generalization of treatment: a multicontext approach to cognitive perceptual impairment in adults with brain injury, *Am J Occup Ther* 45:505–516, 1991; and Toglia J, Kirk U: Understanding awareness deficits following brain injury, *NeuroRehabilitation* 15:57–70, 2000.

Adapted from Gillen G: *Cognitive and perceptual rehabilitation: optimizing function,* St Louis, 2009, Mosby.

Jane's OT administered the Self Awareness of Deficits Interview. Gary was present for this session. Jane reported that she was not any different now from what she was like before her hospitalization, that her brain injury had not had any effect on everyday life, and that she hoped to be ready to graduate and look for her first job as a social worker in the next 6 months. The findings and ratings were indicative of severely limited self-awareness. The OT consistently used the time needed to complete a task as the prediction that Jane would make before each task. The OT chose time as the predictor because Jane had poor initiation, was disorganized, and repeated steps of the tasks. Such behavior increased the amount of time needed to complete tasks. Jane consistently predicted length of time based on her preinjury status. When the OT compared the predicted time with the actual time, Jane reacted with disbelief. As sessions progressed, Jane began to increase her accuracy in reporting the time needed for each task (increased awareness). As her awareness increased, the OT noted that Jane was frequently teary. The OT notified the team that although Jane was developing a better understanding of her current functional status, she required increased emotional support from the team and monitoring for increased levels of depression and anxiety.

Impact of Attention Deficits on Daily Function

Attention in its various forms is one of the most important and basic functions of the human brain, and it constitutes the basis for other cognitive processes. Integrity of the attention system is considered a prerequisite for all other higher cognitive systems, such as memory, executive functions, and so on.[80] In particular, basic memory functions (eg, working memory) are dependent on intact attention processes.[23] If a person does not attend to incoming information and cannot hold information in mind, information will not be remembered and cannot be used to guide appropriate behavior or successfully complete daily activities.[72] Attention skills serve as a cognitive foundation and are a prerequisite for engaging in most if not all meaningful activities; also, any impairment in attention processes will result in observable difficulties in everyday life, which may in fact reduce quality of life. Terminology related to attention impairments is shown in Table 26.6.

TABLE 26.6

Terms Related to Attention Impairments

Attention is the voluntary control over more automatic brain systems to be able to select and manipulate sensory and stored information briefly or for sustained periods.[79]		
Attention Component	**Definition**	**Functional Examples**
Arousal	A state of responsiveness to sensory stimulation or excitability[122]; it is dependent on a widely distributed neural network, including the prefrontal areas and neurotransmitter systems.[115]	• Decreased responsiveness to incoming visual, auditory, or tactile cues during performance of a task • Requires noxious or extreme sensory stimuli (eg, a cold washcloth applied to the face) to elicit a behavioral response
Selective attention	The type of attention involved in the processing and filtering of relevant information in the presence of irrelevant stimuli[93]; the efficiency with which people can search and focus on specific information while ignoring distracters.[94] Because selective attention is critical for encoding information into memory, retaining and manipulating information in working memory, and successfully executing goal-directed behavior, a deficit in selective attention could contribute to the numerous cognitive deficits observed in individuals with neurological impairments.[93] This skill is linked to the prefrontal and underlying anterior cingulated areas.	• Attending to one conversation during a party • Studying outside with the noise of traffic and children playing • Attending to a therapist's instructions and cues in a crowded therapy clinic • Making dinner while the children watch TV in the background • Playing a board game during recess
Sustained attention (vigilance)	Supports tasks that require vigilance and the capacity to maintain attention over time[6]; often measured by the time spent on a task.[121] In adults this component is linked to prefrontal function in the right hemisphere, and impairment is linked to white matter damage.[94]	• Being able to attend to long conversations, instructions, class lessons, TV shows, or movies • Playing a game of chess • Balancing a checkbook • Watching your child on the playground
Attentional switching or alternating attention	The ability to switch attention flexibility from one concept to another; related to cognitive flexibility. The ability to change attentive focus in a flexible or adaptive manner.[5] The ability to move between tasks with different cognitive requirements. This skill appears to be a function of the prefrontal cortex and the posterior parietal lobe, thalamus, and midbrain.[73]	• While typing a paper, a friend comes into your room to discuss a completely different topic; when the conversation is over, you return to typing • Cooking, taking care of a crying child, and then returning to cooking • A unit clerk at the hospital alternating between flagging orders on the medical chart, answering the phone, and writing down phone messages
Divided attention	Dividing attention between two or more tasks simultaneously; dual tasking or multitasking; the capacity to attend to two competing stimuli simultaneously.[6] Deficits occur when limited attentional resources are divided between two tasks.	• Making toast and tea at the same time • Texting while carrying on a conversation • Playing cards while discussing the events of the day
Distractibility	A breakdown in selective attention; an inability to block out environmental or internal stimuli when trying to concentrate on performing a particular task; a symptom of prefrontal damage, particularly the dorsolateral cortex.[68]	• Noise in the hallway takes away your attention while taking notes in class • Inability to attend during a therapy session because of being distracted by watching someone else's session
Field-dependent behavior	Distracted by and acting on an irrelevant impulse that interferes with performance of an activity and takes over goal-directed activity; includes both an attention and a perseveration component.[8]	• While performing oral care, a person becomes distracted by a light switch; the person then stops the oral care activity while turning the light switch on and off (ie, not relevant to the task at hand)
Unilateral neglect (a lateralized attention deficit)	See Chapter 33	See Chapter 33

Adapted from Gillen G: *Cognitive and perceptual rehabilitation: optimizing function*, St Louis, 2009, Mosby.

Compared to controls, impaired attention results in increased rates of off-task behavior during performance of a task (eg, looking up and away from the task at hand, engaging in unsolicited conversations). Individuals with impairments in attention are markedly less attentive than controls both in the presence of distractions (noise, movements) and in their absence.[121] Further compounding this problem is a relationship between attention impairment and awareness of errors. McAvinue et al.[71] investigated the processes of error awareness and sustained attention in individuals with TBI. They found the following:

- In comparison to controls, participants with TBI displayed reduced sustained attention and awareness of error.
- The degree of error awareness strongly correlated with sustained attention capacity, even when the severity of injury was controlled for.
- Error feedback significantly reduces errors.
- TBI leads to impaired sustained attention and error awareness.

The finding of a significant relationship between error awareness and sustained attention deficits in clients with TBI suggests that a link may exist between these two processes.

Posner and Peterson[83] proposed the existence of three main functionally and anatomically distinct attentional control subsystems:

1. An orienting system related to sensory events that relies on the posterior brain areas (superior parietal lobe and temporoparietal junction, in addition to the frontal eye fields). This system is involved in the selection of relevant sensory information. This subsystem brings attention to a specific location in space and generates perceptual awareness. It reflects involuntary orienting or automatic processing. The performance of this system is determined by the reaction time in responding to the detection of stimuli.

2. An executive system focused on selection and involving multiple structures (anterior cingulate, lateral prefrontal cortex, and basal ganglia). This system is responsible for exercising control over lower level cognitive functions and resolving conflicts. The system is prominent in detecting signals for focal or conscious attention. A breakdown in this system results in difficulty managing tasks that require divided attention, screening out interfering stimuli, and responding to novelty.

3. An alerting or sustained attention system involving the frontoparietal regions that is responsible for achieving and maintaining sensitivity to incoming stimuli. Impairments related to this system result in short attention spans.

Dockree et al.[28] summarized the following points:

- Attention deficits are among the most commonly observed deficits after brain injury.
- Damage to the frontal lobes of the brain, particularly the white matter connecting the frontal, parietal, and striatal regions, is partly responsible for these deficits.
- Frontal lobe damage in clients with a brain injury results in a tendency to drift from intended goals and increases the frequency of action slips that were unintended.
- Self-reports from clients with TBI revealed that problems with attention and concentration rate among the highest complaints in this group of clients.

The usual and customary tests of attention include pen and paper measures or laboratory-type tasks, such as the Paced Auditory Serial Addition Test, Trail Making Test Part A, and Wisconsin Card Sorting Task. As discussed earlier, when these measures are used, the question of ecologic validity arises regarding the difficulty generalizing the results to everyday living tasks. (Suggested assessments are described in Tables 26.2 and 26.3.) Impairments in attention are manifested as observable errors during performance of tasks and should be documented as such.

In their meta-analysis of attention rehabilitation after an acquired brain injury, Park and Ingles[79] examined two approaches to treating attention deficits:

- *Directly retraining the damaged cognitive function or direct cognitive retraining.* This approach is used under the assumption that practice of carefully selected exercises promotes recovery of damaged neural circuits and restores function in the impaired attentional processes themselves, along with a further assumption that the tasks mediated by those circuits are performed in a way similar to that used by individuals without brain damage. Intervention is then based on a series of repetitive exercises or drills in which clients respond to visual or auditory stimuli. This intervention has received the most attention in the literature with respect to interventions for those with impairments in attention.
- *Having clients learn or relearn how to perform specific skills of functional significance (ie, specific skill training).* The premise here is that that through carefully structured practice of a specific skill that is impaired as a result of brain damage, it is possible for individuals to compensate and develop alternative neuropsychological processes that rely on preserved brain functions (ie, individuals learn to perform the skill in a way that is different from the way used by individuals without brain damage). In terms of intervention, attention is trained either concurrently with or in the context of the specific skills. In addition, this approach applies behavioral principles and an understanding of how the impairment in attention affects the various skills.

Park and Ingles[79] concluded that specific skills training significantly improved the performance of tasks requiring attention. In comparison, the cognitive retraining methods (ie, those focused on improving impairments in attention out of context) included in the meta-analysis did not significantly affect outcomes. Further analysis revealed that overall performance improved in 69% of the participants who received specific skills training (eg, driving, ADLs), whereas performance improved in only 31% of those not so trained. In terms of effect size, the improvements in cognitive functions after direct retraining were small, whereas the improvements in performance after specific skills training were medium or large. These findings demonstrated that acquired deficits in attention are treatable by specific skills training. The authors also proposed clinical implications of their study, including the following:

- The learning that occurs as a function of training is specific and does not tend to generalize or transfer to tasks that differ considerably from those used in training. This specificity of improvement was demonstrated in both the cognitive retraining studies and the specific functional skill-retraining studies.
- Performance of a task after training will improve to the extent that the processing operations required to complete that task overlap with the processes engaged during training (ie, performance will improve after training if the training task is similar to the targeted outcome measure).
- Many survivors of brain injury are impaired when performing controlled cognitive processes but not when performing automatic processes. Controlled processing is heavily involved in the early stages of learning a skill and is less involved as a skill becomes more routine with practice. Therefore, training programs that reduce the requirement for controlled processing during learning may be the most effective. Examples of reducing the demands of controlled processing include breaking down a complex functional skill into simpler components, providing practice on these components, and structuring training in such a way that performance feedback can be more easily interpreted. The authors recommended the technique of "shaping" as a way to train people with controlled processing deficits because shaping links the difficulty of a task to the person's performance. As a result of using the technique of shaping, the person may make fewer errors and be able to interpret feedback more easily.
- Rehabilitation procedures should be based on a set of learning principles.

Strategies aimed at modification of task and environments have proved to be beneficial for individuals with cognitive impairment (Box 26.2). Specific strategies include the following:

- *Time pressure management (TPM).* Fasotti et al.[32] noted that after severe closed head injury, deficits in the speed of processing information are common and result in a feeling of "information overload" in the performance of daily tasks. The authors tested TPM as an approach for managing slow information processing. TPM uses alternative cognitive strategies to support participation in real-life tasks. The overall focus is to teach people to give themselves enough time to deal with life situations. Specific strategies used to prevent or manage time pressure include enhancing awareness of errors and deficient performance, self-instruction training (eg, trying to focus, not getting distracted by outside sounds and other information, not getting distracted by irrelevant thoughts, and trying to imagine things that are being said), optimizing planning and organization, rehearsing task requirements, modifying the task environment, and using an overall strategy of "Let me give myself enough time."
- *Self-instruction statements.*[119] Such statements can be suggested to improve listening and to ask for repetition if attention strays:

- "To really concentrate, I must look at the person speaking to me."
- "I must also focus on what is being said, not on other thoughts that may want to intrude."
- "I must concentrate on what I am hearing at any moment by repeating each word in my head as the person speaks."
- "Although it is not horrible if I lose track of a conversation, I must tell the person to repeat the information if I have not attended to it."

Box 26.2

Strategies for Practitioners and Caretakers in Managing Deficits in Attention

- Avoid overstimulating/distracting environments.
- Face away from visual distracters during tasks.
- Wear earplugs.
- Shop or go to restaurants at off-peak times.
- Use filing systems to enhance organization.
- Label cupboards and drawers.
- Reduce clutter and visual distracters.
- Use self-instruction strategies.
- Use time pressure management strategies.
- Teach self-pacing strategies.
- Control the rate of incoming information.
- Self-manage effort and emotional responses during tasks.
- Teach monitoring or shared attentional resources when multitasking.
- Manage the home environment to reduce auditory and visual stimuli. Keep radios and phones turned off. Close doors and curtains. Keep surfaces, cabinets, closets, and refrigerators organized and uncluttered.
- Use daily checklists for work, self-care, and instrumental activities of daily living.

Data from Cicerone KD: Remediation of "working attention" in mild traumatic brain injury, *Brain Inj* 16:185–195, 2002; Fasotti L, et al: Time pressure management as a compensatory strategy training after closed head injury, *Neuropsychol Rehabil* 10:47–65, 2000; Michel JA, Mateer CA: Attention rehabilitation following stroke and traumatic brain injury: a review, *Eura Medicophys* 42:59–67, 2006; and Webster JS, Scott RR: The effects of self-instructional training on attentional deficits following head injury, *Clin Neuropsychol* 5:69–74, 1983.

From Gillen G: *Cognitive and perceptual rehabilitation: optimizing function,* St Louis, 2009, Mosby.

A case study by Webster and Scott[120] demonstrated positive effects of this approach both immediately after treatment and at the 18-month follow-up; the client demonstrated improved attention, which resulted in increased recall, increased sexual function, and improved job performance.

- *Self-management strategies.* Sohlberg and Mateer[105] suggest the use of three self-management strategies:

1. *Orienting procedures*. Clients are encouraged to consciously monitor activities to prevent or control a lapse in attention. They are taught to ask themselves orienting questions at various intervals (possibly reminded by an alarm watch): "What am I currently doing?" "What was I doing before this?" and "What am I supposed to do next?"

2. *Pacing*. Pacing is used to decrease task demands. Scheduling uninterrupted work times is one example. Other examples are setting realistic expectations, building in breaks, and self-monitoring fatigue and attention.[105]

3. *Key ideas log*. Clients are taught to quickly write or tape-record questions or ideas to address later so that the task at hand is not interrupted.

Because there is insufficient evidence to support the use of remediation-based approaches to attention training to improve occupational performance,[44] strategy training is considered a practice standard for the post-acute period of rehabilitation by the American Congress of Rehabilitation Medicine.[24] Intervention should focus on strategy training to compensate for attention deficits in functional situations.

Impact of Memory Deficits on Daily Function

Memory impairment is one of the most common consequences of brain injury and degenerative cognitive disorders. The severity and type of memory loss vary according to the structures affected. Human memory is composed of multiple and distinct systems, which the individual needs to support daily activities and participate in the community (Table 26.7).[107] Examples include remembering your significant other's birthday, remembering to take your medications, remembering to feed the dog, remembering how to type, remembering events that occurred during a vacation, and so on. Even this "simple" list of memory tasks requires intact functioning of multiple memory systems and includes knowledge of facts and events, procedures, and future intentions. Clearly, memory serves as a key cognitive support to facilitate independent living.

TABLE 26.7

Terms Related to Memory Impairments

Term	Definition	Examples of Everyday Behavior
Anterograde amnesia	A deficit in new learning; an inability to recall information learned *after* acquired brain damage; an inability to form new memories after brain damage occurs	Not able to recall staff names, easily gets lost secondary to topographic disorientation, not able to recall what occurred in therapy this morning, difficulty learning adaptive strategies to compensate for loss of memory
Retrograde amnesia	Difficulty recalling memories formed and stored *before* the onset of disease; may be worse for recent events than for substantially older memories	Inability to remember autobiographic information (address, social security number, birth order), not able to remember historical events (war, presidential elections, scientific breakthroughs) and/or personally experienced events (weddings, vacations)
Short-term memory	Storage of limited information for a limited time	Difficulty remembering instructions related to the use of adaptive equipment, not able to remember the names of someone just introduced at a dinner party, not able to remember "today's specials" in a restaurant
Working memory	Related to short-term memory; refers to actively manipulating information in short-term storage through rehearsals	While playing a board game, unable to remember and use the rules of the game; not able to perform calculations mentally while balancing the checkbook; difficulty remembering and adapting a recipe
Long-term memory (LTM)	Relatively permanent storage of information with unlimited capacity	May affect declarative memory of knowledge, episodes, and facts or nondeclarative memories such as those related to skills and habits
Nondeclarative memory	Knowing *how* to perform a skill, retain previously learned skills, and learn new skills; a form of LTM; also called **procedural memory**	Driving, playing sports, hand crafts, learning to use adaptive equipment or a wheelchair for activities of daily living
Declarative memory	Knowing that something was learned; verbally retrieving a knowledge base (eg, facts) and remembering everyday events; includes episodic and semantic information; a form of LTM	See episodic and semantic memory
Episodic memory	Autobiographic memory for contextually specific events and personally experienced events; a form of declarative LTM	Remembering the day's events, what one had for breakfast, occurrences on the job, and the content of therapy sessions
Semantic memory	Knowledge of the general world and facts, linguistic skill, and vocabulary; may be spared after injury; a form of declarative LTM	Remembering the dates of holidays, the name of the president, dates of world events
Explicit memory	Memories of events that have occurred in the external world; information about a specific event at a specific time and place	Remembering places and names and various words (see declarative memory)
Implicit memory	Memories necessary to perform events and tasks or to produce a specific type of response; does not require conscious retrieval of the past; knowledge is expressed in performance, without the person being aware of having it	Memory of skills, habits, and subconscious processes (see nondeclarative memory)
Prospective memory	Remembering to carry out future intentions	Remembering to take medications, return phone calls, buy food, pick up the children from school, mail the bills; a critical aspect of memory to support everyday life
Metamemory	Awareness of one's own memory abilities	Knowing when you need to compensate for memory capacity (eg, making a list of errands or a shopping list, writing down a new phone number or driving directions); recognizing errors in memory, and so on

Data from Baddeley AD: The psychology of memory. In Baddeley AD, Kopelman MD, Wilson BA, editors: *The essential handbook of memory disorders for clinicians,* Hoboken, NJ, 2004, John Wiley; Bauer RM, Grande L, Valenstein E: Amnesic disorders. In Heilman KM, Valenstein E, editors: *Clinical neuropsychology,* ed 4, New York, 2003, Oxford University Press; Markowitsch HJ: Cognitive neuroscience of memory, *Neurocase* 4:429–435, 1998; and Sohlberg MM, Mateer CA: Memory theory applied to intervention. In Sohlberg MM, Mateer CA, editors: *Cognitive rehabilitation: an integrative neuropsychological approach,* New York, 2001, Guilford Press.

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The steps or stages of memory have been well documented (Table 26.8).[13,105] The flow of these stages is:

Attention → Encoding → Storage → Retrieval

TABLE 26.8
Stages of Memory

Stage	Description	Neuroanatomic Areas of Function
Attention	Processes that allow a person to gain access to and use incoming information; includes alertness, arousal, and various attention processes (eg, selective attention)	• Brainstem • Thalamic structures • Frontal lobes
Encoding	How memories are formed; an initial stage of memory in which the material to be remembered is analyzed (visual vs. verbal characteristics); correct analysis of the information is required for proper storage	• Dorsomedial thalamus • Frontal lobes • Language system (eg, Wernicke's area) • Visual system (eg, visual association areas)
Storage	How memories are retained; transfer of a transient memory to a form or location in the brain for permanent retention and access	• Hippocampus • Bilateral medial temporal lobes
Retrieval	How memories are recalled; search for or activation of existing memory traces	• Frontal lobe

Data from Sohlberg MM, Mateer CA: Memory theory applied to intervention. In Sohlberg MM, Mateer CA, editors: *Cognitive rehabilitation: an integrative neuropsychological approach*, New York, 2001, Guilford Press.

Traditional measures of memory have tended to be tabletop laboratory-style tools. Contrived tasks commonly used are remembering a string of numbers, a list of words, or the details of a drawn figure and/or paired associate learning (ie, requiring a person to recognize or recall recently presented material). How the results of these tests relate to everyday memory function is not clear, and associations between scores on this type of test and reports of everyday memory failure are not strong.[109] Similarly, functional gains do not always correlate with improvement in memory processes based on objective testing.[91]

A comprehensive evaluation of how impairments in memory affect everyday function includes the use of standardized assessments, nonstandardized observations, standardized self-reports, and standardized reports of caregivers and significant others. (Tables 26.2 and 26.3 provide descriptions of recommended assessments.) The Contextual Memory Test is a useful screening tool.[112] It allows practitioners to objectify three aspects of memory and screen for possible further evaluation:

1. Awareness of memory: Using general questioning before the assessment, predicting performance before assessment, and estimating memory capacity after performance.

2. Recall of 20 line-drawn aspects: Immediate and delayed (15 to 20 minutes) recall.

3. Strategy use: Probes the use of memory strategies and determines the ability to benefit from strategy recommended by the practitioner.

Interventions focused on individuals with memory deficits can be categorized as (1) restorative approaches to improve underlying memory deficits, (2) strategy training, (3) use of nonelectronic memory aids, and (4) use of electronic memory aids or assistive technology. Techniques aimed at improving the underlying memory impairment (eg, memory drills) have been unsuccessful in terms of generalization to meaningful activities. In other words, an improvement may be detected on a laboratory-based measure of memory without a corresponding change in daily function or subjective memory reports.

The most promising interventions to improve function in those with memory deficits rely at least partially on compensatory techniques (Box 26.3). When a compensatory approach is used, choosing the correct system of compensation is critical. Kime[58] suggests a comprehensive evaluation that includes:

- Severity of the injury
- Severity of the impairment in memory
- Presence of comorbid conditions, including physical impairments, language deficits, and other cognitive deficits
- Social supports

- Client's needs (eg, Will the system be used for work, home management, or other occupations?)

Box 26.3

Suggestions for Working With Individuals With Working Memory Deficits

- Keep directions and instructions short.
- Use real-world functional tasks for training (eg, adding up monthly bills rather than practicing rote strings of numbers).
- Speak slowly, but not exaggeratedly so.
- Stress target words during training to help the person realize the key part of the instruction. In addition, put key information at the beginning and end of sentences.
- Increase the automaticity of a response through extra practice and rehearsal (eg, learning to transfer from a wheelchair to a bed).
- Use part-whole learning, or break down a task into components to promote overlearning of the components.
- Teach rehearsal strategies.

Data from Parente R, et al: Retraining working memory after traumatic brain injury, *NeuroRehabilitation* 13:157–163, 1999.

The following sections discuss specific evidence-based interventions.

Memory Notebooks and Diaries

The use of memory notebooks and diaries has been documented to improve orientation and to support everyday living tasks, such as morning ADLs and simple IADLs.[98] Sohlberg and Mateer[103,104] published a systematic, structured training sequence for teaching individuals with severe memory impairments to independently use a compensatory memory book. The training sequence they proposed incorporates principles of learning theory in addition to procedural memory skills, which may be preserved in many clients with even severe memory impairments. Donaghy and Williams[29] suggested that the diary or notebook include a pair of pages for each day of the week. The notebook is set up to aid scheduling of things to do in the future and to record activities done in the past. For each pair of pages, the left-hand page contains two columns, one with a timetable for the day and the other for to-do items. The right-hand page contains the memory log. A "last week" section at the back stores previous memory log entries. A full year calendar allows appointments to be recorded. Ownsworth and McFarland[77] compared two approaches to memory diary training:

- *Diary-only training*. This approach focuses on functional skill building and compensation-based, task-specific learning. The subjects were taught a behavioral sequence consisting of making a diary entry, checking it, and using the information as needed.
- *Diary and self-instructional training*. This approach emphasizes training of the subject's capacity for the higher level cognitive skills of self-regulation and self-awareness. The subjects were taught a ***WSTC*** strategy:

W: What are you going to do?

S: Select a strategy for the task.

T: Try out the strategy.

C: Check how the strategy is working.

The authors found that during the treatment phase, those in the diary and self-instruction training group consistently made more diary entries, reported fewer memory problems, compensated better through use of strategies, and made more positive ratings associated with the efficacy of treatment. Possible sections for a memory notebook are included in Table 26.9.

TABLE 26.9

Sections of a Memory Notebook

Section	Purpose
Daily log	Used to record, store, and retrieve information about daily activities; forms for charting hourly information and scheduling appointments; forms for prioritizing a list of tasks
Calendar	Used to record appointments and retrieve information about important meetings and upcoming events
Names	Used to record, store, and retrieve identifying information and "name drawings" of new people
Current work	Used to record specific procedures for work assignments that may be needed at a later date
Personal notes	Used to record important personal information (eg, personal goals, autobiographic information); also used to record addresses, birthdays, and similar information

From Schmitter-Edgecombe M, et al: Memory remediation after severe closed head injury: notebook training versus supportive therapy, *J Consult Clin Psychol* 63:484–489, 1995.

Errorless Learning

Errorless learning is a strategy that is in contrast to trial-and-error learning or errorful learning. Interventions using an errorless learning approach are based on differences in learning abilities. It is typical for people with impairments in memory to more successfully remember their own mistakes as results of their own action than they are to remember corrections of their mistakes by explicit means (eg, a therapist's cue). In other words, people may remember their mistakes, but not the correction. With errorless learning a person learns something by saying or doing it rather than by being told or shown by someone. A meta-analysis of errorless learning for treating memory loss conducted by Kessels and de Haan[56] documented a large and statistically significant effect size for errorless learning treatment. In addition, no significant effect size was demonstrated for the vanishing cues method (ie, teaching a skill by fading cues over time). It should be noted that the majority of studies analyzed used laboratory-type impairment measures such as word lists, face-name associations, and the like.

Assistive Technology

The literature focused on using technology to improve daily function in those with memory loss is substantial and consistently documents improvement in specifically trained tasks (eg, managing medication, morning routines, and IADLs). A variety of devices have been used (Box 26.4).

Box 26.4

Assistive Technology for Individuals With Memory Loss

- Handheld computers
- Smart phones
- Paging systems
- Voice recorders
- Personal digital assistants
- Alarm watches
- Electronic pillboxes
- Microwave with preset times

- Adaptive stove controls that turn off an electric stove after a certain period or when the heat becomes excessive
- A phone with programmable memory buttons (affix pictures to the buttons)
- A phone with buttons programmed to speak the name of the person being called
- A device for locating keys
- A recording to cue a behavioral sequence, such as morning care

From Gillen G: *Cognitive and perceptual rehabilitation: optimizing function,* St Louis, 2009, Mosby.

Equipment that formerly was specialized (eg, paging systems and handheld computers) continues to become commonplace; therefore, there is a larger population who may be amenable to using devices to compensate for memory loss. Typical smart phones have endless possibilities in terms of being used to cue performance of tasks in those with impaired memory. Examples include calendar functions, alarm functions, shopping list applications, dictation systems, map functions, contact lists, and others.

Mnemonics

Mnemonics is a broad term that refers to any strategy used to remember something, including rhymes, poems, acronyms, and imagery techniques. Examples include "Thirty days hath September …" (rhymes or poems to remember how many days are in each month), the acronym ROYGBIV to remember the colors of the spectrum, and imagining placing the items you want to remember in specific locations in a room with which you are familiar (method of loci).

Hux et al.[53] assessed the effectiveness of three frequencies of intervention sessions focused on using mnemonics and visual imagery strategies to recall names of people: once per day, two times per week, and five times per day. The subjects included seven men who had sustained a TBI, ranging in age from 28 to 40 years. The results showed that sessions held daily and twice a week were more effective than sessions held five times a day. Mnemonics and visual imagery strategies were effective for 4 of the 7 participants, regardless of the frequency of intervention sessions. More research is required to determine whether mnemonic strategies are generalizable to untrained tasks and also who is an appropriate candidate. At this point it seems that mnemonics are best suited for remembering specific and limited types of information (eg, staff names).

Task-Specific Training

A series of experiments by Giles and Morgan[40] documented improved daily function in those with severe memory loss using the following interventions:

- An intervention program consisting of chaining nine discrete activities (eg, shaving, oral care) by using linking phases. The phrases linked the performed activity to the one that immediately followed (eg, "teeth cleaned, now shave"). The person was then asked to repeat the phrase as a cue to initiate the activity, which was followed by the behavioral techniques of verbal praise and a tangible reward.
- An intervention consisting of a cued ADL sequence determined by the client's preinjury habits and responsiveness to cueing. Washing and dressing were conceptualized as a 16-step program in which the staff would cue the next step if behavior compatible with the next step in the sequence was not evident within approximately 5 seconds of completion of the previous step, or if behavior incompatible with production of the next step in the behavioral chain was demonstrated. Although the client's physical and cognitive status remained unchanged during the program, which lasted for 12 treatment days, he did become independent in washing and dressing. Initially requiring 25 to 30 instructions, in addition to physical assistance, to perform the tasks, the client progressed to independence. Independence was maintained at the 6-month follow-up.[42]

Giles et al.[41] presented further support for these specific retraining protocols. Four clients were treated with the aforementioned washing and dressing protocol. Three had sustained a TBI, and one had brain injury after cerebral bleeding. All had moderate to severe memory loss. The training program consisted of behavioral observation, task analysis, consistent practice, and cue fading. The

Adaptive Behavior Scale was used to measure change in behavior. The authors found that three subjects achieved rapid independence in washing and dressing (requiring 20 days, 37 days, and 11 days of treatment), and one did not show significant clinical improvement. Of note was that all clients admitted to the facility during a 3-year period who required retraining in washing and dressing were treated with the same protocol. The authors further concluded that the consecutive series design prevented researchers from selecting clients they believed were good treatment candidates; therefore, the findings supported the general applicability of the training program. Box 26.5 presents strategies for significant others.

Box 26.5

Strategies for Significant Others of Individuals With Memory Loss

- Understand that in many cases the impairment may not be reversible.
- Become familiar with the specific type of compensatory memory strategies that have been prescribed.
- Keep daily schedules as consistent as possible. Stick with habits and routines.
- Simplify the environment by reducing clutter and keeping the living areas organized.
- Reduce excessive environmental stimuli.
- Help by organizing calendars and having clocks and reminders arranged around the house.
- Be proactive in identifying potential safety issues.
- Use short, direct sentences.
- Make sure the most important information comes at the beginning of the sentence.
- Highlight, cue, and emphasize key aspects of communication (eg, repeat, point, and so on).
- Avoid conversations that rely on memory (ie, keep conversations in the present).
- Repetition of sentences may be inevitable.
- Summarize conversations.
- Remember that in many cases intelligence may remain intact.
- Keep "a place for everything, and everything in its place."
- Use photographs, souvenirs, and other appropriate items to help the person access memories.
- Understand that fatigue, stress, sleep disorders, and depression can exacerbate memory loss.
- Keep back-up items (eg, glasses, spare keys).
- Help create to-do lists. Remind loved ones to check off a task or highlight it when it has been completed.
- Label items, drawers, and shelves.

From Gillen G: *Cognitive and perceptual rehabilitation: optimizing function*, St Louis, 2009, Mosby.

Strategy Training

In addition to the strategies discussed previously, Stringer and Small[108] tested an approach called

Ecologically Oriented Neurorehabilitation of Memory, a treatment program that provides a four-step compensatory strategy based on the acronym WOPR: write–organize–picture–rehearse. Performance measures on everyday memory simulations for six declarative memory tasks and one prospective memory task were used as outcome measures. Clients in all three diagnostic groups and at all levels of severity showed significant improvement in memory performance.

Impact of Executive Dysfunction on Daily Function

Executive functions is an umbrella term that refers to complex cognitive processing requiring the coordination of several subprocesses to achieve a particular goal.[30] This term has been defined as "a product of the coordinated operation of various processes to accomplish a particular goal in a flexible manner"[37] or "those functions that enable a person to engage successfully in independent, purposive, self-serving behavior."[66] These higher order mental capacities allow a person to adapt to new situations and achieve goals. They include multiple specific functions, such as decision making, problem solving, planning, task switching, modifying behavior in light of new information, self-correction, generating strategies, formulating goals, and sequencing complex actions. Unfortunately, the published literature is not consistent on whether a particular function is an executive function. Table 26.10 gives an in-depth list of the 20 most commonly reported dysexecutive symptoms and the reported frequencies of these symptoms. Clearly, these executive functions support engagement in daily life activities and participation in the community; they are most important during new, nonroutine, complex, and unstructured situations (Table 26.11).

TABLE 26.10

Frequency of Reporting of Dysexecutive Symptoms[a]

Symptom	Clients Reporting Problem (%)	Caregivers Reporting Problem (%)	Rank of Disagreement[b]	Scaled Disagreement in Rank[c]
Poor abstract thinking	17	21	16.5	−9
Impulsivity	22	22	19.5	−10
Confabulation	5	5	19.5	+3
Planning	16	48	1	+8
Euphoria	14	28	5	+7
Poor temporal sequencing	18	25	15	−8
Lack of insight	17	39	3	+5
Apathy	20	27	13	−5
Disinhibition (social)	15	23	13	−3
Variable motivation	13	15	18	−7
Shallow affect	14	23	10.5	+1
Aggression	12	25	6	+6
Lack of concern	9	26	4	+9
Perseveration	17	26	10.5	−1
Restlessness	25	28	16.5	−6
Can't inhibit responses	11	21	9	+4
Know-do dissociation	13	21	13	−2
Distractibility	32	42	8	+1
Poor decision making	26	38	7	−3
Unconcern for social rules	13	38	2	+10

[a]Only ratings of 3 or 4 (of a maximum of 4) for each item on the Dysexecutive Questionnaire were considered to indicate a problem. These ratings correspond to classification of the symptom as "often observed" or "very often observed." These results are based on data gathered as part of the study by Wilson et al.

[b]This number represents the rank size of the disagreements (in proportions reporting the symptom) between clients and controls, in which 1 represents the greatest disagreement (ie, 1 means that caregivers reported this symptom much more often than clients did).

[c]This number reflects the relative disagreement in rank frequency of reporting between clients and controls, scaled from −10 to +10, with 0 being absolute agreement in rank position of that symptom. On this scale, −10 means that the symptom was commonly reported by clients but not by caregivers, and +1 means that the symptom was frequently reported by caregivers, but it was relatively uncommon for clients to report it.

From Burgess PW, Simons JS: Theories of the frontal lobe executive function: clinical applications. In Halligan PW, Wade DT, editors: *Effectiveness of rehabilitation for cognitive deficits*, Oxford, UK, 2005, Oxford University Press.

TABLE 26.11

Examples of Executive Functions Related to Daily Life: Preparing a Salad

Executive Function	Associated Tasks
Initiation	Starting the task at the appropriate time without overreliance on prompts
Organization	Organizing the work space and performing the task efficiently (eg, gathering the necessary vegetables at the same time from the refrigerator)
Sequencing	Sequencing the steps of the task appropriately (eg, gathering tools and vegetables, washing vegetables, chopping and slicing vegetables, combining vegetables in a bowl, adding dressing)
Problem solving	Solving the problem of using a knife that is too dull to slice

From Gillen G: *Cognitive and perceptual rehabilitation: optimizing function*, St Louis, 2009, Mosby.

Recent studies examining meal preparation abilities in those with frontal lobe involvement have supported the importance of executive functions in everyday activities. Godbout et al.[45] examined executive functions and ADLs in 10 clients with excised frontal lobe tumors and 10 normal controls by means of a neuropsychological test battery, a script generation task, and a complex multitask ADL (planning and preparing a meal). The clients manifested numerous basic executive deficits on the pen and paper tests, were unimpaired on the script generation task (despite an aberrant semantic structure), and demonstrated marked difficulties in the meal preparation task. The authors concluded that the difficulties observed in performing a lengthy, complex, multitask ADL can be explained by impairment of several executive functions, generalized slowness in performance, and paucity of behavior.

Similarly, Fortin et al.[36] investigated executive functions in performing ADLs in 10 clients with frontal lobe lesions after a mild to severe closed head injury (CHI), compared with 12 normal controls, by means of a neuropsychological test battery, a script recitation task, and simulation of a complex multitask ADL. These authors found that the groups did not differ on any neuropsychological test by nonparametric testing. However, the clients with CHI manifested marked anomalies in the meal preparation task. Although small sequences of actions were easily produced, large action sets could not be executed correctly. The authors concluded that an outstanding deficit in strategic planning and prospective memory appears to be an important underpinning of the impairment in ADLs observed in clients with CHI with frontal lobe lesions. It also has been found that components of executive functioning (eg, categorization and deductive reasoning ability) in individuals with brain injury are good predictors of IADL functional performance.[46]

Lezak[65,66] classified the various forms of executive disorders into a four-part schema:

1. *Volition and goal formulation:* Including self-awareness, initiation, and motivation

2. *Planning:* Including the ability to conceptualize change, be objective, conceive alternatives, make choices, develop a plan, and sustain attention

3. *Purposive action:* To implement plans for achieving goals, including productivity, self-regulation, switching, and sequencing of actions

4. *Performance effectiveness:* Including quality control, self-correction, monitoring, and time management

Cicerone et al.[24] also presented a schema for executive functions. It includes four domains based on anatomy and evolutionary development:

1. *Executive cognitive functions* (dorsolateral prefrontal cortex): Involved in the control and direction (planning, monitoring, activating, switching, inhibiting) of lower level functions. Working memory and inhibition mediate executive functions.

2. *Behavioral self-regulatory functions* (ventral/medial prefrontal area): Involved in emotional processing and behavioral self-regulation when cognitive analysis, habit, or environmental cues are not sufficient to determine the best adaptive response.

3. *Activation-regulating functions* (medial frontal areas): Activation through initiative and energizing behavior. Pathology results in a decrease in activation and drive, also known as apathy and abulia.

4. *Metacognitive processes* (frontal poles): Personality, social cognition, and self-awareness as reflected by accurate evaluation of one's own abilities and behavior, rather than objective evaluation or reports by significant others.

People with impairments in executive functions, or **dysexecutive syndrome**, have impaired judgment, impulsiveness, apathy, poor insight, and lack of organization, planning, and decision making, in addition to behavioral disinhibition and impaired intellectual abilities. Specific behavioral characteristics include impulsivity, poor attention, erratic response, lack of flexibility, and poor self-control.[90,106] Of note is that people with impaired executive function may perform normally on pen and paper tests of cognition but unfortunately are found to have catastrophic everyday problems that are particularly evident in situations requiring multitasking and planning.[100]

The usual and customary tests of executive dysfunction include pen and paper measures or laboratory-type tasks, such as the Wisconsin Card Sorting Task, Trail Making Test, and Stroop Test, among others. As discussed earlier, the question of ecologic validity arises when these measures are used, in addition to difficulty generalizing the results to everyday living tasks. These measures have only a low to moderate relationship to everyday skills.

Additionally, the standard clinical tests used to assess executive impairments are considered too structured and rater led; therefore, they fail to capture the common problems of initiation, planning, and self-monitoring. (Recommended instruments are summarized in Tables 26.2 and 26.3.)

Interventions for dysexecutive syndrome (Box 26.6) continue to be tested empirically.

Box 26.6

Categories of Intervention for Clients With Impaired Executive Function

- *Environmental modifications:* Examples include using antecedent control, manipulating the amount of distractions and structure in the environment, organizing work and living spaces, and ensuring balance of work, play, and rest, among others.
- *Compensatory strategies:* Examples include the use of external cueing devices (eg, checklists, electronic pagers) and the use of reminder systems and organizers.
- *Task-specific training:* Training of specific functional skills and routines, including task modifications.
- *Training in metacognitive strategies to promote a functional change by increasing self-awareness and control over regulatory processes.* Such strategies include self-instruction strategies, teaching problem solving, and goal management training.

Data from Cicerone KD, Giacino JT: Remediation of executive function deficits after traumatic brain injury, *NeuroRehabilitation* 2:12–22, 1992; Sohlberg MM, Mateer CA: Management of dysexecutive symptoms. In Sohlberg MM, Mateer CA, editors: *Cognitive rehabilitation: an integrative neuropsychological approach*, New York, 2001, Guilford Press; and Worthington A: Rehabilitation of executive deficits: the effect on disability. In Halligan PW, Wade DT, editors: *Effectiveness of rehabilitation for cognitive deficits*, Oxford, UK, 2005, Oxford University Press.

Because executive functions act as a manager of other cognitive processes, such as attention, memory, and language,[67] some of the interventions previously described in this chapter are appropriate for those with dysexecutive symptoms, including TPM,[32] self-instruction training,[25] WSTC strategy,[63] external cueing devices (eg, paging systems, recorded instructions, and checklists),[21,31,99] and manipulation of environmental variables with a focus on level of distraction.[52] Other examples of specific interventions that have been tested and shown to be effective are described in the next three sections.

Problem-Solving Training

The aim of problem-solving training is to substitute a participant's impulsive approach to problem solving with a verbally mediated systematic analysis of the goal and the means by which it may be achieved.[118] von Cramon et al[118] encouraged participants to act in a manner attributed to an intact executive system, with a focus on five aspects of problem solving:

1. *Problem orientation or identifying and analyzing.* The difficulty in general recognition of a task or situation as a problem was the focus. The participant's tendency to oversimplify problems and neglect relevant information was addressed.

2. *Problem definition and formulation.* Participants learned to survey information by reading and rereading directions and formulated questions to augment their understanding of the problem. Main and relevant points were written down. A focus was to teach participants to discriminate between relevant and irrelevant information.

3. *Generating alternatives and solutions.* Participants were asked to generate as many solutions as possible for a given problem. This was done individually, followed by the participants sharing solutions. The goal was to make participants aware that there were more solutions available than they had originally thought.

4. *Decision making.* Solutions were discussed, and the pros and cons of the solutions were weighed. The feasibility of the solutions was also considered.

5. *Solution verification and evaluation.* Participants learned to recognize faulty solutions, self-correct errors, and return to other hypotheses. The focus here was on increased sensitivity to errors and discrepancies.

Others have recommended using problem-solving strategies such as stop and think; asking clear thinking questions; thinking your way through each step; defining the problem; using clear thinking questions to produce, evaluate, and examine the utility of as many alternative solutions as possible; and emotional self-regulation strategies.[92] These problem-solving skills are then reinforced by role playing and the practice of demanding real-life examples.

Goal Management Training

This intervention is aimed at decreasing disorganized behavior and improving the client's ability to maintain intentions in goal-directed behavior (goal management).[64] Such disorganization results in neglect of daily goals, such as never cleaning the house, forgetting to pack a lunch, or never getting around to making a shopping list—all of which compromise functional independence. Goal management training entails five stages that correspond to key aspects of goal-directed behavior:

Stage 1: *Orienting and assessing the current state.* Stop current activity and direct awareness toward the task.

Stage 2: *Select the main goal.*

Stage 3: *Partition the goals and make subgoals.*

Stage 4: *Rehearse the steps necessary to complete the task.* Encode, rehearse, and retain goals and subgoals.

Stage 5: *Monitor the outcome.* Compare the outcome of action with the stated goal.

These steps are taught using errorless techniques, and the cues for each stage are gradually faded to make sure the person maintains nearly perfect performance.

Metacognitive Training

Birnboim[15] and Birnboim and Miller[16] tested the effectiveness of a metacognitive therapeutic approach in 10 people with multiple sclerosis and executive dysfunction. This approach focused on the metacognitive aspects of behavior and assumed that metacognitive aspects can and should be learned explicitly through a structured process. Phases of the process included the following:

1. *Understanding:* The participant had to recognize his or her specific metacognitive deficits (eg, not planning). This was achieved by confronting various tasks in the clinic to increase awareness.

2. *Practice:* Efficient and specific strategies that the participant and therapist identified together (eg, set priorities) were learned and practiced.

3. *Transfer:* Participants and their therapists considered when and where these strategies could be applied in real-life situations.

Computer strategy games (eg, Mastermind) and tabletop exercises were used during the first two phases of the training. Individualized daily activities were the focus of the generalization phase (eg, specific work tasks). Positive results were noted on a strategy application test, tests of attention, memory tests, tests of executive function, and most important, the Occupational Therapy

Functional Assessment Compilation Tool, which showed an improved occupational role.

Summary

Jane's case will serve as a summary and a conclusion. Jane's initial evaluation was structured to first and foremost foster a client-centered approach to ensure that her OT sessions were tailored to her goals. Gary, Jane's husband, was also involved in this process because Jane was demonstrating poor self-awareness related to her functional limitations. Gary reported that he worked full-time and that Jane would be alone for part of the day. He stated that he would help in any way needed, but he was concerned that helping with self-care would change the dynamic in their new marriage, and he wanted self-care to be a focus of occupational therapy. Jane reported that she felt "humiliated" when staff members had to help her with personal needs, such as ADLs. Jane was also focused on (sometimes perseverating on) finishing school. It was determined that morning OT sessions would focus on self-care, and afternoon sessions would focus on school skills.

As described earlier, the standardized FIM (required on most units) was administered. The FIM findings were supplemented by the standardized A-ONE, which documented the reasons for Jane's limited performance in areas of occupation. Because it was quickly apparent the Jane was not aware of her limitations (one of Gary's greatest concerns), the standardized Self Awareness of Deficits Interview was also administered as a priority. The OT performed nonstandardized assessments of school tasks. To assess performance, the OT requested that Gary bring in Jane's current semester work and supplies at the end of the second week of therapy. The OT was able to document Jane's reading comprehension, ability to attend to lectures (Jane always recorded lectures, and Gary was able to locate the recordings), ability to structure note taking, and use of her laptop for e-mail functions. Deficits were noted in the areas of sustained attention, short-term memory, and being distracted by environmental stimuli.

The OT, along with Jane and Gary, set the following short-term goals, which focused on documenting improvements in areas of occupation.

Week 1

1. Jane will complete upper body dressing with one tactile cue for initiation and no more than two verbal cues for sequencing.

2. Jane will complete grooming tasks (oral hygiene and hair care) with one tactile cue for initiation and the use of a checklist outlining the steps of the tasks.

3. Jane will persist in feeding herself for 10 minutes after one tactile cue for initiation.

Week 3

1. All self-care tasks except for bathing will be completed with no more than one general verbal cue and external cueing devices as needed.

2. Jane will accurately write down three key points from a 10-minute lecture with one general verbal prompt to stay on task.

3. Jane will retrieve her email from her laptop with no more than one verbal cue for sequencing.

In terms of interventions to meet the aforementioned goals and others, the general treatment approach chosen by Jane's OT was the multicontext approach described earlier. This model was chosen primarily because of its emphasis on awareness training so that Jane could redefine her knowledge of her strengths and weaknesses. The OT hypothesized that improving awareness would be the starting point for intervention because he felt confident that if Jane were aware of her errors, he could teach her strategies that would allow her to meet her goals. In addition, the choice of intervention activities was based on Jane's interests and goals (school tasks, reading fiction, cooking). Various processing strategies were practiced during a variety of functional activities and situations. Processing strategies were chosen to allow Jane to control the cognitive symptoms detected on her assessment. As Jane's awareness improved, the OT was vigilant in monitoring her for signs of depression and anxiety. Jane's OT began to place emphasis on teaching specific strategies to keep Jane “on task” (sustained attention), in addition to determining which external cueing devices would allow Jane to stay organized and perform the steps of various tasks in the proper sequence. The OT planned interventions to occur in multiple environments (bedside, OT clinic, hospital gift store, staff office, hospital library) to promote generalization of learning.

Review Questions

1. Name the three levels of the pyramid model of self-awareness.
2. How does the concept of ecologic validity relate to cognitive assessment?
3. List some of the rationales for using self-report/caregiver report measures for individuals with cognitive impairment.
4. How does the OT approach for individuals with cognitive impairments differ from that used by other disciplines?

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27

Eating and Swallowing*

Jerilyn (Gigi) Smith

CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Name and locate oral structures concerned with eating and swallowing.
2. Name and describe the stages of normal eating and swallowing.
3. List the components of the swallowing assessment.
4. Name and describe normal and abnormal oral reflexes.
5. Describe the role of the occupational therapist in the clinical assessment of eating and swallowing.
6. Describe four steps in the swallowing assessment.
7. Describe the appropriate progression of foods and liquids in the assessment and intervention of deglutition and dysphagia.
8. Name two types of tracheostomy tubes, and list the advantages and disadvantages of each.
9. List symptoms of swallowing dysfunction.
10. Identify basic intervention goals for clients with eating and swallowing dysfunction.
11. Describe the roles of the dysphagia team members.
12. Describe proper positioning for safe feeding and swallowing.
13. Describe two methods of nonoral feeding.
14. List principles of oral feeding.
15. List and describe intervention techniques for the management of eating and swallowing dysfunction.

KEY TERMS

Anticipatory phase
Aspiration
Bolus
Compensatory strategies
Deglutition
Dysphagia
Dysphagia diet
Dysphagia team
Eating
Esophageal phase
Feeding
Fiberoptic endoscopy
Gastrostomy tube
Hyoid bone
Instrumental assessment
Larynx
Nasogastric tube
Oral phase
Oral preparatory phase
Pharyngeal phase

Pyriform sinuses
Sulcus
Swallow response
Tracheostomy
Valleculae
Velopharyngeal port
Velum
Videofluoroscopy

Threaded Case Study

Mattias, Part 1

Mattias, a 65-year-old man, experienced a right cerebrovascular accident (RCVA) 3 days ago, which resulted in left hemiplegia. During his occupational therapy evaluation of activities of daily living (ADLs), it was determined that Mattias had difficulties with self-feeding, chewing, and swallowing at meals. He had frequent episodes of coughing, pocketing food in the left cheek, and often had food on the left side of his face. His oral intake is below the normal calorie range at this time. He complains that he chokes on many foods, including water.

An occupational profile provided the following background information. Mattias is married and has two daughters. Until onset, he was working full time as a vice president for marketing in the computer industry. He and his wife are active socially in their golf and tennis club. They also entertain with frequent dinner parties and both are exceptional cooks. Their oldest daughter is engaged and planning to be married in 4 months.

During the occupational therapy assessment, Mattias was asked to prioritize his concerns regarding his occupational performance. Mattias wants to be able to attend and participate in his daughter's wedding in 4 months. His goal is to be able to escort her down the aisle. He wants to be able to eat and drink without concerns about choking or coughing, particularly because he and his wife were going to prepare the dinner for the wedding rehearsal party. He also wants to be able to make and drink a toast to his daughter and her new husband without risk of choking. He had planned to work to the end of the year and then retire. Upon retirement he and his wife planned to travel to Italy to attend a 1-week cooking class.

Critical Thinking Questions

1. What evaluations would you perform to develop an intervention plan for his eating and swallowing needs based on the information described?

2. What interventions would you consider to address his goal to participate in his daughter's wedding?

3. How does context influence Mattias' need to eat safely and eat a variety of foods? How would you incorporate this knowledge into your intervention plan?

4. How would you systematically grade the challenges in the intervention program for Mattias?

Ethical Considerations

Continuing education and special training are required for competence in assessing and intervening with clients who have dysphagia.

Eating is the most basic activity of daily living, necessary for survival from birth until death. Eating occurs throughout life in a variety of contexts and in every culture and is an essential activity of daily living that facilitates an individual's basic survival and well-being.[3] Although eating and **feeding** are closely related, these terms are not synonymous. The Occupational Therapy Practice Framework: Domain and Process, Third Edition (OTPF-3) defines feeding as “the process of setting up, arranging, and bringing food (fluids) from the plate or cup to the mouth; sometimes called self-feeding" and swallowing/eating is defined as "keeping and manipulating food or fluid in the mouth and swallowing it" (p. S19).[3] Swallowing is a complicated act that involves moving food, fluid, medication, or saliva through the mouth, pharynx, and esophagus into the stomach.[5] Feeding, eating, and swallowing are influenced by contextual issues, including psychosocial, cultural, and environmental factors.[5] **Dysphagia** is a medical term that means difficulty with swallowing. This difficulty can occur at any stage (oral, pharyngeal, or esophageal) of the swallow. Dysphagia is not a primary medical diagnosis; rather it is a symptom of underlying disease and is often identified by its clinical characteristics.[33]

Feeding, eating, and swallowing are within the domain and scope of practice of occupational therapy, and occupational therapists are trained to assess and provide intervention for the performance issues involved in these activities.[3,4] *Performance skills* such as motor and praxis, sensory-perceptual, emotional regulation, and cognitive skills; *client factors* such as muscle strength, endurance and motor control, muscle tone, normal and abnormal motor reflexes, respiratory system function, and digestive system function; *activity demands* such as social demands relating to the social environment and cultural contexts, sequence and timing, and required body functions and structures; and *performance patterns* including the habits, routines, and rituals that may interfere with the eating process are assessed. The *contexts* and *environments,* including those that are cultural, personal, and social, that may influence the client's successful engagement in eating are also assessed.[5]

This chapter provides the occupational therapist with a foundation for the assessment and intervention process of the adult client with eating and swallowing dysfunction. Conditions that can result in eating and swallowing problems include cerebral vascular accident (CVA), traumatic brain injury, brain tumor, anoxia, Guillain-Barré syndrome, Huntington's disease, Alzheimer's disease, multiple sclerosis, amyotrophic lateral sclerosis, Parkinson's disease, myasthenia gravis, poliomyelitis, postpolio syndrome/muscular atrophy, and quadriplegia. Anatomic or developmental dysphagia is not discussed in this chapter.

Anatomy and Physiology of Normal Eating Swallow

Deglutition, the normal consumption of solids or liquids, is a complex sensorimotor process involving the brainstem, the cerebral cortex, six cranial nerves, the first three cervical nerve segments, and 48 pairs of muscles.[30,48] A normal swallow requires all of these structures to be intact (Fig. 27.1). Therefore occupational therapists who work with clients with eating and swallowing problems must have a thorough understanding of the anatomy and physiology of all phases of the swallow (Table 27.1). The eating and swallowing process can be divided into four stages: oral preparatory phase, oral phase, pharyngeal phase, and esophageal phase (Fig. 27.2).[5,48] An additional phase, the anticipatory phase, will also be discussed.

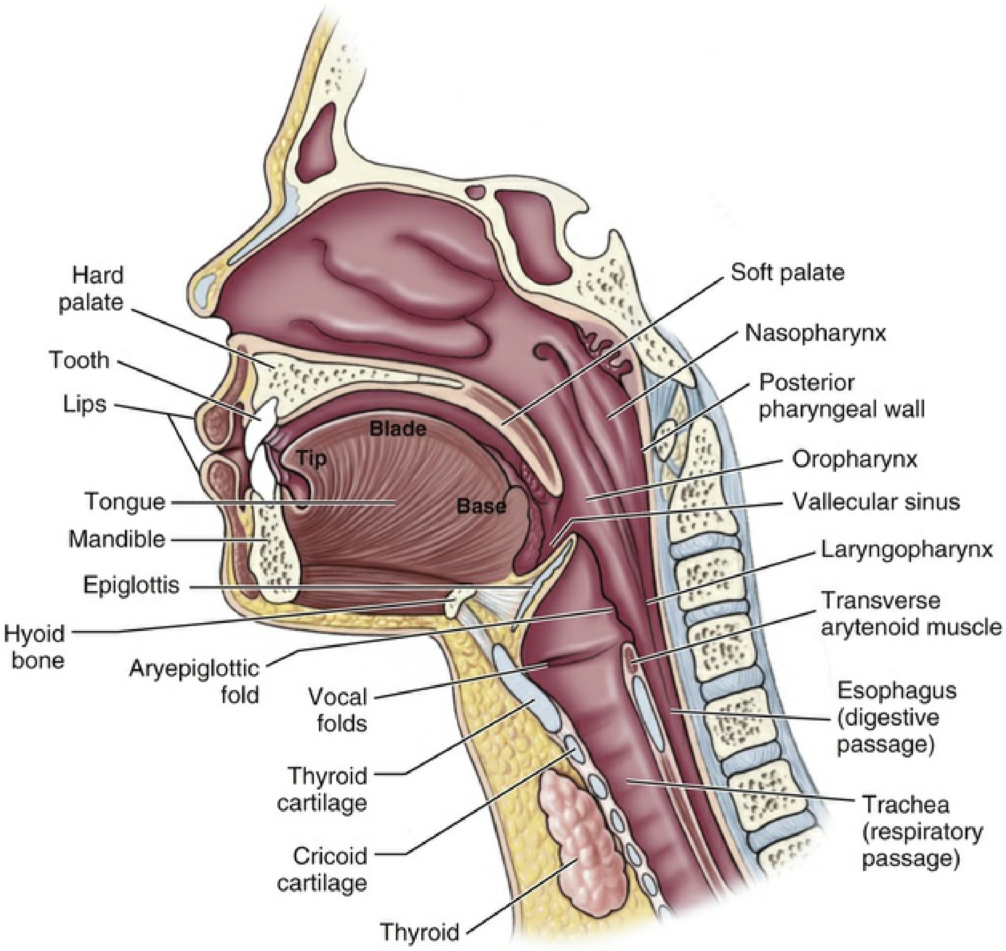

FIG 27.1 Oral structures, swallowing mechanism at rest. (From Herlihy B: *The human body in health and illness*, ed 5, St. Louis, 2014, Saunders.)

TABLE 27.1
Swallowing Process

Oral Preparatory Stage				
Structure	**Muscle**	**Movement**	**Cranial Nerve**	**Sensation**
Jaw	Pterygoideus medialis	Opens jaw	←Trigeminal (V) →	Face, temple, mouth, teeth, mucus
	Pterygoideus medialis and lateralis	Protrudes lower jaw; moves jaw laterally		
	Masseter	Closes jaw		
	Digastricus, mylohyoideus, geniohyoideus	Depresses lower jaw		
Mouth	Orbicularis oris	Compresses and protrudes lips	←Facial (VII)	
	Zygomaticus minor	Protrudes upper lip		
	Zygomaticus major	Raises lateral angle of mouth upward and outward (smile)		
	Levator anguli oris	Moves angle of mouth straight upward		
	Risorius	Draws angle of mouth backward (grimace)		

	Depressor labii inferioris	Draws lower lip downward and outward		
	Mentalis	Protrudes lower lip (pouting)		
	Depressor anguli oris	Draws down angles of mouth		
Tongue	Superior longitudinal	Shortens tongue; raises sides and tip of tongue	Facial (VII) →	Taste, anterior two thirds of tongue
	Transverse	Lengthens and narrows tongue	←Glossopharyngeal (IX) →	Taste, posterior third of tongue
	Vertical	Flattens and broadens tongue	←Hypoglossal (XII)	
	Inferior longitudinal	Shortens tongue; turns tip of tongue downward		
Oral Stage				
Tongue	Styloglossus	Elevates and pulls tongue posteriorly	←Accessory (XI)	
	Palatoglossus	Elevates and pulls tongue posteriorly; narrows fauces (faucial arches)		
	Genioglossus	Depresses, protrudes, and retracts tongue; elevates hyoid	←Hypoglossal (XII)	
	Hyoglossus	Depresses and pulls tongue posteriorly		
Soft palate	Tensor veli palatini	Tenses soft palate	←Trigeminal (V) →	Mouth
	Levator veli palatini	Elevates soft palate	←Accessory (XI)	
	Uvulae	Shortens soft palate		
Pharyngeal Stage				
Fauces (Faucial Arches)	Palatoglossus	Narrows fauces	←Vagus (X) →	Fauces
	Membranes of pharynx			
	Palatopharyngeus	Elevates larynx and pharynx		
Hyoid	Suprahyoideus	Elevates hyoid anteriorly, posteriorly	←Trigeminal (V)	
	Stylohyoideus			
	Sternothyroideus	Depresses thyroid cartilage	←Cervical 1,2,3	
	Omohyoideus	Depresses hyoid		
Pharynx	Salpingopharyngeus	Pharynx elevation	←Glossopharyngeal (IX)	
	Palatopharyngeus	Pharynx elevation		
	Stylopharyngeus	Pharynx and larynx elevation		
	Constrictor pharyngeus	Sequentially constricts the superior nasopharynx, oropharynx, laryngopharynx	←Vagus (X) →	Laryngeal and nasal pharynx
	Membranes of pharynx			
	Constrictor pharyngeus medius			
	Constrictor pharyngeus inferior			
	Cricopharyngeus	Relaxes during swallow; prevents air from entering esophagus		
Larynx	Aryepiglotticus	Closes inlet of larynx	←Vagus (X) →	
	Membranes of larynx			
	Thyroepiglotticus			
	Thyroarytenoideus	Closes glottis; shortens vocal cords		
	Arytenoid-oblique, transverse	Adducts arytenoid cartilages		
	Lateral cricoarytenoid	Adducts and rotates arytenoid cartilage		
	Vocalis	Controls tension of vocal cords		
	Postcricoarytenoideus	Widens glottis		
	Cricothyroideus-straight, oblique	Elevates cricoid arch		
Esophageal Stage				
Esophagus	Smooth	Peristaltic wave	←Vagus (X)	

Data from Finsterer J, Griswold W: Disorders of the lower cranial nerves, *J Neurosci Rural Pract* 6:377–391, 2015; Groher M: Normal swallowing in adults. In Groher M, Crary M, editors: *Dysphagia: clinical management in adults and children,* ed 2, St. Louis, 2016, Elsevier; Gutman SA, Schonfeld AB: *Screening adult neurologic populations,* ed 2, Bethesda, MD, 2009, American Occupational Therapy Association.

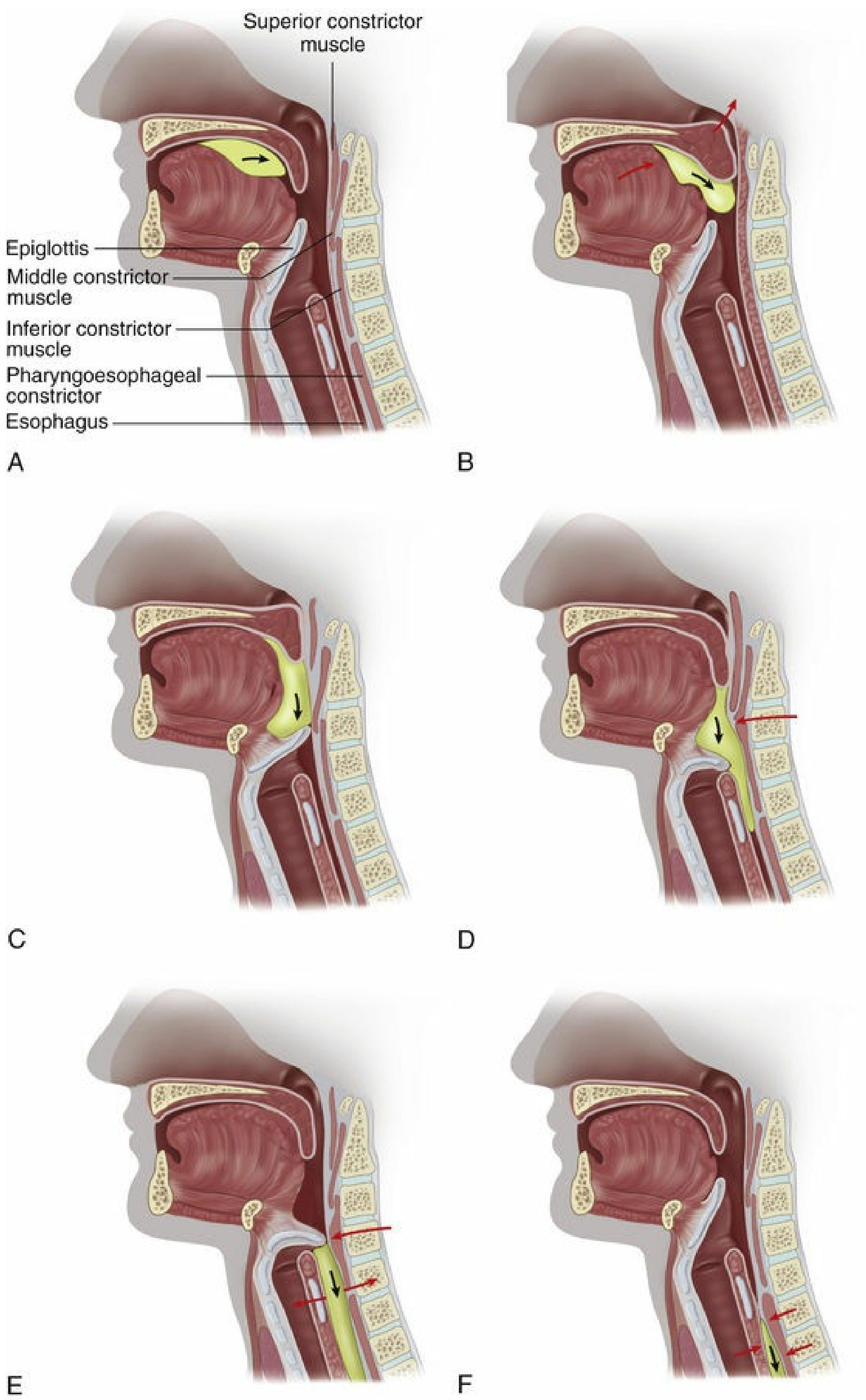

FIG 27.2 **A,** A bolus of food (yellow) is pushed against the hard palate and posteriorly toward the oropharynx by a stripping action of the tongue against the palate. (Black arrows indicate movement of the bolus.) **B** to **E,** The soft palate is elevated, closing off the nasopharynx, and the pharynx is elevated by the palatopharyngeal and salpingopharyngeal muscles. Successive contractions of the pharyngeal constrictors (**C** and **D**) force the bolus through the pharynx and into the esophagus. As this occurs, the epiglottis is bent down over the opening of the larynx, largely by the force of the bolus pressing against it. (Red arrows indicate muscle movement.) **E,** The tonically active pharyngoesophageal constrictor relaxes (outward direction red arrows), allowing the bolus to enter the esophagus. **F,** During the esophageal phase, the bolus is moved by successive contractions of the esophagus toward the stomach. (From Schapira AHV: *Neurology and clinical neuroscience,* Philadelphia, 2007, Mosby.)

Anticipatory Phase

Psychological factors, social interactions, a poor dining environment, and cultural differences contribute to feeding difficulties. The psychological, emotional, and social aspects surrounding mealtime can have a huge impact on an elderly individual's participation in the feeding process as well as on oral intake. Factors to be considered that may have an effect on the **anticipatory phase** include the variety of foods offered, presentation of food, seating during meals, mealtime atmosphere, respect of caregivers for food preferences,[15] and mealtime habits and routines.

The anticipatory phase begins even before the client enters the dining area. The client's expectations of the eating experience will influence his or her reaction to the dining environment and to the foods presented. Appetite/hunger; the sensory qualities of the food; the sensory qualities of the utensils, cups, and plates; the client's motivation to eat; and cognitive awareness of the eating activity will all have an impact on the degree to which the client engages in the feeding process. The anticipatory phase is an important precursor to successful eating. The occupational therapist can be instrumental in identifying environmental modifications that can positively influence the client's response to the eating experience.

Oral Preparatory Phase

In the **oral preparatory phase** of the swallow, food is masticated by the teeth and gums (if necessary) and manipulated by the lips, cheek, and tongue to form a **bolus** of appropriate texture for swallowing.[5,52] Visual and olfactory information stimulates salivary secretions from three pairs of salivary glands. Saliva is mixed with the food to prepare the bolus for the swallow. As tactile contact is made with the food, the jaw comes forward to open. The lips close around the glass or utensil to remove the food or liquid. The labial musculature forms a seal to prevent any material from leaking out of the oral cavity. This phase reflects the close relationship between feeding and eating. As Mattias brought food to his mouth, he did not have symmetrical lip closure on utensils or a glass, and often food or fluid would dribble from the left side of his mouth.

As chewing begins, the mandible and tongue move in a strong, combined rotary and lateral direction. The upper and lower teeth shear and crush the food. The tongue moves laterally to push the food between the teeth. The buccinator muscles of the cheeks contract to act as lateral retainers, to prevent food particles from falling into the **sulcus** between the jaw and cheek.[48] The tongue sweeps through the mouth, gathering food particles and mixing them with saliva. Recall that Mattias frequently had food remaining in his cheek after swallowing. This pocketing of food in the cheek may occur from diminished motor control of the tongue to manipulate the bolus or may indicate diminished sensory appreciation for food remaining in the sulcus. Sensory receptors throughout the oral cavity carry information of taste, texture, and temperature of the food or liquid through the seventh and ninth cranial nerves to the brainstem. The chewing action of the mandible and tongue is repeated rhythmically, repositioning the food until a cohesive bolus is formed. The length of time needed to form a bolus one can safely swallow varies with the viscosity of the food. A short time is needed for soft foods, and a longer time is needed for more textured or dense foods.[78] Large amounts of thick liquids or thick and dense foods require the tongue to divide the food into smaller parts to be swallowed one at a time. The posterior portion of the tongue forms a tight seal with the **velum**, preventing slippage of the bolus or liquid into the pharynx.[48] Foods that are a mixture of liquid and solids (such as soup with chunks of vegetables) require greater oral motor control and often present more difficulty for clients with oral preparatory phase swallowing problems.

In preparation for the next stage, the solid or liquid bolus, having been formed into a cohesive and swallowable mass, may be held between the anterior tongue and palate, with the tongue tip either elevated or dipped toward the floor of the mouth.[48] The tongue cups around the bolus to seal it against the hard palate. The **larynx** and the pharynx are at rest during this phase of the swallowing process, and the airway is open.

Threaded Case Study

Mattias, Part 2

As Mattias brought food to his mouth, he did not have symmetric lip closure on utensils or a glass, and often food or fluid would dribble from the left side of his mouth. Mattias frequently has food remaining in his cheek after swallowing.

Problems at the oral preparatory phase can disrupt the normal swallow sequence. Mattias has problems with this phase of the eating process. Of additional concern to Mattias is the embarrassment of having food or fluid dribble from the left side of his mouth. His decreased sensory awareness compromises his ability to notice foods/fluids and use a napkin to wipe the remaining food from his face.

Oral Phase

The **oral phase** of swallowing begins when the tongue initiates posterior movement of the bolus toward the pharynx.[48] The tongue elevates to squeeze the bolus up against the hard palate and forms a central groove to funnel the bolus posteriorly. As the viscosity of the food increases, the amount of pressure created by the tongue against the palate increases. Thicker foods require more pressure to propel them efficiently through the oral cavity.[48]

The oral phase of the swallow is voluntary, requiring the person to be alert and involved in the process. A normal voluntary oral phase is necessary to elicit a strong **swallow response** during the pharyngeal stage that follows. This stage of the swallow requires intact labial musculature to maintain food or liquid inside of the oral cavity, intact lingual movement to propel the bolus toward the pharynx, intact buccal musculature to prevent material from falling into the lateral sulci, and the ability to comfortably breathe through the nose. The oral phase takes approximately 1 second to complete with thin liquids and slightly longer with thick liquids and textured foods.

Threaded Case Study

Mattias, Part 3

Mattias is alert but has difficulties maneuvering food within his mouth during the oral phase. His ability to chew textured foods is compromised, and he requires additional time to chew foods. This contributes to the decreased oral intake.

Pharyngeal Phase

Voluntary and involuntary components are necessary for a normal swallow. Neither mechanism alone is sufficient to produce the immediate, consistent swallow necessary for normal eating.[48] The **pharyngeal phase** marks the beginning of the involuntary portion of the swallowing process.

This phase of swallowing begins when the bolus passes any point between the anterior faucial arches and where the tongue base crosses the lower rim of the mandible into the pharynx, marking the start of the involuntary component of the swallow.[48,69] After the swallow response has been triggered, it continues with no pause in bolus movement until the total act has been completed. The pharyngeal swallow is controlled by central pattern-generating (CPG) circuitry of the brainstem and peripheral reflexes.[42] Within the medulla oblongata the medullary reticular formation is responsible for screening out all extraneous sensory patterns and for responding only to those patterns that indicate the need to swallow. The reticular formation also assumes control of all motor neurons and related muscles needed to complete the swallow. Higher brain functions such as speech and respiration are preempted.

When the swallow response is triggered, several physiologic functions occur simultaneously. The velum elevates and retracts, closing the **velopharyngeal port** to prevent regurgitation of material into the nasal cavity. The tongue base elevates to direct the bolus into the pharynx. The hyoid and the larynx elevate and move anteriorly. There is closure of the larynx at the vocal folds, the laryngeal entrance, and the epiglottis to prevent material from entering the airway. The pharyngeal tube elevates and contracts from the top to the bottom in the pharyngeal constrictors, using a squeezing motion to move the bolus through the pharynx toward the esophagus. The bolus passes through the pharynx, dividing in half at the **valleculae** and moving down each side through the **pyriform sinuses** toward the esophagus. The upper esophageal sphincter (UES) relaxes and opens, allowing the material to enter the esophagus.[31,48] This movement must be rapid and efficient so that respiration is interrupted only briefly. The pharyngeal phase of the swallow takes approximately 1 second to complete for thin liquids.

Threaded Case Study

Mattias, Part 4

Mattias frequently coughs, indicating difficulties with the timing and coordination of the pharyngeal phase. His problems swallowing water may indicate diminished laryngeal elevation and decreased airway protection during the swallow.

Esophageal Phase

The **esophageal phase** of the swallow starts when the bolus enters the esophagus through the cricopharyngeal juncture or UES. The esophagus is a straight tube, approximately 10 inches long, that connects the pharynx to the stomach. The pharynx is separated from the esophagus by the UES. The lower esophageal sphincter (LES) separates the esophagus from the stomach. During the swallow, the strong muscles of the esophagus contract and the bolus is transported through the esophagus by peristaltic wave contractions. The overall transit time needed for the bolus to reach the stomach varies from 8 to 20 seconds. As the food enters the esophagus, the epiglottis returns to the relaxed position, and the airway opens.[31,48]

Threaded Case Study

Mattias, Part 5

Mattias complains of frequently coughing and choking on food and fluid. This may be due to problems with the preoral, oral, pharyngeal, or esophageal phase of eating. As you read the section on eating and swallowing assessment, use the case presentation of Mattias and consider what assessment results you would look for to identify which phase is producing the episodes of coughing and choking.

Eating and Swallowing Assessment

When a physician refers a client for occupational therapy, a thorough eating and swallowing assessment for possible dysfunction must be completed. The occupational therapist reviews the client's medical history and assesses the client's perceptual and cognitive skills; physical control of head, trunk, and extremities; oral structures; oral motor control; sensation; and swallowing ability.

Medical Chart Review

A review of the client's medical chart before initiating the bedside assessment reveals important information. The therapist should take note of the client's diagnosis, pertinent medical history (including prior incidents of **aspiration**), prescribed medications, and current hydration and nutritional status.

The medical diagnosis may indicate the etiology or cause of the client's eating or swallowing problems. For example, a diagnosis of a neurologic disorder such as a CVA or a degenerative disease/disorder should alert the therapist that eating or swallowing problems may exist.[61,75] It is important to know whether problems developed suddenly or gradually. The therapist should seek information regarding the duration of the client's swallowing difficulties and note any secondary diagnoses that could contribute to dysphagia, such as gastrointestinal or respiratory problems or changes in medication. A diagnosis of dehydration, weight loss, or malnutrition may indicate a chronic problem with deglutition.

Particular attention should be paid to reported episodes of pneumonia or aspiration (entry of food or material into the airway below the level of the true vocal folds). Aspiration pneumonia occurs when food or material enters into the lung and can be a serious medical complication that is identified by x-ray and treated with antibiotics.[30] Possible predictors of aspiration pneumonia include the need for frequent suctioning, chronic obstructive pulmonary disease (COPD), congestive heart failure (CHF), use of a feeding tube, weight loss, swallowing problems, multiple medications, and eating dependence.[2,43,74] An elevated temperature may also indicate that a client is aspirating.

An examination of the client's current hydration and nutritional status provides valuable information about the client's ability to manage oral intake. This information can be found in the dietary section of the chart or in the nursing progress notes in the intake and output (I & O) record. An altered diet texture (pureed food or thickened liquids) alerts the therapist to a potential problem with the client's ability to safely eat a regular diet. The presence of an intravenous (IV) fluid may indicate dehydration. Weight loss is frequently a result of a swallowing or feeding problem. Consideration should be given to prescribed medications that may alter the client's alertness, orientation, saliva production, appetite, and muscle control. The nursing notes may also indicate whether the client coughs or chokes when taking medications. How the client receives nutrition is also important—for example, the presence of a nonoral feeding device such as a **nasogastric tube** (NG tube) or **gastrostomy tube** (G tube) is often an indication of a serious dysphagia problem.

Occupational Profile

In the beginning of the evaluation process, the therapist obtains information from the client to develop the occupational profile. Information gathered for the profile is designed to help the therapist understand what is meaningful and important to the client.[3] Prior eating habits and routines and the importance of eating to the client (and the client's family or significant other) are essential to know so that interventions can be established to meet the client's needs. The occupational therapist must take into consideration the cultural values, beliefs, habits, and routines of the client revolving around food and eating. The client may have strong feelings about particular foods, food temperatures, or food textures. Food and food preparation methods may be symbolically meaningful to clients and may have a strong impact on the client's oral intake. The presentation of food may have a significant influence on the individual's desire to eat. Most adults have firmly rooted routines surrounding the activity of eating. For example, an elderly person may eat a late breakfast, a larger meal at midday, and only a light meal in the evening. He or she may watch TV while eating. This routine can be severely disrupted in an institutionalized setting.

OT Practice Notes

It is important to know the previous habits and routines of the individual and to incorporate them into the intervention program. The therapist must also be sensitive to cultural issues that revolve around eating and foods.

Threaded Case Study

Mattias, Part 6

The intervention program is developed based on information provided to the therapist in the occupational profile. Mattias clearly identified his intervention priorities and discussed his concerns about participating in his daughter's wedding. The issues related to eating and drinking are closely tied to the cultural and social expectations for the father of the bride.

Cognitive-Perceptual Status

The client's cognitive and perceptual abilities are assessed to determine the degree to which the client can actively participate in an eating and swallowing assessment and intervention program. The therapist should establish whether the client is alert, oriented, and able to follow simple directions, either verbal, with demonstration, or with manual guidance. It is important to assess the client's memory to determine if he or she will be able to recall strategies for safe eating. The therapist should also evaluate the client's visual function, visual-perceptual skills, and motor planning skills, as they are important for independent feeding. An individual who exhibits confusion, dementia, poor awareness of the eating task, poor attention span, or impaired perception or memory will require close supervision during eating for safe consumption.[14,16,47]

Physical Status

Control of head and trunk is an important component of a safe swallow. To assess head control, the therapist asks the client to turn the head from side to side and up and down. The therapist assesses the client's range of motion and motor control. Assessment should include the quality of head movement without physical assistance or support initially and with assistance, if needed. The therapist should also gently move the client's head passively from side to side and up and down to look for stiffness or abnormal muscle tone. Poor head control may indicate decreased strength, decreased or increased muscle tone, or decreased awareness of posture. Appropriate head control is necessary to provide a stable base for adequate jaw and tongue movement, allowing an optimal swallow response. Head control is also necessary to anatomically position the client in the safest posture to reduce the risk of aspiration.

In assessing the client's trunk control, the therapist observes whether the client is able to sit in the upright position in midline with equal weight bearing on both hips. The therapist assesses the client's ability to maintain the midline position independently when involved in eating and whether he or she requires the use of postural supports (such as wheelchair trunk supports or a lap board) or physical assistance. It is also important to determine if the client can return to midline if a loss of balance occurs. To participate in an eating and swallowing intervention program, the client must maintain an upright position with the head and trunk in midline to provide correct alignment of the swallowing structures and reduce the risk of aspiration caused by poor positioning. The client's endurance for sitting upright and participating in an eating activity is assessed, and the impact of fatigue on the swallow is determined.

Threaded Case Study

Mattias, Part 7

Mattias is able to independently sit in a chair and at the side of the bed. His head control appears adequate, but he tends to sit shifted to his right side, and his head is most often facing to the right side instead of positioned in midline. This indicates poor trunk and head alignment and can impact eating.

Oral Assessment

Outer Oral Status

The face and mouth are sensitive areas to assess. Most adults are cautious about or even threatened by having another person touch their face. Therefore each step of the assessment process should be carefully explained prior to touching the client, using terms that the individual understands. The therapist also should tell the client how long he or she will be touching the face—for example, “For a count of three.” The therapist assesses the outer oral structures, including the facial musculature and mobility of the cheeks, jaw, and lips. Working within the client's visual field, the therapist moves his or her hand(s) slowly toward the client's face. This allows the individual time to process and acknowledge the approach.

Sensation.

Indications of poor oral sensation include drooling, food remaining on the lips, and food falling out of the mouth without the client being aware that this is happening. To assess the client's awareness of touch, the therapist occludes the client's vision and uses a cotton-tipped swab to gently touch different areas of the face. The individual is asked to point to where he or she was touched. If pointing is difficult, the client is asked to nod or say yes or no when touched. The client with intact sensation responds accurately and quickly.

The client's ability to sense hot and cold should be assessed. The therapist may use two test tubes, one filled with hot water and one with cold water. A laryngeal mirror that is first heated and then cooled using hot and cold water may also be used. The client's face or lips are touched in several places, and the client is asked to indicate whether the touch was hot or cold. An aphasic client or a client with cognitive impairment may have difficulty responding accurately. In this instance, the therapist must make an assessment from clinical observations.

Poor sensory awareness can affect the client's ability to move facial musculature appropriately. The client's self-esteem may be affected, especially in social situations, if decreased awareness causes the client to ignore saliva, food, or liquids remaining on the face or lips.

Threaded Case Study

Mattias, Part 8

Consider Mattias and his personal goal of eating at his daughter's wedding rehearsal dinner. The diminished sensation around Mattias' face will need to be addressed to avoid his embarrassment during this important event. Strategies that promote compensatory habit formation should be used, such as having Mattias wipe his face after every second or third bite of food to remove any food on his face. This strategy provides further sensory input to the face in addition to decreasing the potential embarrassment of having food remain on his face.

Musculature.

An assessment of the facial musculature provides the therapist with information about the movement, strength, and tone available to the client for chewing and swallowing. The therapist first observes the client's face at rest and notes any visible asymmetry. If a facial droop is obvious, the therapist should observe whether the muscles feel slack or taut. A masked appearance, with little change in facial expression, may also be observed. The therapist should observe whether the client appears to be frowning or grimacing with the jaw clenched and the mouth pulled back.

The therapist tests the facial musculature by asking the client to perform the movements listed in Table 27.2. The therapist should note how much assistance the client needs to perform these movements. As the client moves through each task, symmetry of movement is assessed. Asymmetry could indicate weakness or increased tone. Musculature is palpated for abnormal resistance to the movement.

TABLE 27.2

Outer Oral Motor Assessment

Function	Instruction to Client	Testing Procedure*
Facial expression	"Lift your eyebrows as high as you can."	Place one finger above each eyebrow. Apply downward pressure.
	"Bring your eyebrows toward your nose in a frown."	Place one finger above each eyebrow. Apply pressure outward.
	"Wrinkle your nose upward."	Place one finger on tip of nose and apply downward pressure.
	"Suck in your cheeks."	Apply pressure outward against each inside cheek.
Lip control	"Smile."	Observe for symmetric movement. Palpate over each cheek.
	"Press your lips together tightly and puff out your cheeks."	Place one finger above and one finger below lips. Apply pressure, moving fingers away from each other; check for ability to hold air.
	"Pucker your lips as in a kiss."	Apply pressure inwardly against lips (toward teeth).
Jaw control	"Open your mouth as far as you can."	Help patient maintain head control. Apply pressure from under chin upward and forward.
	"Close your mouth tightly. Don't let me open it."	Help client maintain head control. Apply pressure on chin downward.
	"Push your bottom teeth forward."	Place two fingers against chin and apply pressure backward.
	"Move your jaw from side to side."	Place one finger on left cheek and apply pressure to right.

*Apply resistance only in the absence of abnormal muscle tone.

Data from Avery W, et al: *Dysphagia care and related feeding concerns for adults,* ed 2, Bethesda, MD, 2010, American Occupational Therapy Association; Gutman SA, Schonfeld AB: *Screening adult neurologic populations,* ed 2, Bethesda, MD, 2009, American Occupational Therapy Association.

If the client is able to hold the position at the end of the movement, the therapist applies gentle pressure against the muscle to determine strength. An individual with normal strength is able to hold the position throughout the applied resistance. The person who is only able to hold the position briefly against pressure may have adequate strength for chewing and swallowing but may require an altered diet.

Oral reflexes.

A client who has sustained damage to brain-stem or cortical structures may demonstrate primitive oral reflexes that will interfere with a dysphagia-retraining program. The presence of the rooting, bite, or suck-swallow reflex, normal from 0 to 5 months of age, will interfere with oral motor control in adults. Persistence of these primitive oral reflexes interferes with the client's isolated oral motor control, which is needed for chewing and swallowing. The gag, palatal, and cough reflexes should be present in adults and contribute to airway protection. The absence or impairment of these important reflexes may interfere with a safe swallow. Specific assessment techniques are presented in Table 27.3.

TABLE 27.3

Oral Reflexes

Reflex	Assessment	Functional Implications
Rooting (0–4 months)	Stimulus: touch client on right or left corner of mouth	Limits isolated motor control of lip muscles
	Response: client moves lips and head in direction of stimulus	Moves head out of midline, which alters alignment of swallowing mechanism
Bite (4–7 months)	Stimulus: touch crowns of teeth with unbreakable object Response: client involuntarily clamps teeth shut	Prevents normal forward, lateral, and rotary movements of jaw necessary for chewing
Suck-swallow (0–4 months)	Stimulus: introduction of food and liquid Response: sucking	Prevents development of normal voluntary swallow
Tongue thrust (abnormal)	Stimulus: introduction of food and liquid	Interferes with ability to keep lips and mouth closed
	Response: tongue comes forward to front of teeth	Prevents tongue from propelling food to back of mouth in preparation for swallow; prevents formation of bolus, loss of tongue lateralization
Gag (0–adult)	Stimulus: pressure on back of tongue Response: tongue humping, pharyngeal constriction	Protects airway (not always present in normal adult); hypersensitive gag reflex can interfere with chewing, swallowing
Palatal (0–adult)	Stimulus: stroke along faucial arches Response: constriction of faucial arches; elevation of uvula	Protects airway, closes off nasal passages, triggers swallow response

Data from Avery W, et al: *Dysphagia care and related feeding concerns for adults,* ed 2, Bethesda, MD, 2010, American Occupational Therapy Association; Logemann J: *Evaluation and treatment of swallowing disorders,* Austin, TX, 1998, Pro-Ed.

Intraoral Status

An assessment of the client's intraoral status includes an examination of oral structures, including the tongue and palatal function. The therapist first explains each procedure to the client, then works within the client's visual field and gives the person time to process the instructions found in Table 27.4.

TABLE 27.4

Intraoral Motor Assessment

Function	Instruction to Client	Testing Procedure*
Tongue		

Protrusion	"Stick out your tongue."	Apply slight resistance toward the back of the throat with tongue blade after client exhibits full range of motion.
Lateralization	"Move your tongue from side to side."	Apply slight resistance in opposite direction of motion with tongue blade.
	"Touch your tongue to your inside cheek—right, then left; move your tongue up and down."	Using finger on outside of cheek, push against tongue inwardly.
Tipping	"Touch your tongue to your upper lip."	With tongue blade between tongue tip and lip, apply downward pressure.
	"Open your mouth. Touch your tongue behind your front teeth."	With tongue blade between tongue and teeth, apply downward pressure on tongue.
Dipping	"Touch your tongue behind your bottom teeth."	With tongue blade between tongue and bottom teeth, apply upward pressure.
Humping	"Say, 'ng'; say, 'ga.' "	Observe for humping of tongue against hard palate. Tongue should flow from front to back.
	"Run your tongue along the roof of your mouth, front or back."	Observe for symmetry and ease of movement.
Swallow		
Hard palate	"Open your mouth and hold it open."	Using flashlight, gently examine for sensitivity by walking finger from front to back.
Soft palate	"Say, 'ah' for as long as you can (5 seconds). Change pitch up an octave."	Observe for tightening of faucial arches, elevation of uvula. Using laryngeal mirror, stroke juncture of hard and soft palate to elicit palatal reflex. Observe for upward and backward movement of soft palate.
Hyoid elevation (base of tongue)	"Can you swallow for me?"	Place finger at base of client's tongue underneath the chin, and feel for elevation just before movement of the larynx.
Laryngeal		
Range of motion	"I am going to move your Adam's apple side to side."	Grasp larynx by placing fingers and thumb along sides. Move larynx gently side to side; evaluate for ease and symmetry of movement.
Elevation	"Can you swallow for me?"	Place fingers along the larynx: first finger at hyoid, second finger at top of larynx, and so on. Feel for quick and smooth elevation of larynx as the client swallows.
Cough		
Voluntary	"Can you cough?"	Observe for ease and strength of movement, loudness of cough, swallow after cough.
Reflexive	"Take a deep breath."	As client holds breath, using palm of hand, push downward (toward stomach) on the sternum. Evaluate strength of reaction.

*Apply resistance in absence of abnormal muscle tone.

Data from Avery W, et al: *Dysphagia care and related feeding concerns for adults*, ed 2, Bethesda, MD, 2010, American Occupational Therapy Association; Gutman SA, Schonfeld AB: *Screening adult neurologic populations*, ed 2, Bethesda, MD, 2009, American Occupational Therapy Association.

Standard precaution techniques are used throughout the assessment and include the use of examination gloves and careful hand washing. The therapist should check for allergies to latex before examining the person's mouth and use an examination glove made of appropriate material for an intraoral examination. The therapist must place only a wet, gloved finger or dampened tongue blade into the client's mouth. The mouth is normally a wet environment, and a dry finger or tongue blade can be uncomfortable. After a count of three, the therapist removes the finger and allows the client to swallow the secretions that may have accumulated.

Dentition.

Because the adult uses teeth to shear and grind food during bolus formation, it is important for the therapist to assess the condition and quality of the client's teeth and gums. Poor dental status or inadequate denture fit can contribute to dysphagia, discomfort or pain with swallowing, dehydration, malnutrition, low dietary intake, poor nutritional status, and weight loss.[21,58]

For assessment purposes, the mouth is divided into four quadrants: right upper, right lower, left upper, and left lower. The therapist notes whether the client's gums are bleeding, tender, or inflamed and whether the gums feel spongy or firm. Loose teeth and sensitive or missing teeth are also noted.

OT Practice Notes

The therapist should avoid placing his or her finger between the client's teeth until it has been determined that the client does not have a bite reflex.

After assessing the gums, the therapist turns over his or her finger, slides the pad of the finger against the inside of the client's cheek, and gently pushes the cheek outward to feel the tone of the buccal musculature. The therapist notes whether the cheek is firm with an elastic quality, too easy to stretch, or tight without any stretch. The therapist observes the condition of the inside of the client's mouth, checking for bite marks on the tongue, cheeks, and lips. Next, the therapist should remove the finger from the client's mouth, allow or assist the client to swallow saliva, and assist the client to move the lip and cheek musculature into the normal resting position. This procedure is repeated for each quadrant.

If the client has dentures, the therapist must determine whether the fit is adequate for chewing. Because dentures are held in place and controlled by normal musculature and sensation, changes in these areas, or marked weight loss, affect the client's ability to use dentures effectively for eating. Dentures should fit over the gums without slipping or sliding during eating or talking. Clients should always wear well-fitting dentures during oral intake. A dental consultation may be needed to ensure appropriate fit if dentures cannot be held firmly with commercial adhesive creams or powders. Loose dentures or teeth may necessitate changes in food consistencies that the client may have otherwise managed. Clients who have gum or dental problems require appropriate follow-up and excellent oral hygiene to participate in a feeding and eating program. Poor oral hygiene can lead to the development of bacteria, which, if aspirated, contributes to the increased risk of pneumonia.[9,46,53]

Tongue movement.

The tongue has a critical role in the normal chewing and swallowing process. Controlled lingual movement is necessary to assist in the preparation and movement of food in the mouth.[37,72] The extrinsic muscles of the tongue control the position of the tongue in the oral cavity, and the intrinsic muscles are responsible for changing the shape of the tongue, which is necessary in propelling the bolus posteriorly.[68] Lingual discoordination is one of the most commonly reported problems affecting the oral stage of swallowing.[77] A thorough assessment of the tongue's strength, range of motion, control, and tone is an important component of the swallowing assessment.

The client is asked to open the mouth, and the therapist assesses the appearance of the tongue using a flashlight and notes whether the tongue is pink and moist, red, or heavily coated and white. A heavily coated tongue decreases the client's sensations of taste, temperature, and texture and may indicate poor tongue movement or be a sign of infection.

When examining the shape of the tongue, the therapist notes whether it is flattened, bunched, or rounded. Normally, the tongue is slightly concave with a groove running down the middle. The therapist observes the tongue at rest in the mouth and determines whether it is in the normal position of midline, resting just behind the front teeth, retracted or pulled back away from the front teeth, or deviated to the right or left side. A retracted tongue may indicate an increase of abnormal muscle tone or a loss of range of motion as a result of soft-tissue shortening. The client exhibiting tongue deviation with protrusion may have muscle weakness on the affected side, causing the tongue to deviate toward the unaffected side because the stronger muscles dominate. The client also may have abnormal tone, causing the tongue to deviate toward the affected side.

Using a wet gauze pad to grasp the tongue gently between the forefinger and thumb, the therapist pulls the tongue slowly forward. Next, the therapist walks a wet finger along the tongue from front to back to determine whether the tongue feels hard, firm, or mushy. The tongue should feel firm. An abnormally hard tongue may be the result of increased muscle tone, and a mushy tongue is associated with low muscle tone. The right side of the tongue is compared with the left side for symmetry.

While continuing to grip the tongue between forefinger and thumb, the therapist assesses the client's range of motion by moving the tongue forward, side to side, and up and down. The tongue with normal range will move freely in all directions without resistance. Moving the tongue through its range, the therapist can simultaneously evaluate tone. As the therapist gently pulls the tongue forward, he or she determines whether it is easily moved or whether resistance is noted. A tongue pulling back against the movement indicates increased tone. A tongue that seems to stretch too far beyond the front teeth indicates decreased tone. When moving the tongue side to side, the therapist notes whether it is easier to move in one direction or the other. Increased tone makes it difficult for the therapist to move the tongue in any direction without feeling resistance against the movement. Clients who are confused or apraxic may resist this passive motion but not have abnormal tone.

To assess the tongue's motor control (strength and coordination), the therapist asks the client to elevate, stick out, and move the tongue laterally (see Table 27.4). If the client has difficulty understanding verbal directions, the therapist can use a wet tongue blade to guide the client through the desired movements.

Poor muscle strength or abnormal tone decreases the tongue's ability to sweep the mouth and gather food particles to form a cohesive bolus. If the tongue loses even partial control of the bolus, food may fall into the valleculae, the pyriform sinuses, or the airway, possibly leading to aspiration before the actual swallow.[48] The back of the tongue must also elevate quickly and strongly to propel the bolus past the faucial arch into the pharynx to trigger the swallow response.[31] The client with poor tongue control may not be a candidate for eating or may need altered food or liquid textures. Close supervision by an experienced therapist is required for a client with impaired tongue control to participate in eating.

Threaded Case Study

Mattias, Part 9

Mattias had decreased tongue mobility and control. When he protruded his tongue, it was deviated toward the left, which indicates diminished motor control on the left side of his tongue. An additional indication of diminished tongue control is the pocketing of food in his mouth following a swallow.

Clinical Assessment of Swallowing

Because aspiration is a primary concern in swallowing, the occupational therapist must carefully assess the client's ability to swallow safely. A swallow screening should be conducted as soon as medically appropriate followed by a more comprehensive assessment.[11] Before the therapist presents the client with material to swallow, he or she should assess the client's ability to protect the airway. The client must have an intact palatal reflex, elevation of the larynx, and a productive cough. The purpose of a productive cough is to remove any food or liquid from the airway.[43] Individuals with a weak or nonproductive cough are at a higher risk for aspiration.[35,73] Directions for assessing all the components of the swallow are described in Table 27.4. The therapist should note the speed and strength of each component. The client with intact cognitive skills may accurately report to the therapist where and when difficulty occurs with the swallow.

The occupational therapist integrates all the information from the assessment process. Clinical judgment plays an important role in the accurate assessment of dysphagia.[5,22] The following questions should be asked:

1. Is the client alert and able to participate in a swallowing assessment?

2. Does the client maintain adequate trunk and head control, with or without assistance?

3. Does the client display adequate tongue control to form a cohesive bolus and move the bolus through the oral cavity?

4. Is the larynx mobile enough to elevate quickly and with sufficient force during the swallow?

5. Can the client handle saliva with minimal drooling?

6. Does the client have a productive cough, strong enough to expel any material that may enter the airway?

If the answer is yes to all of these questions, the therapist may assess the client's oral and swallow control with a variety of food consistencies.

The therapist should request an assessment tray from dietary services. The following foods are merely suggestions and the therapist must consider cultural factors and medical conditions that influence the selection of foods. For example, a vegetarian or a person who is lactose intolerant will require an appropriate selection of foods. The tray should contain a sample of foods of various textures including pureed food such as pudding or applesauce, soft foods such as a banana or macaroni and cheese, and a mechanical soft-textured food such as ground tuna with mayonnaise or chopped meat with gravy. The tray should also include a thick drink such as nectar blended with half of a banana for a 7-ounce drink; a semithick drink such as fruit nectar or a yogurt drink; and a thin, flavored liquid such as juice and water.

To minimize the risk of aspiration, pureed foods are chosen for clients with decreased oral motor control and chewing difficulties or apraxia. Clients who have poor endurance, breathing difficulties, or have difficulty attending to the task of eating may also require pureed foods. Soft foods are more easily formed into a bolus and require less chewing than regular or ground textures for clients who have impaired oral motor control. Soft foods are also easier for the client to keep in a cohesive bolus as they are moved through the oral cavity. Ground foods allow the therapist to assess a client's ability to chew, form a cohesive bolus, and move it in the mouth. Thick liquids move more slowly from the front of the mouth to back, giving the client with a delayed swallow or impaired oral motor skills more time to control the liquid until the swallow response is triggered. Thin liquids are the most difficult to control because they require intact oral motor strength and coordination, and an intact swallow to prevent aspiration.

For the client who appears to have some ability to chew, the therapist should start with pureed and soft textures. Solid textures may be introduced next if the client is able to safely and efficiently swallow the pureed and soft food textures. The following procedures should be completed after each swallow of food or liquid:

1. The therapist places a small amount ($\frac{1}{3}$ teaspoon) of food or liquid on the middle of the client's tongue. The client is asked to swallow. Two to three bites are presented of each texture to check for fatigue in controlling that texture.

2. The therapist palpates for the swallow by placing the index finger at the hyoid notch, the second finger at the top of the larynx, and the third finger along the midlarynx. The therapist can feel the strength and smoothness of the swallow and can note whether the client requires subsequent or additional swallows to clear the bolus.[43] The therapist evaluates oral transit time by noting when food entered the mouth, when tongue movement was initiated, and when the elevation of the hyoid notch was felt, which indicates the beginning of the swallow process. The therapist can time the swallow from the time that hyoid movement begins to when laryngeal elevation occurs, indicating triggering of the swallow response.[48] A normal swallow takes only 1 second to complete for thin liquids and slightly longer for textured foods.

3. The therapist asks the client to open the mouth to check for remaining food. Food is commonly seen in the lateral sulci, under the tongue, on the base of the tongue, and against the hard palate.[48] Food remaining in the mouth indicates decreased or impaired oral transit skills. The client who exhibits oral motor deficits has increasing difficulty with chewing, shaping a bolus, and moving the bolus in the oral cavity as textured foods are introduced.

4. The therapist asks the client to say "ah." By listening carefully, the therapist can assess the client's voice quality and classify the sound production as strong, clear, gurgly, or gargling.[48]

A gurgly voice may result from a delayed swallow response, which allows material to collect in the larynx prior to the initiation of the swallow. The therapist asks the client to take a second "dry" swallow to clear any pooling of material. Asking the client to say "ah" again enables the therapist to assess whether the voice quality remains gurgly or wet-sounding for any length of time after the dry swallow. In addition, the therapist asks the client to pant for a few seconds. This will shake loose any material that may remain in the pyriform sinuses or valleculae. If the voice is still gurgly, the therapist should be concerned with the possibility that material has come into contact with or is sitting on the vocal cords.[48]

A client with an impaired swallow may aspirate immediately or may pool liquids in the pyriform sinuses and valleculae, which, when full, overflow into the laryngeal vestibule and down into the trachea. If a client continues to have a gurgling or gargling voice after a second dry swallow or has substantial coughing with any of the liquid consistencies, the assessment should be discontinued.

If the client has significant coughing episodes, particularly before the therapist feels the initiation of the swallow (elevation of hyoid notch) with all consistencies, then he or she should not continue to present food. Strategies and techniques to facilitate a safe swallow are appropriate to introduce at this point. If the client continues to have significant coughing or other signs that may suggest aspiration, a **videofluoroscopy** swallow study is indicated.[25,65]

A client with central nervous system damage and impaired sensation may have difficulty with a pureed food because it does not stay together as a bolus. The weight of soft foods, denser than a pureed food, may trigger the swallow response. If the client continues to cough even with soft foods, the swallow assessment should be discontinued. In this instance, a videofluoroscopy swallow study is indicated. If a client is having difficulty at this level, only a prefeeding intervention program should be considered.

A client who has difficulty managing solid consistencies may or may not have difficulty with liquids. To assess the client's swallow with liquids, the therapist starts with a thickened (thick) nectar, then a pure nectar (semithick), and finally a thin liquid such as water or juice (see Table 27.8, presented later in the chapter). Small amounts of the liquid are placed on the middle of the client's tongue with a spoon. The therapist proceeds by following the four-step sequence described earlier for solid foods. The therapist assesses the client's skill at moving material from front to back, the time of oral transit and swallow, and the voice quality after each swallow. Each liquid consistency is assessed for two or three swallows to check for fatigability. If the client tolerates and swallows liquids by spoon without difficulty, the therapist assesses the client's ability to tolerate liquids from a cup or with a straw. The client's voice quality is checked following each swallow.

The therapist must also assess the client's ability to alternate between liquids and solids, which occurs naturally during meals. The therapist presents the client with an easily managed food bolus, followed by the safest type of liquid tolerated, and then assesses the client's ability to safely swallow when the consistency of the food is changed.

A client with a **tracheostomy** tube in place can be assessed as previously described. The same criteria must be met before the therapist assesses the client's eating and swallowing of food or liquids. The therapist must have a thorough understanding of the types of tracheostomy tubes and varied functions. The therapist must also be aware that clients who have had a tracheostomy tube, especially those on ventilation for any length of time, may experience changes in the swallowing mechanism such as muscle atrophy, decreased sensation, and laryngeal damage.[13]

Threaded Case Study

Mattias, Part 10

Although Mattias had frequent episodes of coughing during the bedside evaluation, no gurgly or raspy vocal quality was noted during speech. He is able to clear material from his vocal folds with a strong protective cough. He is able to swallow his secretions, but drooling was noted from the left corner of his mouth, which indicates diminished sensation.

Because Mattias is able to safely manage a modified diet texture using positioning strategies and does not have signs and symptoms of aspiration, a videofluoroscopy was not deemed necessary.

Two main types of tracheostomy tubes exist: fenestrated and nonfenestrated.[48] A fenestrated tube (Fig. 27.3) is designed with an opening in the middle to allow increased air flow. This type of tube is frequently used for clients being weaned from a tube because it allows a client to breathe nasally as he or she relearns a normal breathing pattern. Placement of an inner cannula piece into the tracheostomy tube allows the fenestrated opening to be closed off. With the inner cannula removed, a trachea button may be used to allow the client to talk. A nonfenestrated tube has no opening. A fenestrated tube is preferred for treating a client with dysphagia.

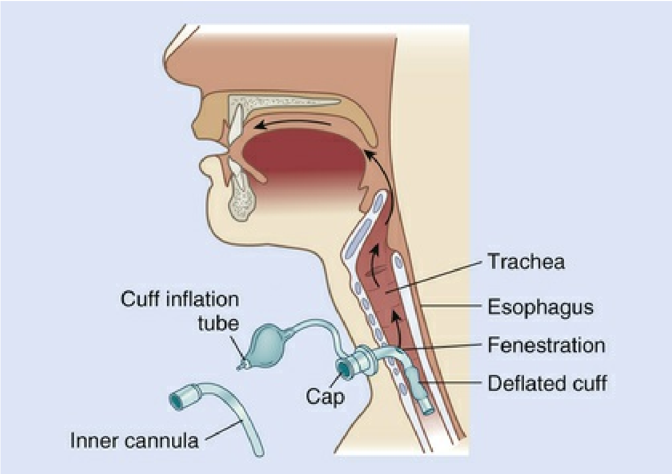

FIG 27.3 Fenestrated tracheostomy. (From Lewis SL, et al: *Medical-surgical nursing: assessment and management of clinical problems*, ed 9, St. Louis, 2014, Mosby.)

A tracheostomy tube may be cuffed or uncuffed. A cuffed tube has a balloon-like cuff surrounding the bottom of the tube (Fig. 27.4). When inflated, the cuff comes into contact with the trachea wall, preventing the aspiration of secretions into the airway. A cuffed tube is used in cases in which aspiration has occurred. The therapist should consult with the client's attending physician to see whether the client is still at risk of aspiration or if it is safe to deflate the cuff for an eating and swallowing assessment.

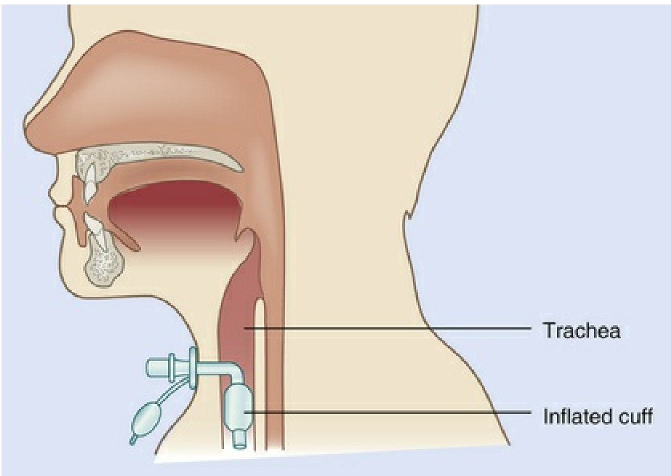

FIG 27.4 Cuffed tracheostomy. (From Lewis SL, et al: *Medical-surgical nursing: assessment and management of clinical problems,* ed 9, St. Louis, 2014, Mosby.)

The presence of a tracheostomy tube may affect a client's ability to swallow because laryngeal elevation is impeded due to the presence of the tube, loss of upper airway sensitivity, inability of the larynx to effectively close during the swallow, and reduced subglottal air pressure atrophy of the laryngeal muscles due to disuse.[32] Despite these challenges, studies have found that a tracheostomy does not necessarily increase the risk of aspiration in chronically dysphagic patients.[40,44]

Before the therapist presents food or liquid to the client with a tracheostomy who has a fenestrated tube, the inner cannula should be in place. If the client has a cuffed tube, the therapist should thoroughly suction orally and around the cuff, present food, and slowly deflate the cuff while suctioning to prevent substances from penetrating the airway. The airway again needs to be suctioned orally and through the tracheostomy to ensure that all secretions have been cleared.[48]

After presenting food or liquids, the therapist should assess oral transit skills and the pharyngeal swallow as previously described. Blue food coloring may be added to food or liquids presented orally if the client is not allergic to dyes. This can help the therapist identify aspirated material in the trachea. The client or the therapist can use a gloved finger to cover the trachea opening and thereby achieve a more normal tracheal pressure, which has been shown to improve the pharyngeal swallow.[34]

If the tracheostomy tube is cuffed and inflated during the assessment, the cuff is slowly deflated after the client has swallowed. The airway is suctioned through the tracheostomy tube to determine whether any material entered the airway. The swallow assessment should not be continued if material is found in the trachea.[48] When the assessment is complete, the airway is thoroughly suctioned. The inner cannula is removed from the fenestrated tube, or the cuff is inflated to the level prescribed by the physician.

The client's performance on the swallowing assessment determines whether he or she is able to participate in a feeding program and which diet texture is the most appropriate to ensure a safe, efficient swallow. The safest consistency is that which the client is able to chew, move through the oral cavity, and swallow with the least risk of aspiration.

Indicators of Eating and Swallowing Dysfunction

Symptoms of oropharyngeal dysphagia include (but are not limited to) the following:

1. Difficulty with bringing food to the mouth

2. Difficulty or inability to shape food into a cohesive bolus-prolonged chewing

Loss of food or liquids from the mouth; drooling

Loss of food or liquids from the nose (nasal regurgitation)

3. Coughing or frequent throat clearing before, during, or after the swallow

4. Wet or gurgling voice quality after eating or drinking

5. Changes in mealtime behaviors

Food residue remaining in the mouth (cheeks, gums, teeth, tongue)

Loss of appetite; dehydration or weight loss

Discomfort or pain when swallowing

Difficulty breathing while eating

Unusual head or neck movements when swallowing

6. Delayed or absent swallow response

7. Weak cough

8. Reflux of food after meals

Heartburn

Changes in eating—for example, eating slowly or avoiding social occasions

Food avoidance

Prolonged mealtimes

Recurrent episodes of pneumonia

Aspiration

Swallowing dysfunction can lead to aspiration of food or liquid into the airway. Aspiration can occur at any point during the swallowing process (Fig. 27.5). The following are acute symptoms of aspiration that may occur before, during, or after the swallow:[48]

1. Any change in the client's color, particularly if the airway is obstructed

2. Prolonged coughing or choking

3. Gurgling voice and extreme breathiness or loss of voice

4. Excessive secretions

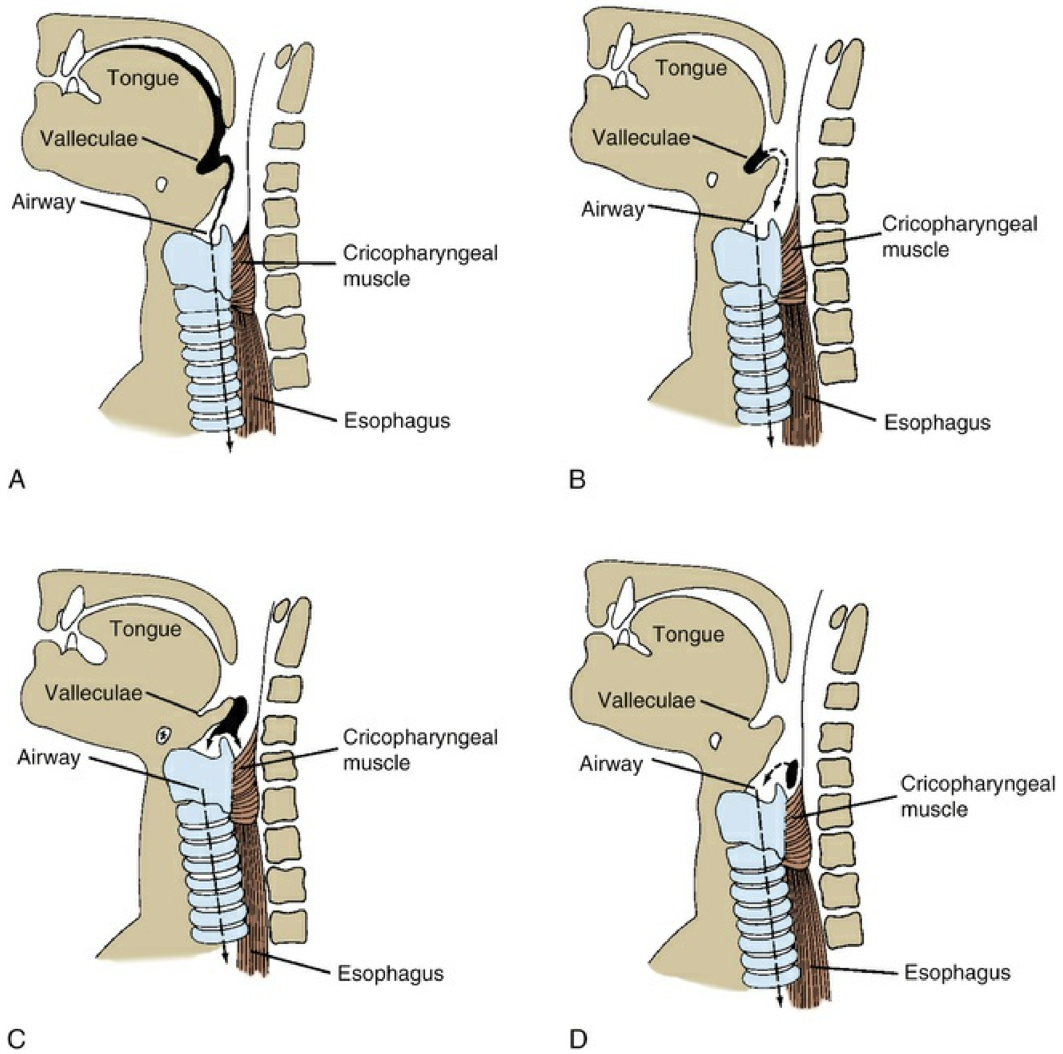

FIG 27.5 Types of aspiration. **A,** Aspiration before swallow caused by reduced tongue control. **B,** Aspiration before swallow caused by absent swallow response. **C,** Aspiration during swallow caused by reduced laryngeal closure. **D,** Aspiration after swallow caused by pooled material in pyriform sinuses overflowing into airway. (From Logemann J: *Evaluation and treatment of swallowing disorders,* San Diego, 1998, College-Hill Press.)

Many individuals with dysphagia silently aspirate, which means they show no clinical symptoms of aspiration during swallowing. For these individuals, aspiration and the etiology of aspiration can only be determined through an instrumental assessment.

During the 24 hours immediately after the swallow, the therapist and medical staff must observe the client for additional signs of aspiration. Aspiration pneumonia is a lung infection requiring medical intervention that may result from aspiration during swallowing. Clinical signs include fever, shortness of breath with a rapid heart rate, mental confusion, and incontinence, although not all of these symptoms are always present, especially in older clients.[30] If aspiration pneumonia develops, the client must be reevaluated for a change in diet levels or taken off the feeding program, if necessary. An alternative feeding method may be necessary to ensure adequate hydration and nutrition.

Instrumental Assessment

Instrumental assessments are important techniques for evaluating biomechanical and physiologic function and for determining swallow safety as well as assessing the effects of **compensatory strategies** (ie, posture and bolus texture) on swallowing. They are performed in conjunction with the clinical bedside assessment to rule out or identify silent aspiration. Silent aspiration may not always be accurately identified solely through a clinical bedside assessment. Studies have shown that 2% to 25% of clients with acute stroke[52] and up to 50% or more with neurologic impairment[12,29,45] are found to be silent aspirators during the instrumental assessment. Aspiration can occur before the swallow because of poor tongue control, pooled material in the valleculae, or a delayed or absent swallow response. Poor laryngeal closure can result in aspiration during the swallow. Aspiration after the swallow is the result of pooled material in the pyriform sinuses or in the valleculae overflowing into the trachea. Understanding why a client is aspirating can help the occupational therapist plan appropriate intervention. Instrumental evaluations provide valuable information about a client's swallow during a specific period of time, under specific conditions. They allow the therapist to try different intervention strategies and to assess the results of these strategies on the swallow. This information is considered part of the complete evaluation process, which includes the bedside assessment and client performance during intervention sessions and meal activities.

The two most common instrumental evaluations used, videofluoroscopy swallow study (VFSS) and fiberoptic endoscopy (FEES), are described next.

Ethical Considerations

Instrumental assessment procedures require advanced knowledge and training in techniques, purpose, and indications for use. Only occupational therapists who have these advanced skills may use instrumental evaluation procedures.[5]

Assessment With Videofluoroscopy

The videofluoroscopic swallow study (VFSS) is the most commonly used instrumental assessment tool to examine oropharyngeal swallowing disorders.[25,35,48] This assessment uses fluoroscopy to capture the client's swallow with a variety of foods and textures. The VFSS allows the therapist to see the client's jaw and tongue movement, measure the transit times of the oral and pharyngeal stages, observe the stages of the swallow, note any residue in the valleculae and the pyriform sinuses after the swallow, and identify aspiration.[49,57] With videofluoroscopy, the therapist can determine the anatomic or physiologic cause of aspiration. Various compensatory techniques may also be assessed to determine if the airway can be protected and if swallow function can be improved, which may allow the therapist to initiate a feeding program.[48,49] Videofluoroscopy, in conjunction with the clinical assessment, may be used to select appropriate intervention techniques and assist the therapist in determining the safest diet level to help the client achieve a safe swallow.

The VFSS is conducted in the hospital radiology department. The radiologist, the radiology technician, and the swallowing therapist are present during the evaluation. Equipment necessary for the VFSS includes the fluoroscopy x-ray machine, a monitor for viewing the movement of the bolus in real time. The images are usually videotaped or digitally recorded to allow the radiologist and the therapist to review the recording in slow motion or frame by frame for more in-depth analysis. Other pieces of equipment normally available in a radiology department are lead-lined aprons, lead-lined gloves, and foam positioning wedges. Although VFSS subjects the client to radiation, the doses are relatively small and are considered to be safe,[41,57] with the benefits of assessing oropharyngeal swallow biomechanics and intervention strategies outweighing the minimal risk of exposure to radiation.

The client is positioned to allow a lateral view, with the fluoroscopy tube focused on the lips, hard palate, and posterior pharyngeal wall. The lateral view is most frequently used because it allows the therapist to evaluate all four stages of the swallow. This view clearly shows the presence of aspiration. A posterior-anterior view also may be needed to evaluate asymmetry in the vocal cords and pooling of the valleculae or pyriform sinuses.

During the VFSS, the therapist presents the client with food or liquid to which barium paste or powder has been added.[48,49] The barium contrast allows the bolus to be visible on videofluoroscopy. The therapist mixes or spreads small amounts of paste or powder onto or into each food or liquid consistency. Premixing the consistencies with the barium paste or powder prevents time-consuming interruptions during the actual assessment procedure.

Food and liquids are presented in the same sequence used for the clinical assessment. Starting with pureed foods, the client is given $\frac{1}{2}$ to $\frac{1}{3}$ teaspoon at a time of each consistency and asked to swallow when instructed. Liquids are tested separately, beginning with the thickened substance. Material is given in small amounts to reduce the risks of aspiration. An experienced dysphagia therapist may choose to use only foods or liquids that the client had difficulty with during the clinical examination, rather than to proceed through the entire sequence. The therapist continues to present each consistency to determine if the client can swallow safely and efficiently without aspirating. If aspiration occurs, the therapist should try compensatory strategies and reassess with the same texture. If aspiration occurs while using the strategies, the assessment with this texture is discontinued.

The videofluoroscopy procedure can also be used to observe for fatigue of the oral or pharyngeal musculature or the swallow reflex. The client is asked to take repeated or serial swallows of solids and liquids. The therapist also assesses the client's ability to control mixed consistencies of solids and liquids such as soups with broth and bits of vegetables, as well as the client's ability to alternate between solids and liquids. The solid and liquid consistency that the client manages without aspiration is selected as the starting point for eating and swallowing intervention. A client who aspirates on pureed or soft foods is not suited for an oral program. The client who aspirates on thick liquids is not a candidate for liquid intake.

VFSS is a valuable tool to be used in conjunction with the clinical examination. It can provide the therapist with additional information regarding the client's difficulties. By identifying silent aspiration, the therapist can feel comfortable with the decisions made in determining a course of treatment. The therapist must keep in mind that VFSS records the client's performance in an isolated instance and is not a conclusive indicator of the client's potential ability in a feeding program. Many factors may interfere with an individual's ability to participate in a VFSS, including a poor level of awareness, impaired cognitive status, or inability to consent.[19] A second VFSS may be indicated in some situations to reevaluate a client who previously was initially unable to safely swallow on video but now shows signs of readiness to participate in a feeding program.

When the results of a VFSS test are documented, foods that were presented, problems that occurred at each stage, and the number of swallows taken to clear the food or liquid are recorded. The therapist also should document compensatory strategies or facilitation techniques that worked effectively to elicit a safe swallow or reduce aspiration risk.

Assessment With Fiberoptic Endoscopy

Fiberoptic endoscopy (FEES) is a nonradioactive alternative to the VFSS. FEES allows for direct assessment of the motor and sensory aspects of the swallow. It can be repeated as often as necessary without exposure to radiation. FEES has been shown to be highly effective in detecting aspiration and critical features of pharyngeal dysphagia.[8,10,38,45]

The equipment needed for a FEES includes a flexible fiberoptic nasopharyngolaryngoscope, a portable light source, a video camera, a video recorder, and a monitor. Placed on a rolling cart, this system can be brought directly to the client's bedside. The therapist passes a flexible fiberoptic tube through the nasal fossa, along the floor of the nose through the velopharyngeal port, ending in the hypopharynx. The scope allows the therapist to observe the oral cavity, the base of the tongue, and the swallowing structures. The client is given foods and liquids. As the client the swallows, the therapist is able to observe on the monitor tongue movement, pharyngeal and laryngeal function both before and after the swallow, and assess for penetration and aspiration.[23] The results of a thorough assessment determine the course of intervention to increase a client's ability to safely eat. Upon completion of the entire dysphagia assessment, the therapist should clearly document the client's strengths, major problems, goals and objectives, and intervention plan. The objectives should be concise and measurable. The intervention plan should include the type of diet needed, the training and facilitation that the client requires, positioning techniques to be used during feeding, and the type of supervision that must be provided. Recommendations should be communicated to the appropriate nursing and medical staff.

Intervention

Because a client may display more than one problem at each stage of deglutition, the intervention program for eating and swallowing problems is multifaceted. Intervention for the client with dysphagia involves trunk and head positioning techniques to facilitate oral performance, improve pharyngeal swallow, and reduce the risk of aspiration. The occupational therapist uses clinical reasoning skills to evaluate the interplay of physical, cognitive, environmental, and sociocultural factors that have an impact on feeding, eating, and swallowing.[5] Clients with severe problems can require a prolonged course of intervention before they reach optimal recovery.

Intervention falls into two broad categories: rehabilitation techniques and compensatory strategies. Rehabilitation techniques include the use of exercise to improve strength and function. Oral motor exercises are specifically designed to improve the strength and coordination of facial musculature, the tongue, and jaw. An effortful swallow in which the client is instructed to swallow with maximal effort either with or without food has been shown to increase tongue base retraction and oral and pharyngeal pressure to improve the swallow.[18,27] Other swallowing maneuvers such as the effortful swallow, the Mendelsohn maneuver, the Masako maneuver, and the Shaker head lift are rehabilitative techniques used to physically change swallow function. Compensatory swallowing strategies increase swallow safety and decrease the client's symptoms, such as aspiration, but do not change the physiology of the swallow. Postural techniques such as those listed in Table 27.5 have been found to redirect bolus flow and reduce aspiration risk.[6] Rehabilitative techniques and compensatory strategies are often both used during the client's therapy program.

TABLE 27.5

Postural Techniques Used in Dysphagia Management

Problem	Posture	Rationale
Impaired oral transit	Head back	Utilizes gravity to clear oral cavity
Delay in triggering of pharyngeal swallow	Chin down	Widens valleculae to prevent bolus from entering airway; narrows airway entrance; pushes epiglottis posteriorly
Residue in valleculae after the swallow	Chin down	Pushes tongue base backward
Reduced laryngeal closure	Chin down, head rotated to weak side	Narrows laryngeal entrance, increases vocal fold closure
Reduced pharyngeal contraction (residue in pharynx)	Lying down on side	Eliminates gravitational effect in pharynx
Unilateral oral and pharyngeal weakness	Head tilt to stronger side	Directs bolus down stronger side
Cricopharyngeal dysfunction (residue in pyriform sinuses)	Head rotated	Pulls cricoid cartilage away from posterior pharyngeal wall, reducing resting pressure in cricopharyngeal sphincter

Adapted from Logemann J: *Evaluation and treatment of swallowing disorders*, Austin, TX, 1998, Pro-Ed.

Goals

The overall goals of occupational therapy in the remediation of eating and swallowing dysfunction are as follows[3,4,6,42]:

1. Facilitation of appropriate positioning during eating

2. Improvement of motor control at each stage of the swallow, through normalization of tone, facilitation of quality movement, and strengthening of oral musculature

3. Maintenance of an adequate hydration and nutritional intake

4. Prevention or reduction of aspiration risk

5. Reestablishment of oral eating to the safest, optimum level on the least restrictive diet

Team Management

Because of the complex nature of dysphagia treatment, the client's optimal progress is facilitated by the use of a team approach.[11,51] The **dysphagia team** should include the client's attending physician, the occupational therapist, the dietitian, the nurse, the physical therapist, the speech-language pathologist, the radiologist, and the client's family. Each professional contributes expertise to facilitate client improvement. All members of the dysphagia team should have the training and knowledge necessary to work with clients with dysphagia. Interdepartmental in-service education is frequently required so that team members have a similar frame of reference.

The occupational therapist's role is to select, administer, and interpret assessment measures; develop specific intervention plans; and provide therapeutic interventions.[5] The American Occupational Therapy Association [AOTA] has prepared a document, *Specialized Knowledge and Skills in Feeding, Eating, and Swallowing for Occupational Therapy Practice,* that describes the knowledge and skills that occupational therapists and occupational therapy assistants should have to provide comprehensive feeding, eating, and swallowing management and services which includes developing and implementing an intervention plan designed to improve swallowing skills.[5] The occupational therapist may also be responsible for coordinating the team effort, which includes obtaining physician's orders as needed, communicating with other team members and staff, providing family education to ensure proper follow-through, and selecting the appropriate diet.

The attending physician's role involves the medical management of the client's health and safety. The physician gives the orders for clinical and instrumental assessments and approves intervention and program recommendations. He or she oversees all decisions regarding treatment for diet level selection, oral and nonoral feeding procedures, and the progression of treatment as recommended by the team. The physician also reinforces the course of treatment with the client and the family.[33]

The dietitian is responsible for monitoring the client's caloric intake. This member of the dysphagia team makes recommendations to ensure that the client receives a balanced, nutritional diet in accordance with the medical condition. The dietitian is involved in suggesting types of feeding formulas for the nonoral client. Diet supplements to augment oral intake may be recommended. In conjunction with the dysphagia team, the dietitian ensures that the client receives the proper food and liquid consistencies. Additional training may be necessary for the dietary staff, because **dysphagia diets** vary from traditional medical diets.

The client's physical therapist is involved in muscle reeducation and tone normalization techniques. The client receives treatment in balance, strength, and control. The physical therapist and the occupational therapist collaborate on positioning options. The physical therapist is involved in increasing the client's pulmonary status for breath support, chest expansion, and cough.

The role of the speech-language pathologist (SLP) involves reeducating the oral and laryngeal musculature used in speaking, voice production, and swallowing. The SLP is a key member of the dysphagia team.[6]

The nurse is another important member of the dysphagia team. The nursing staff is responsible for monitoring the client's medical and nutritional status. Nurses who are available on a 24-hour basis in the hospital setting and who are trained in dysphagia screening are in a key position to administer initial swallowing screenings.[39] The nurse usually is the first to notice changes in the client's condition, such as an elevated temperature; an increase in pulmonary congestion; and an increase in secretions, which indicates swallowing dysfunction.[33] The nurse informs the physician and the dysphagia team of these changes. The nurse records the client's oral and fluid intake and notifies the dysphagia team when the client's nutritional status is adequate or inadequate. The nursing staff members administer supplemental tube feedings that have been ordered by the physician; the staff also provides oral hygiene, tracheostomy care, and supervision for appropriate clients during meals.[33,39]

The client's family is included on the team to act as program supporters. Families frequently underestimate the danger of aspiration. Therefore both the family and the client must be educated, beginning with the first day of assessment. The family and client should understand which food consistencies are safe to eat and which foods must be avoided.[2,4]

The roles of the team members may vary from one treatment facility to another. Designated roles must be clearly defined to ensure a coordinated team approach. Therapists who are responsible for direct treatment should have advanced knowledge and training in dysphagia treatment procedures.

Positioning

Proper positioning is essential when working with the client who has dysphagia. This is an important role for the occupational therapy practitioner as a member of the dysphagia team. The client should be positioned symmetrically with normal alignment between the head, neck, trunk, and pelvis. The ideal position is as follows:

1. The client is seated on a firm surface, such as a chair.

2. The client's feet are flat on the floor.

3. The client's knees are at 90-degree flexion.

4. There is equal weight bearing on both ischial tuberosities of the hips.

5. The client's trunk is flexed slightly forward (100-degree hip flexion) with the back straight.

6. Both of the client's arms are placed forward on the table.

7. The head is erect, in midline, and the chin is slightly tucked (Fig. 27.6).

FIG 27.6 Proper head position for a client with aphasia.

For the client who may be restricted to bed but is able to sit in a semireclined position, the same positioning principles apply: equal weight bearing on both ischial tuberosities for the hips, the trunk flexed slightly forward (100-degree hip flexion) with the back straight, knees slightly flexed, and both arms placed forward on a bedside table. The head and neck should be aligned appropriately to reduce the risk of aspiration.

For the client who must remain completely supine in bed, oral feeding is usually contraindicated. If the client can be positioned side-lying in bed, appropriate head and neck alignment must be achieved before the assessment of feeding skills. The client's knees and hips should be slightly flexed and trunk aligned while supported in the side-lying position. The use of additional pillows, rolls, and supports may be required to maintain the appropriate alignment.

A client who has difficulty moving into the correct position or maintaining the position presents a challenge to the occupational therapist. A careful analysis of the client is needed to determine the major problem preventing proper positioning. Poor positioning may be a result of decreased control, strength or balance secondary to hypertonicity, hypotonicity, or weakness or poor body awareness in space secondary to perceptual dysfunction (Fig. 27.7). After the cause is identified, the therapist develops intervention to address the specific problems. Treatment suggestions are described later in this chapter.

FIG 27.7 Positioning of the client with dysphagia. **A,** Incorrect positioning. **B,** Correct positioning.

Fig. 27.8 shows different supportive positions that allow the therapist to help the client maintain head control. Correct positioning allows more appropriate muscular action, which thereby facilitates quality motor control and function of the facial musculature, jaw and tongue movement, and the swallowing process, all of which minimize the potential for aspiration.

Threaded Case Study

Mattias, Part 11

Mattias was able to sit in a chair and responded well to physical prompts to sit aligned with both arms supported on the tabletop. Although he was concerned that resting his arms on the table was impolite, his therapist suggested using a chair with armrests. He typically would slightly extend his neck when attempting to swallow foods, and using the technique of a slight chin tuck diminished the coughing and choking episodes when he ate textured foods.

FIG 27.8 Different supportive positions allow the therapist to help the client maintain head control. **A-B,** Side hold position for clients requiring maximum to moderate assistance. **C,** Front hold position for clients requiring minimal assistance. **D,** Turning the head toward the more involved side for an individual who sustained a CVA.

Oral Hygiene

Oral care by nursing and therapy team members prevents gum disease, the accumulation of secretions, the development of plaque, and the aspiration of food particles that remain after eating. Poor or inadequate oral hygiene has been linked with healthcare-associated pneumonia, respiratory tract infections, and influenza in elderly people.[9,20,56] The client who is hypersensitive or resistant to having anything in the mouth may require intervention from the occupational therapist. Preparation steps may include firmly stroking outside the client's mouth or lips with the client's or therapist's finger. Sensitive gums can also be firmly rubbed, preparing the client for the toothbrush.

For cleaning purposes, the mouth can be divided into four quadrants. A toothbrush with a small head and soft bristles is used to clean each quadrant, starting with the top teeth and moving from front to back. When brushing the bottom teeth, the therapist brushes from back to front. Next, holding the toothbrush at a vertical angle, the therapist brushes the inside teeth downward from gums to teeth. Finally, the cutting surfaces of the teeth are brushed. An electric toothbrush can be more effective, if the client can tolerate it.

After each procedure the client is allowed to dispose of secretions. After brushing, the client is carefully assisted in rinsing the mouth. If the client can tolerate thin liquids, small amounts of water can be given. Having the client flex the chin slightly toward the chest helps prevent the water from being swallowed. The therapist can help the client expel the water by placing one hand on each cheek and simultaneously pushing inward on the cheeks while the chin remains slightly tucked. If the client has no ability to manipulate liquids, a dampened sponge toothette can be used.

Oral hygiene for the nonoral or oral client can be used as effective sensory stimulation of touch, texture, temperature, and taste. It can be used to facilitate beginning jaw and tongue movements and to encourage an automatic swallow.[20] Lack of oral stimulation over a prolonged time leads to hypersensitivity within the oral cavity. Clients who display poor tongue movement or decreased oral sensation and who are able to eat frequently have food remaining on their teeth or dentures or between the cheek and gum. A client with decreased sensation is not aware of the remaining food. A thorough cleaning should follow each time the client eats.

Nonoral Feedings

A client who aspirates more than 10% of food or liquid consistencies or whose combined oral and pharyngeal transit time is more than 10 seconds, regardless of positioning or facilitation techniques, is an inappropriate candidate for oral eating.[48] This client needs a nonoral nutritional method until eating and drinking capability is regained. Clients who lack the endurance to take in sufficient calories also may require nonoral feedings or supplements.

The two most common procedures for nonoral feedings involve the nasogastric tube (NG tube) and the percutaneous endoscopic gastrostomy (PEG).[31] The NG tube is passed through the nostril, through the nasopharynx, and down through the pharynx and esophagus to rest in the stomach. The NG tube is a temporary measure that should not be used for longer than 1 month.[30] The NG tube has several advantages:

1. The NG tube can be inserted and removed nonsurgically.

2. The NG tube allows the physician to choose between continuous or bolus feedings (a feeding that runs no more than 40 minutes).

3. The NG tube allows the therapist to begin prefeeding and feeding training while the tube is in place.

4. The NG tube provides full nutrition and hydration if necessary and keeps the digestive system active, which is important for moving to oral feedings.

The NG tube also has some disadvantages:[30,48,59,62,63]

1. It can desensitize the cough reflex and the swallow response.

2. It can interfere with a positioning program (the client needs to be elevated to 30 degrees during feeding).

3. It can increase aspiration risk, pharyngeal secretions, and nasal reflux.

4. It can decrease the client's self-esteem.

5. It can be uncomfortable.

6. It distends pharyngeal esophageal segment and upper esophageal sphincter; it may promote reflux.

7. It can cause nasal ulceration.

Placement of a PEG is a minor surgical procedure. The client receives a local anesthetic, and a small skin incision is made to create an external opening in the abdominal wall. A tube is passed through the opening into the stomach. A PEG offers several advantages:

1. Using a PEG allows the physician to choose between continuous or bolus feedings.

2. The PEG provides full nutrition and hydration if necessary and keeps the digestive system active, which is important for moving to oral feedings.

3. It allows the therapist to begin a prefeeding or feeding program while the tube is in place.

4. It carries less risk of reflux and aspiration.

5. It does not irritate or desensitize the swallowing mechanisms.

6. It does not interfere with a positioning program.

7. It can be removed when the client no longer requires supplemental feedings or liquids.

However, use of a PEG also has some disadvantages[30,62,63]:

1. It requires surgical placement.

2. The stoma site can become irritated or infected.

3. Reflux if the stomach fills too fast.

4. The family can perceive the tube as being permanent.

A PEG is the ideal choice for the client who may require tube feeding or supplemental feedings for longer than 1 month.[30]

A commercially prepared liquid formula that provides complete nutrition usually is used for tube feedings. Many types and brands are available. The physician and dietitian determine which formula is best suited to the client. The feedings are administered by either a bolus or a continuous method. A bolus feeding takes 20 to 40 minutes to run through either the NG tube or the PEG. It can be gravity assisted or run through a feeding pump. Bolus feedings can be scheduled at numerous times throughout a 24-hour period.

Continuous feedings, which the client may better tolerate, provide smaller amounts that are administered continuously by a feeding pump. The feeding pump can be set to regulate the rate at which the formula is dripped into the tube. A disadvantage of continuous feedings is that the client must be attached to the feeding pump during tube feedings, which limits mobility.

As a client begins to eat enough to require an adjustment in the intake amount of formula, bolus feedings become the preferred method. A bolus feeding allows the therapist to work with the physician to wean the client from formula feeding. A bolus feeding can be held back before a feeding session, and the number of bolus feedings per day can be decreased as the client improves. If satisfied by the tube feedings, the client will not have an appetite and will have decreased motivation to eat.

As the client improves, oral intake can be increased, and the formula feeding can be used to supplement the client's caloric intake. An accurate calorie count, determined by recording the percentage of oral intake, assists the physician in decreasing the calories received through the tube feedings as the client begins to meet nutritional needs orally. The occupational therapist works closely with the dietitian to ensure that all hydration and caloric needs are being met. If the client has progressed only enough to handle solids, the NG or PEG can be used to meet the client's total or partial fluid requirements. When the client is able to meet nutrition and hydration needs through oral feedings, the NG or PEG can be removed.

Oral Feedings

For a client to be an appropriate candidate for oral feeding, several criteria must be met. The therapist can use the criteria for evaluating a client's swallow with foods or liquids. To participate in an oral feeding program, a client must (1) be alert, (2) be able to maintain adequate trunk and head positioning with assistance, (3) have beginning tongue control, (4) manage secretions with minimal drooling, and (5) have a reflexive cough. The therapist needs to identify the food or liquid consistency that is most appropriate for the client. The safest consistency with which to initiate the oral program is one that enables the client to complete the oral and pharyngeal stages combined in less than 10 seconds and to swallow with minimal aspiration (10% or less).[48] The ultimate goal of an oral feeding program is for the client to be able to safely swallow the least restrictive diet in sufficient amounts to meet nutrition and hydration needs without aspiration.

Diet Selection

For those diagnosed with dysphagia, the texture of their food may need to be modified to help make swallowing safer and more efficient and to help prevent aspiration. A dysphagia diet must be carefully selected to reflect the needs of the client. In general, foods chosen for dysphagia diets should (1) be uniform in consistency and texture, (2) provide sufficient density and volume, (3) remain cohesive, (4) provide pleasant taste and temperature, and (5) be easily removed or suctioned when necessary.[1]

The following foods are contraindicated for dysphagia diets: foods with multiple textures, such as vegetable soup and salads; fibrous and stringy vegetables, meats, and fruits; crumbly and flaky foods; foods that liquefy, such as gelatin and ice cream; and foods with skins and seeds.[1]

The therapist should work closely with the dietitian to identify the appropriate dysphagia diet for the client. Using established dysphagia diets develops a standard for consistently describing which food textures and what foods are allowed at each level. This consistency is critical for client safety. Because many disciplines are involved in the care of an individual with dysphagia, standardized language is needed when describing food and liquid textures to facilitate the diagnostic and nutritional management of the client.[1] The National Dysphagia Diet Task Force (NDDTF) has developed a science-based, multilevel, standardized diet for clients with dysphagia. Once the therapist has determined the appropriate diet level, all members of the team, including the family and the client, should be educated about which foods are acceptable in each level and which foods should be avoided to ensure the client's safety. Liquid diet levels should also be established. When requesting a dysphagia diet, the therapist should specify both levels desired, liquid and solid, because a client may handle each differently.

Diet Progression

Tables 27.6 through 27.8 list foods in three progressive dysphagia levels. These levels reflect the food texture levels recommended by the NDDTF.[1] After mastering level 3 the client may progress to a regular diet. Dysphagia diet level 1 (dysphagia pureed) is for individuals with moderate to severe swallowing difficulty who may have a reduced ability to protect their airway. All foods are pureed. This food group is best for persons with little or no jaw or tongue control, a moderately delayed swallow, and a decreased pharyngeal transit, resulting in pooling in the valleculae and pyriform sinuses. Pureed foods move more slowly past the faucial arches and into the pharynx, which allows time for the swallow response to trigger. Pureed foods should be homogenous, pudding-like in consistency. No coarse textures, raw fruits or vegetables, or nuts are allowed. Any foods that require mastication are not allowed. Level 1 foods are best used only to increase the client's oral intake. It may be difficult to meet caloric and nutrition needs on this diet, and often high-caloric, nutrient-dense foods are recommended. The client should be advanced to the next level as soon as possible.

TABLE 27.6

Dysphagia, Level 1: Dysphagia Pureed

Food Groups	Recommended	Avoid
Cereals and breads	Pureed bread mixes, pregelled slurried breads, pancakes, or French toast	All other breads, rolls, crackers, muffins, etc.
	Smooth, homogenous cooked cereals, creamed wheat or rice, Malto Meal	All dry cereals and any cereals with lumps
	Cereals should have a pudding-like consistency	Oatmeal
Eggs	Custard, pureed eggs	All others
Fruits	Pureed fruits or well-mashed bananas Applesauce	All others—any whole fruits (fresh, frozen, canned)
Potatoes and starches	Mashed potatoes with gravy, pureed potatoes with gravy, butter, margarine, or sour cream Pureed well-cooked noodles, pasta or rice Must be pureed to a smooth, homogenous consistency	All others
Soups	Soups that have been pureed in a blender or strained May need to be thickened Thickened, strained cream	Soups that have chunks or lumps (to a consistency of pureed vegetables)
Vegetables	Pureed vegetables without lumps, chunks, pulp, or seeds	All vegetables that have not been pureed
Meat and meat substitutes	Pureed meat	Whole or ground meats, fish, or poultry
	Pureed poultry with gravy	Cottage cheese, cheese
	Softened tofu mixed with moisture	Peanut butter, unless pureed into foods
	Hummus or other pureed legume spread	
Desserts	Smooth puddings, custards, yogurt, pureed desserts, and soufflés	Ices, gelatins, frozen juice bars, bread and rice pudding, yogurt with fruit
		All other desserts
		These foods are considered thin liquids and should be avoided if thin liquids are restricted:
		Frozen malts, milk shakes, frozen yogurt, ice cream, sherbet, gelatin
Fats	Butter, margarine, strained gravy, sour cream, mayonnaise, cream cheese, whipped topping	All fats with chunky additives

Data from American Dietetic Association: National dysphagia diet: standardization for optimal care, Chicago, 2002, American

Dietetic Association; American Occupational Therapy Association: AOTA resource guide: feeding and dysphagia, Rockville, MD, 1997, American Occupational Therapy Association; Avery-Smith W: An occupational therapist coordinated dysphagia program *Occup Ther Pract* 3:10, 1998; Community Hospital of Los Gatos, Rehabilitation Services: Dysphagia protocol, Los Gatos, CA, 2003, Community Hospital of Los Gatos; Curran J: Nutritional considerations. In Groher M, editor: *Dysphagia: diagnosis and management*, ed 3, Newton, MA, 1997, Butterworth-Heinemann; Rader T, Rende B: *Swallowing disorders: what families should know*, Tucson, AZ, 1993, Communication Skill Builders.

TABLE 27.7

Dysphagia, Level 2: Dysphagia Mechanically Altered Characteristics (Mechanical Soft)

Food Groups	Recommended	Avoid
Cereals and breads	Cooked refined cereals with little texture (eg, oatmeal) Slightly moistened dry cereals with little texture (eg, Corn Flakes, Rice Krispies) Soft pancakes with syrup French toast without crust Graham crackers	Very coarse cooked cereals that may contain seeds or nuts Whole-grain dry or coarse cereals All others
Eggs	Poached, scrambled or soft eggs (egg yolks should be moist and mashable with butter, not runny) Souffles—may have small chunks	Hard cooked or fried eggs
Fruits	Soft canned or cooked fruits without seeds or skin	Fruits with seeds, coarse skins, fibers; fruits with pits, raisins, grapes
	Soft, ripe bananas	
	Baked apple (no skin)	All raw fruits except those listed
Potatoes and starches	Well-cooked, moistened, boiled, baked, or mashed potatoes Well-cooked noodles in sauce	Potato skins and chips, fried potatoes, rice
Soups	Soups with easy to chew or easy to swallow soft meats or vegetables (particle sizes < ½ inch)	Soups that have large chunks of meat or vegetables
	Cream soups	Soups with rice, corn, peas
Vegetables	Soft, well-cooked vegetables; should be easily mashed with a fork	All raw vegetables Cooked corn and peas Broccoli, cabbage, brussels sprouts, asparagus, or other fibrous, nontender cooked vegetables
Meat and meat substitutes	Moistened ground or cooked meat, poultry, or fish; may be served with gravy Casseroles without rice Soft-moist lasagna, moist macaroni and cheese Moist meatballs, meat loaf, or fish loaf Tuna or egg salad without large chunks, celery, or onion Cottage cheese, smooth quiche Tofu All meats or protein substitutes should be served with sauces or moistened to help maintain cohesiveness in the oral cavity	Dry, tough meats (such as bacon, sausage, hot dogs) Peanut butter Dry casseroles Pizza Sandwiches All other cheeses
Desserts	Pudding and custard Soft fruit pies with bottom crust only Crisps and cobblers without seeds or nuts Canned fruit (excluding pineapple) Soft, moist cakes with icing Pregelled cookies or soft moist cookies “dunked” in milk, coffee, or other liquid	Dry, coarse cakes or cookies Anything with nuts, seeds, coconut, pineapple, or dried fruit Rice or bread pudding
Fats	Butter, margarine, strained gravy, sour cream, mayonnaise, cream cheese, whipped topping	All fats with chunky additives

Data from American Dietetic Association: National dysphagia diet: standardization for optimal care, Chicago, 2002, American Dietetic Association; American Occupational Therapy Association: AOTA resource guide: feeding and dysphagia, Rockville, MD, 1997, American Occupational Therapy Association; Avery-Smith W: An occupational therapist coordinated dysphagia program *Occup Ther Pract* 3:10, 1998; Community Hospital of Los Gatos, Rehabilitation Services: Dysphagia protocol, Los Gatos, CA, 2003, Community Hospital of Los Gatos; Curran J: Nutritional considerations. In Groher M, editor: *Dysphagia: diagnosis and management*, ed 3, Newton, MA, 1997, Butterworth-Heinemann; Rader T, Rende B: *Swallowing disorders: what families should know*, Tucson, AZ, 1993, Communication Skill Builders.

TABLE 27.8

Dysphagia, Level 3: Dysphagia Advanced

Food Groups	Recommended	Avoid
Cereals and breads	All well-moistened cereals Any well-moistened breads, muffins, pancakes, waffles, etc. Add butter, margarine, syrup, etc., to moisten	Coarse or dry cereals such as shredded wheat Dry toast, crackers Crusty bread such as French bread, hard rolls Popcorn
Eggs	Eggs, prepared any way	
Fruits	All canned and cooked fruit	Difficult-to-chew fresh fruits such as apples or pears
	Soft, peeled fresh fruit, without seeds	Stringy, high-pulp fruits such as papaya or pineapple
	Soft berries	Uncooked dried fruit
		Fruit with seeds or coarse skins
Potatoes and starches	All, including rice and fried potatoes	Potato skins
		Tough, crisp-fried potatoes
Soups	All soups except those on the Avoid list	Soups with tough meats Corn or clam chowders Soups with large chunks (>1 inch)
Vegetables	All cooked, tender vegetables	All raw vegetables, except shredded lettuce
	Shredded lettuce	Cooked corn
		Nontender, stringy, cooked vegetables
Meat and meat substitutes	Thin-sliced tender or ground meats and poultry	Tough, dry meats and poultry
	Well-moistened fish	
	Casseroles with small chunks of meat, ground meats, or tender meats	
Desserts	All except those on the Avoid list	Dry, coarse cakes or cookies
		Anything with nuts, seeds, coconut, pineapple, or dried fruit
Fats	All except those on the Avoid list	All fats with chunky additives

Data from American Dietetic Association: National dysphagia diet: standardization for optimal care, Chicago, 2002, American Dietetic Association; American Occupational Therapy Association: AOTA resource guide: feeding and dysphagia, Rockville, MD, 1997, American Occupational Therapy Association; Avery-Smith W: An occupational therapist coordinated dysphagia program *Occup Ther Pract* 3:10, 1998; Community Hospital of Los Gatos, Rehabilitation Services: Dysphagia protocol, Los Gatos, CA, 2003, Community Hospital of Los Gatos; Curran J: Nutritional considerations. In Groher M, editor: *Dysphagia: diagnosis and management*, ed 3, Newton, MA, 1997, Butterworth-Heinemann; Rader T, Rende B: *Swallowing disorders: what families should* *know*, Tucson, AZ, 1993, Communication Skill Builders.

Level 2 items are soft foods that stay together as a cohesive bolus; thus the possibility of particles spilling into the airway is decreased. Dysphagia diet level 2 (dysphagia advanced altered) foods are best for clients with a beginning rotary chew, enough tongue control with assistance to propel food back toward the pharynx, and a minimally delayed swallow. Mechanical soft foods reduce the risk of aspiration in individuals who have both a motor and a sensory loss. Mechanical soft foods with a density provide increased proprioceptive input throughout the mouth. Meats should be ground or minced and kept moist with gravies and sauces. These foods also stay together as a cohesive bolus rather than crumbling and falling uncontrolled into the airway. The level 2 diet is for individuals with mild to moderate swallowing difficulties.

Dysphagia diet level 3 (dysphagia advanced) requires that the client be able to chew and have adequate oral motor skills to form a cohesive bolus of textured foods and move the bolus posteriorly in the oral cavity. This food group offers a wider variety of consistencies and food choices. Level 3 is a step down from a regular diet. Level 3 foods work well for the client who has minimal problems with jaw or tongue control and a mildly delayed but intact swallow response. The client who has reached a level 3 diet needs to be concerned with a delayed swallow only when fatigued. Dysphagia level 4 (regular) diet includes all foods.

When a client is ready to progress to the next diet level, the therapist can adjust the meals by requesting one or two items from the higher group, which enables assessment at the new level. This technique is also appropriate for clients who become fatigued. The client is thus able to work with the therapist on the more challenging food items first and continue the meal with foods that are easier as the client begins to fatigue. The therapist also may consider arranging several small meals throughout the day for the client who fatigues, rather than three traditional meals.

Threaded Case Study

Mattias, Part 12

Mattias agreed to eat pureed foods to increase his caloric intake and joked with his wife that his occupational therapist gave him permission to eat ice cream. He was progressed to textured foods (level 2) but continued to use the pureed foods as a supplement because of the effort required to eat a sufficient quantity of textured foods.

After 3 weeks of intervention, Mattias progressed to a level 3 diet, which greatly increased the variety of foods he could eat and increased his overall satisfaction with meal selections. He continued to support caloric intake using foods from both levels 1 and 2 because of motor coordination and fatigue issues. His daughter selected foods for the wedding meal that required minimal chewing, including baked sole and crème brûlée in addition to the wedding cake.

A client should progress to a regular diet when oral motor control is within functional limits, allowing the client to chew and form any consistency of food into a bolus and propel it back toward the faucial arches. The client at this level should be able to swallow all food and liquid consistencies with only occasional coughing. Continuing dietary precautions for a client with a history of dysphagia include avoiding raw vegetables, stringy foods, and foods containing nuts or seeds.[1]

Many individuals with dysphagia have difficulty with thin liquids, as this texture requires greater oral motor and pharyngeal control as well as an intact swallow response. Increasing the viscosity of the liquid is often used as a strategy to decrease aspiration risk. The liquid progression is divided into four groups: "thin," "nectar-like," "honey-like," and "spoon-thick." Thin liquids include water, coffee, tea, soda or anything else that will quickly liquefy in the mouth. Thin liquids require an intact swallow. Nectar-like liquids are thickened to a consistency that coats and drips off a spoon, similar to unset gelatin. Honey-like liquids have been thickened to a honey consistency; the liquid flows off a spoon in a ribbon, like honey. Spoon-thick liquids are thickened to a pudding consistency and remain on the spoon in a soft mass.[1] The liquid consistency chosen depends on the client's swallowing problem. Examples of liquids in these levels are given in Table 27.9.

TABLE 27.9

Liquids

Liquid Level	Examples
Thin	Water, ice chips Coffee, tea Milk Hot chocolate Fruit juices Broth or consommé Gelatin dessert Ice cream Sherbet
Nectar-like	Nectars Extra thick milkshake Extra thick eggnog Strained creamed soups Yogurt and milk blended V-8 juice
Honey-like	Nectar thickened with banana Nectar thickened with pureed fruit Regular applesauce with juice Eggnog with baby cereal Creamed soup with mashed potatoes Commercial thickener
Spoon-thick	Commercial thickener

Data from American Dietetic Association: National dysphagia diet: standardization for optimal care, Chicago, 2002, American Dietetic Association; American Occupational Therapy Association: AOTA resource guide: feeding and dysphagia, Rockville, MD, 1997, American Occupational Therapy Association; Avery-Smith W: An occupational therapist coordinated dysphagia program *Occup Ther Pract* 3:10, 1998; Community Hospital of Los Gatos, Rehabilitation Services: Dysphagia protocol, Los Gatos, CA, 2003, Community Hospital of Los Gatos; Curran J: Nutritional considerations. In Groher M, editor: *Dysphagia: diagnosis and management*, ed 3, Newton, MA, 1997, Butterworth-Heinemann; Rader T, Rende B: *Swallowing disorders: what families should know*, Tucson, AZ, 1993, Communication Skill Builders.

Thick liquids are the appropriate choice for clients with cognitive problems that interfere with bolus preparation, moderate to severely impaired oral motor skills, markedly delayed swallow response, or diminished ability to protect the airway.[54] A thick liquid moves more slowly through the oral cavity, which allows the client with impaired motor skills to have greater control of the bolus, preventing it from entering the pharynx and open airway before the swallow has been triggered. Videofluoroscopic studies show higher aspiration rates for thin liquids compared to thicker liquid consistencies for individuals with dysphagia.[55] Care must be taken when a client is on modified liquids to ensure that adequate hydration is maintained. Many clients dislike thickened liquids and do not take them in sufficient amounts, putting them at risk for dehydration.

Thickened liquids are made by adding thickening agents such as banana, pureed fruit, yogurt, dissolved gelatin, baby cereal, cornstarch, or a commercial thickener to achieve the appropriate viscosity. The thickened drink or soup should stay blended and not separate or liquefy. It is important that everyone involved in the client's care understand what constitutes the various liquid levels so that the correct amount of thickening agent is added. Commercially prepared thickened liquids (all levels) are available for use in the hospital setting and at home. Using a commercially prepared product guarantees the proper viscosity.

Principles of Oral Feeding

The therapist should incorporate certain principles into the oral feeding program. An important aspect of the oral preparation stage is looking at, recognizing, and reaching for food. The client must actively participate in the eating process. Food should be presented within the client's visual field. If the client has a severe visual field deficit or unilateral neglect, the therapist must help the client to scan the plate or tray visually.

When physically possible, the client should feed himself or herself, even if assistance is necessary. If the client does not have a normal hand-to-mouth movement pattern, the therapist must help the client achieve one by guiding the extremity in the correct pattern. Abnormal movement of the upper extremity influences abnormal movement in the trunk, head, face, tongue, and pharynx and decreases the client's ability to safely swallow.

If the client is not capable of self-feeding, the therapist can keep the client actively involved by allowing the client to choose which food or liquid is preferred for each bite. Food is presented by moving the utensil slowly from the front, toward the mouth, so that the client can see the food the entire time. The client should be allowed as much control of the eating situation as possible.

For adults, eating is a social activity shared with friends and family. A normal dining environment facilitates normal eating. If the client has difficulty in this environment, intervention can be directed toward reducing distractions and identifying environmental modifications that will allow the client to be successful. Cultural preferences must be taken into account when selecting foods and dining settings. The client's normal eating habits and routines should be considered in the development of the eating program. Special care must be taken to obtain this information during the initial assessment.

The occupational therapist must continually assess the client's positioning, muscle tone, oral control, and swallow. If the client displays poor oral motor skills, the therapist assesses for food pocketing after every few bites. The rate of the client's intake is monitored. The therapist should determine when too much food is in the mouth and when the client puts food into the mouth before the previous bite has been cleared. The therapist feels for the swallow with a finger at the hyoid notch if the client displays abnormal laryngeal movement or a delayed swallow.[43] The therapist also assesses the client's voice quality upon completion of the swallow to assess for possible penetration into the laryngeal vestibule.

The frequency with which the therapist must check each component depends on the skill level and performance of the client. The more difficulty the client exhibits, the more frequent the assessment. The therapist may find it necessary to assess after each bite or sip, after a few bites or sips, or after each food item. Use of skilled observational skills allows the therapist to make the appropriate clinical decision. Specific techniques for assessment during feeding trials can be found in the swallowing assessment section of this chapter. After completing the feeding process, the client should remain in an upright position for 15 to 30 minutes to reduce the risk of refluxing food and of aspirating small food particles that may remain in the throat.

The therapist must observe the client for signs of aspiration while eating and monitor for the development of aspiration pneumonia over time. Clients vary in the amount of aspiration they can tolerate before developing aspiration pneumonia, according to age, health, and pulmonary status. The signs of acute and chronic aspiration were outlined previously.

When a client with compromised swallow function is participating in oral feedings, careful monitoring of the nutritional status is necessary. Nutrient requirements and fluid intake needs are determined by a nutrition assessment.[17,60] Nutritional deficiency is a concern, especially for older individuals, and places the client at risk for adverse health outcomes such as decreased functional ability and increased use of healthcare services.[17] The client's caloric needs are determined by the dietitian and the physician and depend on the client's height, weight, activity level, and medical condition. Caloric and fluid intake is monitored by having the physician order a calorie count and a liquid intake and output hydration count (I and O). Each person who works with the client with oral intake should record the percentage of each item the client eats or drinks. The dietitian converts the percentages into a daily calorie total. The client also should be monitored for physical signs of nutritional deficiency and dehydration. These symptoms include weakness, irritability, depression, decreased alertness, changes in eating habits, hunger, thirst, decreased turgor, and changes in amounts or color of urine. If a client is not able to take in the necessary calories, supplemental feedings are necessary to make up the difference.[28] The physician and dietitian decide on the number of supplemental feedings.

Techniques for the Management of Dysphagia

Tables 27.10 through 27.13 provide intervention techniques for the management of dysphagia. These techniques are not intended to be used in all situations. Each client presents a different clinical picture and may display one deficit or a combination of deficits. After careful assessment, the therapist must determine the primary cause of the client's deficits and intervene accordingly. The occupational profile determines the focus of occupational therapy services and identifies the importance of dysphagia intervention within the client's priorities.

TABLE 27.10

Dysphagic Treatment: Oral Preparatory Stage

Structure	Symptoms	Problem	Prefeeding Technique	Feeding Technique
Trunk	Leaning to one side	Decreased trunk tone Ataxia Increased trunk tone Poor body awareness in space	Facilitate trunk strength Exercises at midline Have client clasp hands, lean down, and touch foot, middle, other foot; rotate trunk with hands clasped and shoulders flexed to decrease or normalize tone	Assist client to hold correct position; assist with head control Assist client to hold correct feeding position; provide with perceptual boundary; consider lateral trunk support
	Hips sliding forward out of chair	Increased tone in hip extensors Poor body awareness in space	See previous entry Provide firm seating service	Adjust positioning so that client leans slightly forward at hips, arms forward on table
Head	Inability to hold head in midline	Decreased tone Weakness	Facilitate strength through neck and head exercises in flexion, extension, and lateral flexion	Assist with head control
	Inability to move head	Increased tone Poor range of motion	Tone reduction of head, shoulders, and trunk Facilitate normal movement Myofascial release techniques Soft tissue mobilization	Assist with head control
Upper	Spillage of	Decreased tone	Facilitate increased tone through weight bearing, sweeping, or tapping	Guide client through correct movement pattern

extremity	food from utensils	Apraxia Decreased coordination	muscle belly of desired muscle	Provide adaptive equipment or utensils as needed
	Inability to self-feed	Increased tone Abnormal movement patterns Weakness or decreased motor control	Reduce proximal tone with scapula mobilization, weight bearing through arm strengthening exercises Facilitation of normal movement	Guide client through correct movement pattern Provide adaptive equipment or utensils as needed
Face	Drooling, food spillage from mouth	Decreased lip control Poor lip closure secondary to decreased tone, poor sensation Apraxia	Place a wet tongue blade between client's lips; ask client to hold tongue blade while therapist tries to pull it out Vibrate lips with back of electric toothbrush down cheek and across lips Lip exercises: movements described in outer oral motor evaluation; client performs repetitions two to three times daily Blow bubbles into glass of liquid with straw	Using side handgrip for head control, the therapist approximates lip closure by guiding and assisting with jaw closure Have client use a straw when drinking liquids until control improves Place food to unimpaired side Use cold food or liquids
		Decreased sensation	Fan lips so that client feels drool or wetness on lips or chin to increase awareness	Teach client to pat mouth (versus wiping mouth) and chin every few bites or sips
Tongue	Pocketing of food in cheeks or sulci Poor bolus formation	Poor tongue control for lateralization or tipping Decreased tone Poor sensation	Tongue exercises: use movements described in inner oral motor evaluation	Avoid crumbly foods Stroke client's outside cheek where pocketing occurs with index finger back and up toward client's ear; instruct client to check cheek for pocketing
	Retracted tongue	Increased tone Retracted jaw	Tongue range of motion: wrap tip of tongue in wet gauze; gently pull tongue forward, side to side and up and down; move slowly Pull tongue wrapped in wet gauze forward past front teeth, using index and middle fingers to vibrate tongue back and forth sideways to decrease tone and facilitate protrusion	Avoid crumbly foods Reduce tone as needed during meal Double swallow Resist head flexion to facilitate jaw closure Resist head extension to facilitate jaw opening

Data from Daniels S, Huckabee ML: *Dysphagia following stroke (clinical dysphagia),* ed 2, San Diego, CA, 2013, Plural Publishing; Logemann J: *Evaluation and treatment of swallowing disorders,* ed 2, Austin, TX, 1998, Pro-Ed.

TABLE 27.11

Dysphagic Treatment: Oral Stage

Structure	Symptoms	Problem	Prefeeding Technique	Feeding Technique
Tongue	Slow oral transit	Poor anterior to posterior movement; decreased tone, poor sensation	Practice "ng-ga" sounds	Tuck chin toward chest
	Tongue retraction	Increased tone	Grasping tongue wrapped in gauze, pull it forward past front teeth; use finger or tongue blade to vibrate base of tongue back and forth sideways Improve tongue range of motion	Position food in center, midtongue Avoid crumbly foods Use cold or hot foods instead of warm Correct positioning Place index finger at base of tongue under chin; stroke up and forward
	Slow oral transit time Inability to channel food back toward pharynx	Inability to form central groove in tongue Apraxia	Grasping tongue wrapped in gauze, pull forward to front teeth; stroke firmly down middle of tongue with edge of tongue blade	Tuck chin toward chest Position food in center, midtongue Avoid crumbly foods Use cold or hot foods instead of warm Correct positioning Place index finger at base of tongue under chin; stroke up and forward
	Repetitive movement of tongue; food is pushed out front of mouth	Tongue thrust	Facilitate tongue retraction to bring tongue back into normal resting position; vibrate on either side of the frenulum found inside the mouth, under the tongue with finger Increase jaw control; teach isolated tongue movements	Correct positioning Place food away from midline of tongue toward back of mouth Provide downward and forward pressure to back of tongue with spoon after food placement
	Food falls off tongue into sulci or food remains on tongue without the client's awareness	Poor sensation	Ice tongue with ice chips placed in gauze to prevent ice chips from slipping into pharynx Brush tongue with toothbrush to stimulate receptors	Use foods with high viscosity or density Alternate presentation of cold and hot foods during meal
	Slow oral transit time; food remains on hard palate; coughing before swallow	Poor tongue elevation; decreased tone	Ask client to practice "k," "g," "n," "d," and "t" sounds Lightly touch tongue blade or soft toothbrush to roof of mouth at back of tongue; instruct client to press spot with tongue; resist movement with blade or brush to increase strength Vibrate tongue at base below chin; provide quick stretch by pushing down on base of tongue	Correct positioning With finger under chin at base of tongue, move finger upward and forward to facilitate elevation Avoid crumbly foods Double swallow
	Slow oral transit time Food remains on back of tongue because client is unable to elevate tongue to push food to hard palate Coughing before the swallow Retracted tongue	Decreased sensation Increased tone Decreased range of motion Soft tissue shortening	Tone tongue with gauze reduction; grasping wrapped tongue forward with around tip, pull finger or tongue blade Apply pressure to base of tongue right to left Grasping base of tongue under chin between two fingers, move it back and forth to decrease tone Tone reduction Range of motion exercises Place a variety of tastes on lips to facilitate tongue licking lips	Adjust correct positioning by increasing forward flexion at hips, arms forward to decrease tone Reduce tone as needed; give client breaks because tone increases with effort With finger under chin at base of tongue, move finger upward and forward to facilitate tongue elevation

Data from Logemann J: *Evaluation and treatment of swallowing disorders,* ed 2, Austin, TX, 1998, Pro-Ed; Wheeler-Hegland K, et al: Evidence-based systematic review: oropharyngeal dysphagia behavioral treatments. Part II—impact of dysphagia treatment on normal swallow function, *J Rehabil Res Dev* 46:185–194, 2009.

TABLE 27.12

Dysphagia Treatment: Pharyngeal Stage

Structure	Symptoms	Problem	Prefeeding Technique	Feeding Technique
Soft palate	Tight voice; nasal regurgitation Air felt through nose or mist seen on mirror when client says "ah" Decreased tone Nasal speech	Increased tone Decreased tone Rigidity	Facilitate normal head/neck positioning Have client tuck chin into therapist's cupped hand, then push into hand as therapist applies resistance; client says, "ah" afterward; speed and height of uvula elevation should increase; follow by thermal application	Facilitate normal head and neck positioning With head and neck in midline, have client tuck chin slightly to decrease rate of food entering into pharynx
	Delayed swallow	Decreased triggering of swallow response	Thermal application: using a laryngeal mirror #00 after being placed in ice water or chips for 10 seconds, touch base of faucial arch; repeat up to 10 times; process can be repeated several times a day	Alternate presentation of food; start with a very cold substance, then warm; cold substance can increase sensitivity of faucial arches; tuck chin slightly forward to prevent bolus entering airway
Hyoid	Delayed elevation of hyoid bone Poor tongue elevation	Delayed swallow Incomplete swallow	Increase tongue humping because elevation of tongue and hyoid stimulates triggering of response	Place index finger under chin at base of tongue and push up forward to facilitate tongue elevation
	Tongue retraction	Abnormal tongue tone; poor	Tone reduction	

		range of motion		
Pharynx	Coughing after swallow	Decreased pharyngeal movement Penetration into laryngeal vestibule	None	If appropriate, alternate presentation of liquid with stage II or stage III solids; liquid material moves solids through pharynx
	Coating of pharynx seen on videofluoroscopy Gurgling voice	Pharyngeal weakness	Isometric or resistive head and neck exercises	Have client take second dry swallow to clear valleculae and pyriform sinuses Tilt head to stronger side Supraglottic swallow
	Seen on videofluoroscopy, anteroposterior view; material residue seen on one side; weak or hoarse voice	Unilateral pharyngeal movement	None	Compensatory technique for clients with low tone: have client turn head toward affected side during swallow to prevent pooling in affected pyriform sinuses; evaluate technique against its effect on client positioning and tone in trunk, upper extremities
Larynx	Coughing, choking after swallow	Decreased laryngeal elevation Decreased tone Weakness	Quickly ice up sides of larynx; ask client to swallow; assist movement by guiding larynx upward Vibrate laryngeal musculature from under chin, downward on each side to sternal notch	Teach client to clear throat immediately after swallow to move residual Use supraglottic swallow, Mendelsohn maneuver, effortful swallow
	Noisy or audible swallow	Increased tone Rigidity Uncoordinated swallow	Range of motion—place fingers and thumb along both sides of larynx and gently move it back and forth until movement is smooth and easy tone decreased Using chipped ice, form pack in washcloth and place around larynx for 5 min	Placing fingers and thumb along both sides of larynx, assist client with upward elevation before swallow Double swallow
Trachea	Continuous coughing before, during, after swallow	Aspiration—before: poor tongue control; during: delayed swallow response; after: decreased pharyngeal movement	Teach client how to produce a voluntary cough; ask client to take a deep breath and cough while breathing out; therapist uses palm of hand to push downward (toward stomach) on the sternum	Encourage client to keep coughing; facilitate reflexive cough; push downward on sternum as client breathes out; suction client if problem increases Push into client's sternal notch to assist with cough
	Client grabs or reaches for throat Reddening in the face No voice or cough	Blocked airway	None	Perform Heimlich maneuver Seek medical assistance

Data from Crary M: Imaging swallowing examinations: videofluoroscopy and endoscopy. In Groher ME, Crary MA: *Dysphagia: clinical management in adults and children,* ed 2, St. Louis, 2016, Elsevier; Logemann J: *Evaluation and treatment of swallowing disorders,* Austin, TX, 1998, Pro-Ed; Wheeler-Hegland K, et al: Evidence-based systematic review: oropharyngeal dysphagia behavioral treatments. Part II—impact of dysphagia treatment on normal swallow function, *J Rehabil Res Dev* 46:185–194, 2009.

TABLE 27.13

Dysphagia Treatment: Esophageal Stage

Structure	Symptoms	Problem	Prefeeding Technique	Feeding Technique
Esophagus	Frequent regurgitation of food or liquid and coughing or choking after the swallow: material collecting in a side pocket in esophagus	Esophageal diverticulum	Requires a medical diagnosis; problem can be seen through traditional barium x-ray examination Surgical correction is needed	Report symptoms to medical staff (therapist cannot treat)
	Regurgitation of food, coughing, or choking on food after the swallow: inability of food to pass through the pharynx, esophagus, or stomach	Partial or total obstruction of the pharynx or esophagus Impaired esophageal peristalsis	Requires a medical diagnosis; problem can be seen through traditional barium x-ray examination Surgical correction is needed	Report symptoms to medical staff (therapist cannot treat)

Data from Crary M: Imaging swallowing examinations: videofluoroscopy and endoscopy. In Groher M, Crary M, editors: *Dysphagia: clinical management in adults and children,* ed 2, St. Louis, 2016, Elsevier; Logemann, J: *Evaluation and treatment of swallowing disorders,* Austin, TX, 1998, Pro-Ed.

Intervention for clients with dysphagia is multifaceted and may involve rehabilitative techniques and compensatory strategies. It is essential to have an excellent understanding of the underlying problems causing the swallowing disorder so that an intervention program can be designed that directly addresses these problems. The overarching goal of dysphagia intervention is the resumption of safe oral intake with the least restrictive diet. The therapist should strive toward facilitating the return of normal eating habits and routines for each client. Establishing proper positioning for safe swallowing is often the first therapeutic intervention in dysphagia management. This may involve the use of positioning equipment, therapeutic exercises to improve trunk and head control, and mechanical positioning by feeding staff.

When a client is unable to orally manage food, an *indirect swallowing intervention* program is initiated. Indirect intervention does not involve the ingestion of food or liquid. Indirect intervention techniques include facilitation of tone and movement for hypotonic muscles, desensitization for hypersensitive areas of the face and oral cavity, sensory stimulation to heighten sensation and proprioception, range-of-motion and gentle resistive exercises to strengthen weak oral and pharyngeal musculature, swallowing stimulation (without food), and oral motor exercises and tasks.[24]

Intervention for swallowing performance is called *direct intervention* because it involves the ingestion of food or liquid. These interventions are aimed at facilitating oral performance, improving the pharyngeal swallow, and reducing the risk of aspiration. Examples include compensatory swallowing techniques and strategies, thermal or tactile stimulation, gradation or alteration of the bolus size/texture/consistency, or method of food presentation and specialized positioning.

Compensatory techniques are introduced to improve swallow safety by helping to control the flow of food and liquid and reduce the risk of aspiration. They do not change the physiology of the individual's swallow. Compensatory strategies used in dysphagia intervention include (1) postural techniques (for example, turning the head toward the more involved side for an individual who sustained a CVA closes off the weaker pharyngeal wall and allows safer swallowing (see Fig. 27.7, D), (2) techniques to improve oral sensory awareness, (3) modification of bolus volume and speed of presentation, and (4) texture modifications (Box 27.1). Compensatory strategies often allow a client to safely engage in oral eating while continuing to work on remediation of the underlying problems. The client and those involved with assisting the client to eat are trained in the use of these strategies.

Box 27.1

Bolus Textures and Swallow Problems

Texture	Disorders for Which This Texture Is Most Appropriate
Thin liquid	Tongue dysfunction (ROM, strength, coordination)
	Reduced tongue base retraction
	Reduced pharyngeal wall contraction
	Reduced laryngeal elevation
	Reduced cricopharyngeal opening
Thickened liquid	Tongue dysfunction (ROM, strength, coordination)
	Delayed pharyngeal swallow
Pureed	Oral motor impairment
	Delayed pharyngeal swallow
	Impaired cognition
	Decreased endurance
Mechanical soft	Oral motor impairment (decreased chew)
	Decreased endurance

Adapted from Logemann J: *Evaluation and treatment of swallowing disorders,* ed 2, Austin, TX, 1998, Pro-Ed; Crary MA: Imaging swallowing examinations: videofluoroscopy and endoscopy. In Groher M, Crary M, editors: *Dysphagia: clinical management in adults and children,* ed 2, St. Louis, 2016, Elsevier.

Rehabilitative or remediation techniques include oral motor, range-of-motion exercises, oral motor strengthening exercises, bolus control exercises, vocal fold adduction and laryngeal elevation exercises, neuromuscular electric stimulation, and exercises to improve pharyngeal pressure.[11,67,70,71] Swallow maneuvers may also be introduced to improve laryngeal closure and bolus movement through the pharynx. See Box 27.2 for examples of swallow maneuvers.

Box 27.2

Techniques to Improve Oral Sensory Awareness

- Downward pressure of metal spoon on tongue during presentation of food
- Cold bolus
- Sour bolus
- Larger bolus
- Bolus that requires chewing
- Thermal-tactile stimulation*

*Tactile stimulation provided directly to the anterior faucial arch using a cold, size 00 laryngeal mirror prior to the presentation of the bolus. This technique heightens oral awareness and provides an alerting sensory stimulus to the cortex and brainstem to facilitate the triggering of the swallow response.

Adapted from Logemann J: *Evaluation and treatment of swallowing disorders,* ed 2, Austin, TX, 1998, Pro-Ed.

The therapist continually assesses the client's response to intervention and makes necessary modifications to the eating and swallowing program. The therapist must develop excellent clinical observation skills. For complex clients, the clinician should seek a consultation with an experienced dysphagia therapist. To develop expertise in dysphagia management, it is recommended that the therapist seek continued education in this area.

Summary

Eating is the most basic activity of daily living. Several performance components are required for the client to eat and swallow effectively. Dysphagia refers to difficulty with swallowing or an inability to swallow. The occupational therapist is trained to assess and provide intervention for many of the problems that interfere with normal eating. An understanding of the normal anatomy and physiology of swallowing and advanced training in eating and swallowing disorders are required to effectively treat dysphagia.

Assessment of the client with dysphagia includes testing of head and trunk control, sensation, perception, cognition, intra and outer oral structures, oral reflexes, and swallowing. Instrumental assessment may also include videofluoroscopy or fiberoptic endoscopy.

Several members of the rehabilitation team are involved in the treatment of the client with dysphagia. Positioning, selection of appropriate feeding procedures, diet texture selection, diet progression, and special techniques to facilitate normal patterns of swallowing are part of the intervention plan. The social, cultural, contextual, and psychological aspects of eating are also important considerations in the intervention program.

Case Study

Nick

Nick is a 65-year-old man who suffered a right cerebrovascular accident (CVA) with left hemiplegia 2 weeks ago. He has a PEG in place for nutrition. He recently retired from his position as vice president of a local marketing company. Nick lives with his wife. He and his wife have two grown children living in the area. Before the onset of the CVA, Nick was independent in all ADLs and instrumental activities of daily living (IADLs). He was an active member of the community.

Results of the occupational therapy evaluation indicate that Nick needs moderate to maximum assistance in dressing, toileting, bathing, eating and swallowing, and transfers. The clinical assessment of eating indicates that the client has a mild to moderate increase in jaw and facial tone with poor rotary chew, poor isolated tongue control, and a mild increase in laryngeal tone with delayed swallow.

The videofluoroscopy confirmed that the client had a mildly delayed swallow with minimal pooling in the valleculae and pyriform sinuses. Aspiration was less than 10% on pureed foods. The occupational therapist saw the client three times a week for 6 weeks. A summary of evaluation results and a treatment plan are shown in Fig. 27.9.

DYSPHAGIA EVALUATION AND INTERVENTION PLAN	
Name: N.X. **Dx:** R CVA **Age/Onset:** 65 y/o male, 1 week ago	
Medical hx: Elevated BP x 5 years. Elevated blood lipids. Otherwise unremarkable. Independent in ADL & IADL prior to onset. No previous swallowing problems. Previously ate a regular diet.	
Current nutritional status:	NG tube, NPO until swallowing evaluation
Mental status:	
Alert/oriented	Oriented to self only
Direction following	Follows 1-2 step directions well
Physical status (symmetry, control, tone)	
Head control	Slight increase in tone with head turning.
Trunk control	Poor trunk control. Leans to the right, unable to bring self to midline
Endurance	Fatigues after 20 minutes of activity
Respiratory	No SOB noted
Outer oral status:	
Facial expressions	Flat affect. Unable to mimic facial expressions. Drooping right side
Jaw movement	Poor rotary chew pattern, poor jaw glide, uses up and down movement
Lip movement	Asymmetrical purse and retract, poor lip compression with closure
Sensation	Decreased-absent touch on right side
Abnormal reflexes	Absent
Inner oral status (symmetry, control, tone)	
Dentition	Dentures, fit well
Tongue	
Appearance	White coating, deviated to right
Tone	Hypotonic
Movement: Protrusion	To just past lips, poor anterior to posterior sweep on palate
Lateralization	Reduced ROM both sides, deviated to right at rest
Elevation	With effort, fatigues with repetition
Soft palate/gag reflex:	Uvula rises symmetrically but with slight delay "ah". Gag present
Cough (reflexive/voluntary):	Weak voluntary cough to command
Swallow:	
Spontaneous	Intact
Voluntary	Slight delay with effort
Laryngeal movement	Mild reduction in laryngeal excursion
Food management:	
Puree	Requires verbal cues to attend to food in mouth. Increased oral transit
Mechanical soft	Requires increased effort, verbal cues, transit time, residuals after sw.
Regular	Not tested
Liquids: Thick	With straw, 5 second delay, no cough
Semi-thick	With straw, 5 second delay, cough; by spoon, 5 second delay, no cough
Thin	Not tested
Required assistance with feeding to utilize strategies (chin tuck, clearing swallow). Decreased sensory awareness of food and liquid in mouth. Weak cough reduces airway protection. Limited amounts of PO provided during testing.	

DYSPHAGIA EVALUATION AND INTERVENTION PLAN

Major problems:

1. Poor sitting balance
2. Poor endurance for eating
3. Weak cough
4. Impaired cognition for attention and awareness of food in mouth
5. Decreased intra-oral and extra-oral sensation
6. Poor isolated tongue movements for lateralization, elevation and protrusion
7. 3-second delay in pharyngeal swallow as per videofluoroscopy evaluation
8. 5-10% residuals in valleculae and pyriform sinus after the swallow as per videofluoroscopy

Recommendations/methods:

(positioning, diet texture modifications, environmental modifications, sensory stimulation, compensatory strategies to improve pharyngeal swallow, client/caregiver training)

1. Positioning – Upright on a solid seating surface, feet flat on the floor, trunk and head in midline, arms supported with slight forward flexion at hips
2. Diet texture – Pureed and mechanical soft (finely chopped) foods, nectar thick liquids. P.O. intake with nursing or therapist only
3. Environmental modifications – quiet eating environment without distractions
4. Alternate cold, frozen textured liquid with food to increase sensory awareness in the mouth.
5. Small frequent meals
6. Oral motor exercises to increase tongue ROM and strength
7. Chin tuck during swallow to reduce risk of aspiration due to delayed swallow
8. Clearing (double) swallow to clear pharyngeal residuals
9. Monitor for signs of aspiration
10. Check mouth for pocketing or residuals after oral intake
11. Advance diet texture as client status improves

Long term goals:

1. Good trunk and head control for safe eating
2. Good awareness of food and liquid in mouth – no food/liquid loss from mouth during eating
3. Good attention to task of eating in a variety of eating environments without verbal cues
4. Improved endurance for eating so that client can eat a full meal without signs of fatigue
5. Adequate strength and coordination of oral musculature to safely manage a soft diet
6. Able to safely drink thin liquids via straw and cup
7. Able to meet nutrition and hydration needs P.O.
8. No signs or symptoms of aspiration
9. Safe eating with caregivers

FIG 27.9 Dysphagia evaluation and intervention plan.

The client responded well to treatment. The PEG was removed after 5 weeks. The client achieved all treatment goals by the time of discharge. He went home with family supervision for correct diet, positioning, and swallowing techniques during meals. The client was referred to home health occupational therapy for 2 to 3 weeks for ADLs and home modification so that he could achieve independence at home. The client returned for follow-up outpatient visits.

Review Questions

1. List the components of dysphagia.
2. List the four stages of swallowing and the characteristics of each.
3. List the physiologic functions that occur when the swallow response triggers, and explain why these functions are necessary.
4. Why is it necessary to assess a client's mental status during a dysphagia evaluation?
5. Describe what the therapist should look for when evaluating the trunk and head during the dysphagia evaluation.
6. What information can the therapist gain when assessing the client's facial motor control?
7. How does poor tongue control contribute to aspiration?
8. Name the components required to protect the airway.
9. What is the safest food sequence to follow for a swallowing evaluation?
10. Describe the finger placement that a therapist can use to feel the strength and smoothness of the swallow.
11. Why should the therapist assess voice quality after a swallow?
12. Will a client who has difficulty handling solids also have difficulty with liquids?
13. List the indicators of swallowing dysfunction.
14. List the acute symptoms of aspiration.
15. When is videofluoroscopy necessary?
16. List the types of intervention used with clients with dysphagia.
17. Describe how the client should be optimally positioned for eating and give the rationale
18. What are the indications for placing a client on a nonoral treatment program?
19. Name five important criteria a client must meet to participate in an oral feeding program.
20. List the properties of food preferred for diets for clients with dysphagia.
21. Why is it important to involve the client in the eating process?
22. What are the symptoms of nutritional deficiency?
23. Name three treatment techniques the occupational therapist can use for poor rotary jaw movement and increased tone.
24. Describe two ways a therapist can decrease abnormally high tone in the tongue.
25. Describe thermal application as a treatment technique. For which problem is it used?
26. When is use of the dry swallow technique appropriate?

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28

Pain Management

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CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Differentiate acute from chronic pain.
2. Explain the biopsychosocial model of pain.
3. Describe two common acute and two common chronic pain syndromes.
4. Summarize two approaches to pain evaluation.
5. Describe occupationally based approaches to pain intervention.

KEY TERMS

Acute pain

Biopsychosocial model of pain

Chronic pain

Nociception

Pain

Pain assessment

Pain behavior

Pain intervention

Suffering

Threaded Case Study

Cathy, Part 1

Cathy, a 34-year-old white single woman, sustained a lumbar strain 5 months ago when catching a heavy weight while employed as an electrician. Cathy was initially treated at an emergency room, where narcotics, muscle relaxants, heat application, and bed rest were prescribed. After she persistently complained about pain, she was given pelvic traction and transcutaneous electrical nerve stimulation. Cathy has not returned to work since her injury and described her current lifestyle as sedentary. She described her pain as severe (a "9" or "10" on an 11-point numerical scale, with "0" representing "no pain" and "10" indicating "pain as bad as could be") and almost constant. She reported that prolonged sitting, standing, and ambulation exacerbated pain factors. Cathy described occasional mild pain relief with ibuprofen use and bed rest. Her self-report on the Brief Pain Inventory revealed moderate to high pain interference with instrumental activities of daily living (IADLs) and recreational, social, and work activities. Cathy described using pain-contingent rest and asking for assistance as the means of coping with her pain.

During evaluation, Cathy was found to have decreased active right shoulder range of motion and strength, decreased left lower extremity strength, and muscle spasms throughout the left lumbar paraspinal muscles and into the left buttock. She demonstrated poor body mechanics, poor posture, and mild shortness of breath. Cathy offered numerous verbal complaints of pain and expressed fear that the pain would never go away.

Physical retraining and cognitive behavioral techniques were emphasized in intervention. Cathy participated in generalized mobility, strengthening, and cardiovascular endurance exercises to increase her occupational performance, minimize fatigue, and enhance feelings of well-being. Functional tasks were incorporated into treatment. Cathy was taught how to monitor her daily routine (eg, balance of rest, relaxation, and activity) and modify faulty thinking (eg, catastrophizing, such as thinking there is nothing that can stop the pain). Her daily routine included progressive relaxation rehearsal.

Cathy made good progress in her intervention program, and after 4 weeks she demonstrated normal mobility, strength, and endurance. Bed rest during the day was eliminated. Cathy was taught proper posture and body mechanics and was observed to use them in her routine activities. Although her verbal complaints of pain continued, she stated that she no longer felt the pain was controlling her. Cathy was now ready to progress to a work-hardening program.

Critical Thinking Questions

1. What occupational limitations would you anticipate due to Cathy's injury and pain?
2. How would you approach an occupational therapy evaluation?
3. How would you provide an occupation-based intervention program to meet Cathy's occupational performance needs?
4. What problems in social participation do you anticipate due to the level of pain Cathy experiences on a daily basis?

Pain is a primary reason for seeking healthcare. An estimated one in four adult Americans reported experiencing a daylong pain episode within the past month, with 10% stating the pain lasted at least 1 year.[59] Chronic pain affects more than 100 million Americans, over 30% of the U.S. population.[39] This is more than the combined number of persons with diabetes, heart disease, and cancer in the United States.[1] Despite people's use of pain medications, two-thirds of individuals experiencing chronic pain cannot perform routine occupations.[1] At least $100 billion is spent each year on direct medical expenses, lost income, and lost productivity let alone the inestimable costs of human suffering.[2] The obligation to manage pain and relieve a client's suffering is fundamental to healthcare.[20] Pain may coexist with a medical condition (eg, arthritis) or a rehabilitative procedure (eg, splinting), and it may be the primary complaint (eg, low back pain) or a secondary disability (eg, chronic pain in persons with cerebral palsy). Occupational therapy practitioners may suspect that pain is impeding the client's progress but are unsure about how to best evaluate the condition and intervene. This chapter defines pain, discusses the **biopsychosocial model of pain**, describes common pain syndromes, outlines assessment procedures, and proposes interventions.

Definitions of Pain

Pain is defined as an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage.[56] This definition conveys that pain is a subjective and multifaceted experience. Individual variables such as mood, attention, prior pain experiences, and familial and cultural factors are known to affect one's experience of pain.[4,53]

There are many types of pain, yet most investigators differentiate acute from chronic nonmalignant pain, which is critical for selecting appropriate assessment and intervention strategies. **Acute pain** and its associated physiologic, psychological, and behavioral responses are typically caused by tissue irritation or damage related to injury, disease, disability, or medical or rehabilitative procedures. It has a well-defined onset and serves a biologic purpose by directing attention to injury, irritation, or disease and signaling the need for immobilization and protection of a body part.[54] Fortunately, acute pain is predictable and usually responds to medication and treatment of its underlying cause.[36]

In contrast, **chronic pain** (or *persistent pain*) continues for more than 12 weeks. It may begin as acute pain or may be more insidious and endure beyond the point at which an underlying pathologic condition can be identified.[58] Increased sympathetic nervous system activity does not continue. Chronic pain does not appear to serve a biologic purpose. It is unpredictable and not amenable to routine interventions. Chronic pain typically produces significant chances in quality of life (eg, mood, thoughts, attitudes, lifestyle, and environment).[76] As pain progresses from acute to chronic, factors other than tissue damage or irritation (eg, personality changes) become prominent. Our client, Cathy, is now experiencing chronic pain that is negatively impacting her occupational performance.

Biopsychosocial Model of Pain

Occupational therapy has long embraced the biopsychosocial model for its emphasis on the interaction of the individual's body, mind, and environment.[57] Conceptualizing pain using a biopsychosocial model can clarify the complex, multifaceted nature of pain that is critical to accurate evaluation and effective intervention.[26,80] Loeser and Fordyce[48] suggested the phenomenon of pain could essentially be divided into four distinct domains: nociception, pain, suffering, and pain behavior (Fig. 28.1).

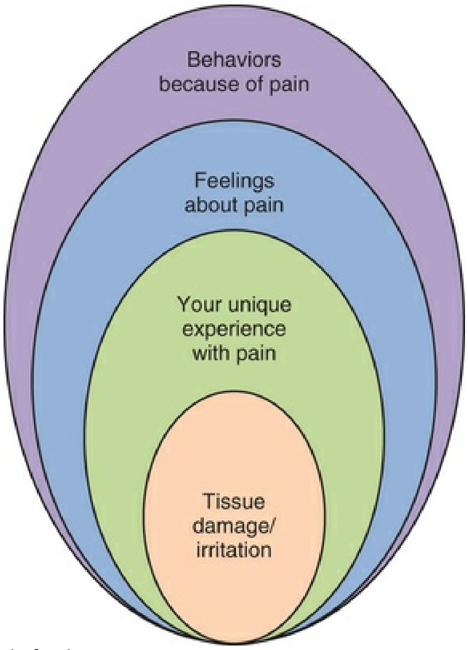

FIG 28.1 Loeser's model of pain. (Adapted from Loeser JD: Concepts of pain. In d'A Stanton-Hicks M, Boas R, editors: *Chronic low back pain*, New York, 1982, Raven Press.)

Nociception is the detection of tissue damage by transducers in the skin and deeper structures, as well as the central transmission of this information by A-delta and C fibers in the peripheral nerves. Nociception is the body's message to do something or avoid doing something for pain relief. For example, you are working at your desk and have ignored the tingling in your hand and wrist for weeks; today, however, you experience a sharp pain shooting through your wrist and up through your arm, signaling carpal tunnel syndrome. **Pain** is the perceived noxious input to the nervous system. Specifically, it is an unpleasant sensory and emotional experience. In the previous example, it is the feeling of the sharp pain that is likely signaling carpal tunnel syndrome. **Suffering** is the negative affective response to pain. For example, chronic pain is often associated with depression, dysthymic disorder, fear, anxiety, substance abuse/dependence, and insomnia.[74] Suffering is personal. The individual knows the impact of pain on his or her body, sense of self, social responsibilities, and daily occupations. Finally, **pain behavior** is what an individual says or does (eg, moaning) or does not say or do (eg, engage in occupations, attend a job) that communicates to others the presence of pain. Pain behaviors are observable and are influenced by familial, cultural, and environmental consequences. This model purports that one can experience or demonstrate some domains of the model in the absence of other domains. In chronic nonmalignant pain, pain behaviors and suffering often exist in the absence of nociception.[24,48,81]

Consider our client, Cathy, as she continues to experience pain and also expresses fear that the pain will never go away. In that sense she is captive to her pain experience.

Pain Syndromes

The evaluation and treatment of pain resulting from trauma, disease, or unknown etiology are significant healthcare concerns. The following sections describe common pain syndromes, their etiology, and typical interventions.

Headache Pain

Recurrent headaches are one of the most common pain problems. Migraines affect approximately 12% to 15% of the general population. More than half of people with headaches do not seek treatment because they perceive the problem as too trivial, have concerns about medication side effects, and believe no adequate treatment is available.[50]

Migraine headaches are characterized by recurrent pain episodes varying in frequency, duration, and intensity. Migraines may occur when the individual oversleeps, is tired, skips meals, overexerts, is stressed, or is recovering from stress.[30] The pain is typically unilateral and pulsatile and may be accompanied by anorexia, nausea, vomiting, neurologic symptoms (eg, sensitivity to light and sound), and mood changes (eg, irritability).[50] A strong genetic predisposition exists for migraines. Experimental evidence supports the role of serotonin in the incidence of migraines. Stress, attention, the environment, and mood (eg, anxiety) affect these headaches.

Tension-type headaches (TTHs) are the most common headache disorder. Approximately 73% of adult Americans experience one or more tension headaches in a year.[9] These headaches are typically of mild-to-moderate intensity. The pain is bilateral and of a pressing character and does not have associated symptoms. Precipitating headache factors include situational stress, missed meals, sleep deprivation, and noxious stimuli (eg, heat exposure).[50] TTH has been attributed to a disorder of central nervous system (CNS) modulation. Simple analgesics (eg, acetaminophen) are standard treatment. Headaches are often controlled with lifestyle management and medication.

Low Back Pain

Low back pain (LBP) is the second most common pain complaint among the adult population. Approximately 3% to 7% of people in Western industrialized countries experience chronic LBP. Job absenteeism, loss of productive activity, and decreased participation are common consequences.[78] Clients may restrict occupational engagement due to a fear that the etiology of pain, the interventions, and the restricted social consequences can be harmful. The most common causes of LBP are injury (eg, lifting) and stress, resulting in musculoskeletal and neurologic disorders (eg, muscle spasm and sciatica). Back pain also may result from infections, degenerative diseases (eg, osteoarthritis), rheumatoid arthritis, spinal stenosis, tumors, and congenital disorders.[66] LBP tends to improve spontaneously over time.[79] Numerous schools of thought govern interventions. Functional restoration is key for the client with chronic back pain. Medication management, physical therapy (eg, exercise, massage, traction), and self-care education are common treatment approaches. Once significant back pain has lasted for 6 months, however, the chance that the client will return to work is only 50%[16] (see Chapter 41).

Threaded Case Study

Cathy, Part 2

Cathy's LBP has significantly compromised her ability to engage in occupations. She has not returned to work since her injury and is at risk for never being gainfully employed in the future. Cathy is no longer able to engage in her preferred recreational activities, dancing and bowling. Her ability to care for her personal activities of daily living (ADLs) is compromised, and she has difficulty stepping in and out of the tub and even bending over to turn the faucet handles to regulate the water temperature. She must request assistance when grocery shopping because bending and reaching for items increases the pain. Cathy even reports that getting in and out of her car is difficult and requires planning and care.

Arthritis

Approximately one-third of all American adults experience joint pain, swelling, or limited mobility due to arthritis.[46] Osteoarthritis (OA), the most common form of arthritis, is a degenerative joint disease characterized by a progressive, dull ache and swelling, typically affecting the fingers, elbows, hips, knees, and ankles. Movement may exacerbate OA. Degeneration of the articular cartilage leading to joint pain, reduced mobility, and swelling occurs, typically affecting weight-bearing joints in persons after age 45.[28,70]

Rheumatoid arthritis (RA) affects 1% to 2% of Americans, with women more often affected.[28] It usually has a slow insidious onset, characterized by aches, pains, swelling, and stiffness. Any joint may be involved, but usually there is a symmetric pattern affecting the fingers, wrists, knees, ankles, and cervical spine. This systemic disease involves remissions and exacerbations of destructive inflammation of connective tissue, especially in the synovial joints.[70] The Arthritis Foundation supports self-management (eg, exercise, relaxation, problem solving strategies) of the disease.[49] (See Chapter 38 for more information on arthritis.)

Complex Regional Pain Syndrome

The incidence of complex regional pain syndrome (CRPS) has been reported as 25.2 new cases per 100,000 annually.[35] CRPS is characterized as a continuous, severe burning pain that results from trauma, postsurgical inflammation, infection, or laceration to an extremity, causing a cycle of vasospasm and vasodilation. Pain, edema, shiny skin, coolness of the hand, and extreme sensitivity to touch occur. An individual experiencing CRPS may also have excessive sweating or dryness. The key feature of CRPS is continuous, intense pain out of proportion to the severity of the injury (if an injury has occurred), which worsens over time. Exacerbating pain factors include movement, cutaneous stimulation, and stress.[43,83] Occupational therapy (OT) treatment strives to normalize sensation, reduce edema, and increase mobility, strength, and endurance while decreasing guarding and restoring routine activities. Simultaneously clients often receive physical therapy, psychotherapy, pharmacotherapy, recreational therapy, and vocational rehabilitation.[35]

Myofascial Pain Syndrome

Muscle pain is common across all age groups, with the elderly most often affected. Myofascial pain refers to a large group of muscle disorders defined by the presence of trigger points (ie, localized areas of deep muscle tenderness). Pressure on the trigger point elicits pain to a well-defined distal area. Myofascial pain is perceived as a continual dull ache often located in the head, neck, shoulder, and low back areas. The trapezius muscle is one of the most commonly affected muscles. The pain may result from sustained muscle contraction or from an acute strain caused by a sudden overload or overstretching of the muscles in the head, neck, shoulder, or lower back regions.[31,69] Physical therapy, needling therapies (ie, insertion of a solid needle for relief of muscular pain), manual therapies, and modalities are common treatment approaches.[13]

Fibromyalgia

The prevalence of fibromyalgia ranges from 0.7% to 3.2% in the adult population. Fibromyalgia is widespread musculoskeletal pain in the muscles, ligaments, and tendons. Skeletal muscles have been implicated as the cause of fibromyalgia, but no specific abnormalities have been identified. Abnormalities of the neuroendocrine system, autoimmune dysfunction, immune regulation, cerebral blood flow difficulties, and sleep disturbances have been suggested.[37] Genetic factors, physical trauma, peripheral pain syndromes, infections, hormonal changes, and emotional distress are capable of triggering fibromyalgia. Pharmacologic therapies, cardiovascular exercise, and cognitive behavior therapy have all proved beneficial.[10]

Cancer Pain

Clients with cancer often have multiple pain problems that are frequently undertreated. Cancer pain varies greatly in frequency, duration, and intensity. In the initial and intermediate stages, 40% to 50% of clients experience moderate to severe pain. About 60% to 90% of clients with advanced cancer have pain. Cancer pain may result from tumor progression, interventions (eg, surgery, chemotherapy, and radiation), infection, or muscle aches when clients decrease their activity.[72]

Disability-Related Pain

Pain is a significant problem for many persons with physical disabilities,[15] including cerebral palsy,[18] spinal cord injury,[12] limb deficiency,[34] and multiple sclerosis.[32] Physiologic changes resulting from the disability and psychosocial factors (eg, negative thoughts) are known to influence the intensity and impact of pain in many persons with chronic pain as a secondary condition to their disability.[42] Data support the use of relaxation training, hypnosis, and medication management.

Evaluation

Referral for an OT evaluation is made when pain interferes with the client's occupational performance. As a member of an interdisciplinary or multidisciplinary team, the occupational therapist focuses the evaluation on factors that contribute to the client's pain perception and pain interference. Before the occupational therapy program is implemented as well as throughout the interventions, performance should be measured objectively to determine the client's occupational profile and the value of those occupations.[33] Factors that may contribute to pain perception, occupational role disruption, decreased occupational performance, and diminished quality of life should be identified. In addition, pain intensity should be recognized as the fifth vital sign and assessed on a regular basis.[2]

The occupational therapist performs a pain evaluation, viewing pain as a complex phenomenon involving psychological arousal, sensations of noxious stimulation, tissue damage or irritation, behavioral changes, complaints of distress, and the social environment. Self-report measures are the most common type of **pain assessment** because pain is considered to be a subjective experience.[77] The clinical interview focuses on the client's identification of pain onset, location(s), frequency, intensity, duration, exacerbating and relieving pain factors, past and current pain treatments, mood, and occupational performance. A verbal rating scale (VRS), 0-10 numeric rating scale (NRS), or visual analog scale (VAS) (Box 28.1) may be used to assess self-reports of pain intensity.[61,77] These instruments have strong psychometric properties and high utility. A VRS of pain intensity consists of a list of 4 to 15 verbal descriptors and a corresponding number (eg, 0 = no pain, 1 = mild pain, 2 = moderate pain, and 3 = severe pain). This is an easy-to-use scale, but it might have a lengthy list of verbal descriptors and the client may not find a descriptor on the list that matches his or her experiences.[41]

Box 28.1

Examples of Pain Intensity Scales

Simple Descriptive Pain Intensity Scale*					
No pain	Mild pain	Moderate pain	Severe pain	Very severe pain	Worst pain possible

0-10 Numeric Pain Intensity Scale*										
0	1	2	3	4	5	6	7	8	9	10
No pain					Moderate pain					Worst pain possible

Visual Analog Scale (VAS)†	
No pain	Pain as bad as it could possibly be

*If used as a graphic rating scale, a 10-cm baseline is recommended.

†A 10-cm baseline is recommended for VAS scales.

From U.S. Department of Health and Human Services, Acute Pain Management Guideline Panel: *Acute pain management in adults: operative procedures. Quick reference guide for clinicians,* AHCPR Pub No. 92-0019, Rockville, MD, 1995, U.S. Government Printing Office.

The NRS consists of a range of numbers, typically 0 (“no pain”) to 10 (“worst pain possible”) (see Box 28.1). The client selects which one number is most representative of his or her pain intensity. Use of the 0-10 NRS is highly recommended. Pain ratings in the 1 to 4 range have minimal impact on functional performance and are labeled “mild” pain. Ratings of 5 or 6 (“moderate” pain) indicate that pain has a greater impact on functioning. Ratings of 7 to 10 (“severe” pain) have the greatest impact on performance.[14]

The VAS consists of a horizontal or vertical line, typically 100 mm long, with each end of the line labeled with descriptors representing the range of pain intensity (eg, “no pain” and “pain as bad as can be”). The client draws a mark on the line that represents his or her pain intensity and the distance measured from the “no pain” anchor to the mark becomes that individual's pain score. It should be noted some individuals have difficulty understanding and completing the measure.[41]

For both the NRS and VAS, decreases or increases between 30% and 35% appear to indicate a meaningful change in pain. Clients tend to prefer VRSs and NRSs over VASs.[41] It has been recommended that both clinicians and researchers use the 11-point NRS so that comparisons between studies can be made.[14] When occupational therapy services were initiated for Cathy, the therapist used a NRS to determine the existence and intensity of the pain Cathy experienced on a daily basis.

Pain behaviors are often targeted in evaluation and intervention.[23] Pain behaviors include guarded movement, bracing, posturing, limping, rubbing, and facial grimacing[44] and are in response to pain, suffering, and distress. The University of Alabama Pain Behavior Scale[64] is an example of a standardized rating scale that is a reliable, valid, and easy method for documenting observable behaviors. Analysis of the client's pain behaviors before, during, and after intervention with and without a significant other present can provide valuable information about the role of situational and learned factors in the individual's pain perception, as well as responses to intervention. Healthcare utilization and medication use are additional clinically relevant pain behaviors.[74] Merskey[55] cautioned practitioners not to provide treatment for reducing pain behaviors in lieu of attempts at alleviating the pain. Evaluation that focuses solely on pain behavior may lead to the inaccurate conclusion that pain behavior suggests malingering, lack of motivation, or hypochondriasis.

The primary focus of the occupational therapist is occupational performance. The client may complete daily activity diaries as an assessment technique and outcome measure.[21] With this technique, the client records hourly entries of time spent in sitting, standing, reclining, and engaging in productive activities, and these behaviors may be corroborated by trained staff or significant others. Activity diaries are highly reliable and valid.[23]

The Brief Pain Inventory (BPI)[11] is a reliable and valid instrument that may also be used to measure pain interference. Pain interference is defined as the extent to which pain impacts daily functioning.[41] Clients rate on an ordinal scale how much their pain has interfered with general activity, mood, mobility, work, interpersonal relationships, sleep, enjoyment of life, self-care, and recreation (Box 28.2).

Box 28.2

Pain Interference Scales

A. *In the past week,* how much has pain interfered with your daily activities?

0-10 Numeric Pain Intensity Scale										
0	1	2	3	4	5	6	7	8	9	10
No interference										Unable to carry out any activities

B. *In the past week,* how much has pain interfered with your ability to take part in recreational, social, and family activities?

0-10 Numeric Pain Intensity Scale										
0	1	2	3	4	5	6	7	8	9	10
No interference										Unable to carry out any activities

C. *In the past week,* how much has pain interfered with your ability to work (including housework)?

0-10 Numeric Pain Intensity Scale										
0	1	2	3	4	5	6	7	8	9	10
No interference										Unable to carry out any activities

From National Institutes of Health, National Institute of Child Health and Human Development, National Institute of Neurological Disorders and Stroke: Ongoing research (Grant No. 1 PO1 HD/NS33988), Pain Management.

The responses are averaged to determine the pain interference score. This information may help to determine baseline tolerance levels for occupations that may be addressed in treatment. The BPI can be used with persons with disability-related pain (eg, spinal cord injury, cerebral palsy) as well as an outcome measure.[41] Similarly, the Pain Disability Index (PDI) is a brief, valid, and reliable self-report measure of general and domain-specific pain-related disability. It uses an ordinal scale to measure how disabling pain is with family/home responsibilities, recreation, social activity, occupation, sexual behavior, self-care, and life-support activity.[63]

Similarly, the Canadian Occupational Performance Measure (COPM)[45] can also be used in valid and reliable pain assessment. The COPM detects changes over time in the individual's perceptions of his or her occupational performance in the areas of self-care, productivity, and leisure, as well as the importance of being able to perform these occupations and the level of satisfaction with performance, using 10-point scales. The COPM has good evidence of concurrent criterion validity and sensitivity to change. It is especially helpful in collaborative functional goal setting.[65]

Finally, evaluation must acknowledge that cultural disparities in pain experiences exist. Differences in pain experiences have been found between whites and African Americans. For example, African Americans report a poorer quality of life with increasing levels of pain, disability, symptoms, and emotional distress as compared to whites. Women are known to report more pain than men. It should also be noted that persons with a lower socioeconomic status tend to be sicker and overall have more chronic health problems.[60] Lastly, pain frequently has been overlooked and therefore undertreated in children and the elderly.[73] These differences have been attributed to numerous causes such as limited access to healthcare and poor coping skills.

Threaded Case Study

Cathy, Part 3

Cathy had indicated that her pain and the fear associated with the pain severely limited her ability to engage in several occupations. She had not returned to work and had greatly decreased social activities. Her contact with friends was limited to infrequent phone conversations and occasionally a friend would stop by to visit. Prior to her injury she regularly went out with friends to movies and to go dancing and bowling, but she discontinued all of those activities due to the pain.

Intervention

The obligation to manage pain and relieve a client's suffering is fundamental. A multi- or interdisciplinary team approach to chronic pain is common and includes the client as an active and educated participant. The occupational therapist typically works in collaboration with the client, a physician, a psychologist, a physical therapist, and a nurse. Occupational therapy interventions focus on increasing physical capacities, productive and satisfying performance of life tasks and roles, mastery of self and environment through activities, and education.[40] As the causes of pain are multifactorial, so are the approaches to treatment. Effective pain management addresses all dimensions of pain. Typical **pain interventions** are described here.

Interventions should be introduced in a systematic manner to assess the appropriateness of the selected intervention for the specific client. The effectiveness of pain interventions can be measured and documented in a variety of ways. Clinical improvement can be measured by occupational performance (eg, BPI or COPM), increased participation (eg, diary), lower pain intensity (eg, NRS), reduction in pain behaviors (eg, University of Alabama Pain Behavior Scale), improved mood (eg, Sickness Impact Profile[5]), and decreased drug and healthcare utilization.

Medication

Medications are generally the treatment of choice for individuals experiencing acute pain and are prescribed by the physician. Occupational therapists need to observe clients for possible drug reactions. To reduce possible discomfort from rehabilitative procedures, practitioners should check that clients are adequately medicated in advance. The World Health Organization[82] analgesic ladder is well established in adult pain management as a stepwise approach for choosing an analgesic. Aspirin and acetaminophen are frequently used to treat mild pain (eg, backache) because of their high level of effectiveness, low level of toxicity, and limited abuse potential. Nonsteroidal anti-inflammatory agents have been used in the treatment of arthritis and inflammation of a musculoskeletal origin. Codeine is often used for moderate-intensity pain that has not responded adequately to aspirin or acetaminophen. Morphine is the standard medication used to relieve severe pain. The use of opioid analgesics (narcotics) in chronic nonmalignant pain has been controversial because of concerns about addiction.[36] Clear and accurate communication among the client, occupational therapist, and physician regarding responses to medications is critical to maximize the effectiveness of the entire intervention program.

Activity Tolerance

Although a few days of rest may be indicated for acute pain, therapeutic activity is important for the treatment of any underlying impairment. Activity levels are increased on a gradual basis, with the client working to "tolerance" (ie, gradual increase in task demands such as mobility, strength, and endurance), as opposed to "pain," before a scheduled rest period. The client should not initiate rest when the pain begins or exacerbates because this may reinforce pain behaviors.[24] A gradual increase in activity also lessens the likelihood of an exacerbation of pain. Fordyce[24] provided guidelines for the use of quota programs for clients with chronic pain. Regular gentle exercise (eg, walking, swimming, water aerobics) is recommended. Modalities (eg, heat or cold) may be applied before activity as a means of enhancing functional performance. When an individual is engaged in interesting and purposeful activity, he or she may be more relaxed, less preoccupied with pain, and have more fluid movement. Task selection based on occupational roles, interests, and abilities is a unique contribution of occupational therapy in pain management.[71]

Body Mechanics and Posture Training

Instruction in and rehearsal of proper body mechanics and posture that will not increase the risk of low back injury or strain are essential for clients experiencing both acute and chronic LBP.[51] The intervention plan should include opportunities to practice using the body safely and to maximize performance during routine tasks in natural (ie, home, work, or leisure) environments.[68,71] The client should be taught to avoid tasks or positions that do not allow balanced posture. For detailed guidelines on proper posture and body mechanics principles, please refer to Chapter 41. For clients in wheelchairs, the information on positioning in Chapter 11 is also helpful.

Energy Conservation, Pacing, and Joint Protection

Instruction in energy conservation, pacing, and joint protection may help clients to obtain the recommended amounts of rest during task completion, recommended time spent physically active, and balance between rest and physical activity. Clients, especially those with rheumatoid arthritis, are taught to use these strategies before they experience pain and fatigue so that occupational performance can continue as long as possible.[27]

Splinting

Splinting of the upper extremity may be necessary if contractures or muscle imbalances occur. In CRPS, static resting splints may provide pain relief. Splint use is alternated with tasks that require joints to be taken through range of motion, because total immobilization could increase pain and dysfunction. Static resting splints maintain joint alignment, reducing inflammation and pain during flare-ups of rheumatoid arthritis. Splints that support the wrist in a functional position throughout the day and night may be necessary for 4 to 6 weeks.[6] Caution is necessary because orthoses may add to the stress on proximal joints when the wrist is confined.[8]

Adaptive Equipment

Clients with acute LBP may use a back support for stabilization of the lumbar area and increased abdominal pressure to improve postural alignment. This can decrease muscle spasm, reduce pain, and improve one's ability to engage in occupations.[6,75] Adaptive equipment is often used to increase function and comfort in persons with arthritis.[70]

Relaxation

Relaxation training can decrease muscle tension, which is believed to precipitate or exacerbate pain. Progressive muscle relaxation involves the systematic tensing of major musculoskeletal groups for several seconds, passive focusing of attention on how the tensed muscles feel, and release of the muscles and passive focusing on the sensations of relaxation. As the client learns to recognize muscle tension, he or she can direct attention to inducing relaxation.[62]

Autogenic training is another means to induce relaxation. This approach involves the silent repetition of self-directed positive statements that describe the psychophysiologic aspects of relaxation (eg, "My arms and legs are warm"). The client passively concentrates on these phrases while assuming a comfortable body posture, with eyes closed, in a quiet setting. Relaxation training has been used successfully to modify a variety of chronic pain complaints, including headache, LBP, myofascial pain, arthritis, and cancer pain.[29,62]

Biofeedback

Biofeedback is the use of instrumentation to provide visual or auditory signals that indicate some change in a biologic process, such as skin temperature, as it occurs. The signals increase the client's awareness of these changes so that the changes may come under voluntary control. Biofeedback is based on the assumption that a maladaptive psychophysiologic response results in pain. Despite the questionable validity of this assumption, data do exist to support the use of biofeedback for the treatment of headache disorders, LBP, arthritis, myofascial pain, and CRPS.[29] Biofeedback for pain control is typically used in conjunction with relaxation training.

Distraction

Distraction is often used to divert an individual's attention and concentration away from acute mild-to-moderate intensity pain and reduce distress, especially during medical and rehabilitative procedures. Distraction may have an internal focus (eg, daydreaming, guided imagery) or an external focus (eg, listening to music, watching television).[38]

Therapeutic Modalities

Occupational therapists may use physical agent modalities (PAMs) as adjuncts to or in preparation for purposeful activities. Appropriate postprofessional education is needed to ensure that the practitioner is competent in the use of these modalities (see Chapter 29). Both heat and ice can reduce pain and muscle spasm of musculoskeletal and neurologic pathologies. Superficial heat includes hot packs, heating pads, paraffin wax, fluidotherapy, hydrotherapy, whirlpool, and heat lamps. The application of heat increases local metabolism and circulation. Vasoconstriction occurs initially, followed by vasodilatation resulting in muscle relaxation. The use of heat is indicated in the treatment of subacute and chronic traumatic and inflammatory conditions such as muscle spasms, arthritis of the small joints of the hands and feet, tendonitis, and bursitis.[7,22,47]

The use of heat is contraindicated for clients who have acute inflammatory conditions, cardiac insufficiency, malignancies, or peripheral vascular disease. Preexisting edema may be aggravated with the application of heat. It should not be used for clients who are insensate. Heat may cause malignancies to spread.[52]

Cold can help a client to control pain by elevating the pain threshold (ie, the minimal level of noxious stimulation at which the client first reports pain). Local vasoconstriction occurs in direct response to cold therapy (cryotherapy). When the area is subsequently exposed to air, vasodilatation occurs. Cold applications also decrease local metabolism, slow nerve conduction velocity, diminish muscle spasm secondary to joint or skeletal pathologic conditions and spasticity, decrease edema, and lessen tissue damage. Cold can be applied via commercial packs, sprays, ice cups, or a massage stick.[7,47]

There are several contraindications to the use of cryotherapy. Clients who are extremely sensitive may not be able to tolerate cold. If a client has a history of frostbite in the area to be treated, another modality must be used. If a client has Raynaud's disease, severe pain may occur in the treated area. Cryotherapy is contraindicated in the very young and elderly because their thermoregulatory responses may not function sufficiently.[22]

Transcutaneous Electrical Nerve Stimulation

Transcutaneous electrical nerve stimulation (TENS) is a noninvasive pain relief measure that uses cutaneous stimulation. A TENS unit consists of a battery-powered generator that sends a mild electrical current through electrodes placed on the skin at or near the pain site, stimulating A fibers. Some success has been demonstrated when using TENS to relieve acute and chronic painful conditions caused by disease or injury of nervous system structures or the skeleton, muscle pain of ischemic origin in the extremities, and angina pectoris.[67]

Relapse Management

Clients with chronic pain frequently experience a flare-up or an exacerbation of pain. During the flare-up the client is typically encouraged to reduce aerobic conditioning exercises (eg, walking, stationary biking, swimming). As pain subsides, activity can be added incrementally.[25] The client should be encouraged to increase his or her use of pain coping and self-management strategies throughout the flare-up.[19]

Threaded Case Study

Cathy, Part 4

The occupational therapy intervention program for Cathy considered her active lifestyle prior to the injury and began with simple activities such as accompanying a friend to a local shopping mall and walking in the complex. The occupational therapist helped Cathy plan the outing by suggesting that the walk occur during a weekday evening instead of on busy weekends and that Cathy take frequent breaks during the initial walk to sit on one of the benches provided within the mall.

Cathy employed energy conservation and pacing throughout her daily life and was able to return to many previous occupations. For example, she was able to do her laundry by using a portable table to hold the laundry basket when putting the clothes in her top-loading washer. She also used the table when she transferred the clothes from the washer to the side-opening dryer.

Relaxation strategies allowed Cathy to regain a bit of her old self. When out shopping with friends she would often pause briefly and appear to be studying a clothing item while using the relaxation strategies rehearsed during her occupational therapy sessions. This allowed her to continue with the outing.

Summary

Pain is a complex phenomenon. Occupational therapists bring their understanding of anatomy, physiology, kinesiology, psychology, and function to the comprehensive evaluation and treatment of the client with pain. Interventions focus on relieving pain, improving occupational performance, and developing coping strategies. Data are needed to support the use of the OT interventions described in this chapter.

Review Questions

1. Contrast acute pain and chronic pain.
2. List and describe two different pain syndromes that may be present in persons referred for occupational therapy.
3. Identify the essential elements of a pain assessment.
4. Explain at least six interventions used in the treatment of pain.
5. Describe the role and define the scope of occupational therapy in the evaluation and treatment of pain.

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PART V

The Occupational Therapy Process: Implementation of Intervention

OUTLINE

29

Therapeutic Occupations and Modalities

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CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Recognize and differentiate occupation, activity, preparatory methods, and preparatory tasks as they relate to intervention choices.
2. Discuss the role of occupational analysis and activity analysis in the selection of intervention strategies.
3. Understand the similarities and distinctions between therapeutic activity and therapeutic exercise as intervention strategies.
4. Describe how grading and adapting intervention choices heighten occupational performance.
5. Describe how occupation, activity, preparatory methods, and preparatory tasks are used in practice in different contexts through case study exploration.
6. Differentiate between the various types of therapeutic exercise as intervention strategies.
7. Describe how and why preparatory methods, such as PAMs, are used in occupational therapy practice.
8. Identify the role of physical agent modalities in occupational therapy practice.
9. Identify the requirements established by the American Occupational Therapy Association for the use of physical agent modalities in occupational therapy practice.

KEY TERMS

Adapting
Grading
Occupation
Physical agent modalities
Preparatory methods
Preparatory tasks
Therapeutic activity
Therapeutic exercise

Case Study

Fareed

Fareed is a 66-year-old, semiretired (working part time) bookkeeper whose primary diagnosis is s/p right CVA. The stroke resulted in his hospitalization and subsequent admission to a subacute facility. He has a past medical history of hypertension and prostate cancer, and he has exhibited reactive depression since his recent hospitalization.

Prior to this recent hospitalization, Fareed lived with his wife in a private two-story home in a suburban neighborhood. One of his children lives in a nearby town and visits weekly. His other two children and their families live in cities within a day's drive and visit several times a year. Since his change to semiretirement and working part time as a bookkeeper, Fareed has developed or expanded several interests, including woodworking, gardening, cooking, and traveling. He also enjoyed communicating with his grandchildren through interactive computer sites. He and his wife have taken a yearly vacation, traveling to various locations in the United States for periods of 3 weeks since his semiretirement. Fareed had also been responsible for managing the family's finances. In all, Fareed had an active schedule and was engaged in varied occupations before his recent hospitalization.

The initial evaluation in the subacute facility revealed that Fareed is dependent in dressing and bathing. He requires set-up for mealtimes (eg, opening containers, positioning the tray, and cutting foods as needed). Once set up Fareed was independent to feed himself using a spoon and a fork; he requires assistance with cutting. He is also independent with drinking from a cup. He exhibits a mild left visual field cut.

He requires moderate assistance for bed mobility. Results of the Berg Balance Scale indicate that Fareed is able to move from sit to stand with minimal assistance to stand or stabilize, and one person minimum (min) assist to complete a stand pivot transfer. He is able to sit unsupported at the edge of the bed with arms folded for up to 30 seconds. When interacting with the environment, he requires min assist to maintain his balance. Fareed requires several attempts to maintain a standing position for 30 seconds unsupported. When engaging in occupations, he requires min assist from another person to maintain dynamic standing balance.

Evaluation of upper extremity function revealed residual shoulder and hand pain of his left upper extremity (LUE). Fareed's range of motion (ROM) and strength are within normal limits in his right upper extremity (RUE). In the LUE he has limited active and passive ROM of the shoulder, with pain on passive flexion of the left shoulder at the end of the range. Active ROM is limited in the LUE, but Fareed is able to use a gross grasp with assistance to open his fingers secondary to increased tone. He is able to pronate his forearm, flex the elbow, and internally rotate the shoulder with a gross manual muscle grade of 3/5. Although his prospects for recovery are positive, Fareed expresses feelings of grief over his loss of function and discouragement about regaining his ability to resume his independence, roles, and occupations.

The focus of occupational therapy (OT) intervention included the following:

- Prepare Fareed and family with skills needed for him to return home through client and family education
- Engage in meaningful occupations to reduce feelings of grief over his loss of function and discouragement
- Adapt and grade occupations and activities
- Reduce pain associated with movement to enable use of LUE in occupations through the use of preparatory methods and modalities
- Increase ROM and strength of LUE to facilitate occupational performance in activities of daily living (ADLs), leisure, and work
- Improve balance and mobility through participation in occupations and activities to facilitate occupational performance in ADLs, leisure, and work
- Prepare Fareed to resume occupations and social participation with family, friends, and coworkers

Critical Thinking Questions

1. Identify occupations Fareed engaged in before his stroke, those he engaged in during intervention, and those he assumed or resumed. Describe how his progress relied on evaluation of his occupational performance.
2. Explore the contextual factors that influence Fareed in resuming preferred activities. Describe roles he resumed because of these influences.
3. Describe how the occupations and activities in which Fareed engaged could be graded and/or adapted to provide an interface between activity demands and client factors.

Occupational Therapy Intervention

OTPF-3 as the Foundation for Intervention Planning and Implementation

In 2014 the American Occupational Therapy Association (AOTA) developed the third edition of the "Occupational Therapy Practice Framework: Domain and Process"[1] (OTPF-3), a document that describes OT practice. The Framework contains two sections, the first of which is the domain, describing the profession's purview and the areas in which OT practitioners have established knowledge and expertise. The second area of the Framework is the process, which describes "the actions practitioners take when providing services that are client centered and focused on engagement in occupations"[1] (OTPF-3, p. S3). This chapter will focus primarily on aspects of intervention related to the process of occupational therapy.

Occupation

Occupation is the foundation of OT practice. **Occupations** may include personal care, caregiving, leisure occupations (eg, reading, bowling, games, or crafting), schoolwork (including the use of technology such as computers and iPads), work, and vocational pursuits. In support of engagement in a variety of occupations, Wilcox[35] states that "a varied and full occupational lifestyle will coincidentally maintain and improve health and well-being if it allows people to be creative and adventurous physically, mentally, and socially."

When clients face a physical disability and occupational performance becomes impaired, the OT practitioner works with clients to regain skills, using occupation as both means and ends. Trombly[33] describes occupation as end as "not only purposeful but also meaningful because it is the performance of activities or tasks that a person sees as important." Gillen[11] refers to this as the use of occupations that are the end product of the intervention. For example, an intervention focused on improving a client's ability to complete a meal for his or her family would be considered an end product. Occupation as means "refers to occupation acting as the therapeutic change agent to remediate impaired abilities or capacities."[33] For example, cooking (mixing and stirring) may be used to improve shoulder ROM and strength for a client who enjoys cooking.

Ultimately the focus of OT intervention is to design intervention that enables clients to assume or resume their ability to engage in their desired life occupations. The needs and interests of clients guide the selection of occupations used as intervention in therapy. These needs are often governed by the roles clients play in their worlds. The clients' needs and interests are tied to the societies in which they live. In a society in which independence, leisure, and work are all valued, the interests of clients are variable and include self-care, hobbies, and work-related tasks. As such, OT practitioners must remember that clients have an inner drive to engage in occupations beyond self-care or self-maintenance, which Tubbs and Drake[34] point out is too often the starting and stopping point of most traditional rehab programs. As OT practitioners working with clients with physical dysfunction, it is important to have a broad focus with regard to the scope of intervention.

Relationships Among Person, Environment, and Occupation as They Relate to Intervention Choices

There are many factors that OT practitioners address as a part of the intervention planning process. Occupational therapists complete a thorough analysis of each client's interests and abilities and the contexts within which they engage in occupations. Intervention choices are based on this analysis and may target aspects of the person, the environment or context, and/or occupations themselves. Intervention decisions should be made in collaboration with the client, family, and other important people in the client's life as appropriate and as feasible.

Aspects of the person that may influence the OT process include the client's values, beliefs, and spirituality.[1] What a client values or believes about his or her health, sense of purpose or meaning, and roles in life, for example, will be important factors for the OT practitioner to understand in terms of how these factors will influence intervention choices. In addition, understanding how a diagnosis or disease process may influence the client's body functions and body structures will affect intervention decisions. For example, in the case study, given Fareed's limitations in ROM of his left upper extremity, it will be important to assess the structure of the shoulder girdle as it relates to joint ROM at the shoulder.

OT practitioners will also assess the client's performance skills within a variety of occupations, depending on the setting in which he or she practices. Occupations within an acute care setting may differ from those within a home health setting, based on the client's goals and his or her health status. The Framework describes performance skills as “goal directed actions that are observable as small units of engagement in daily life occupations”[1] (OTPF-3, p. S7). In the case study, Fareed demonstrates concerns in the area of motor performance skills, such as stabilizing and positioning, reaching and grasping, and moving about his environment. Performance skill deficits may exist in many different areas, including motor and process skills. It is also important in planning intervention to consider what performance skills may be assets for the client in regard to his or her recovery and participation in OT intervention. Performance skills that assist Fareed in his recovery include motor skills in his right upper extremity and social interaction skills.

Aspects of the environment that may influence intervention include the physical and the social environment.[1] In addition to environment, OT practitioners consider contextual factors, such as cultural, personal, temporal, and virtual contexts. Environmental influences to consider for Fareed include the accessibility of his home, given the two stories; his workplace environment; and the many facets of his social support. Examples of contextual factors to consider include Fareed's previous experience with computer use for communication, his age, and any spiritual considerations as a part of his culture.

How various factors come together to support or inhibit a client's participation in desired and meaningful occupations is at the center of OT practice. As such, OT practitioners need to develop a wide range of skills related to understanding and facilitating participation and engagement in a variety of occupations across the lifespan and across multiple contexts. For persons with disabilities, participation may require relearning skills, learning new skills, or learning to perform activities in new ways. Therefore, the OT practitioner must be prepared with a broad knowledge of occupations, activities, and techniques that may be used as intervention strategies in a client-centered approach.

Types of Occupational Therapy Intervention

1. Occupations are described as "client-directed daily life activities that match and support or address identified participation goals"[1] (OTPF-3, p. S29). An occupation focus for Fareed might include a focus on his prior independence with self-care, his bookkeeping work, and his leisure interests, including gardening, cooking, traveling, and woodworking.

2. Activities are described as "actions designed and selected to support the development of performance skills and performance patterns to enhance occupational engagement. Activities often are components of occupations and always hold meaning, relevance, and perceived utility for clients at their level of interest and motivation"[1] (OTPF-3, p. S29).

3. Preparatory tasks are described as "actions selected and provided to the client to target specific client factors or performance skills"[1] (OTPF-3, p. S30). In preparatory tasks the client is an active participant. These tasks may simulate aspects of occupation but on their own do not necessarily hold meaning or relevance to the client.[1]

4. Preparatory methods are described as "modalities, devices, and techniques to prepare the client for occupational performance"[1] (OTPF-3, p. S29). Preparatory methods typically do not require the client's active participation but are done by the therapist to support the client's participation or engagement in the intervention process. Application of hot or cold packs at the beginning of a treatment session is an example of a preparatory method as part of an intervention plan. As an example with Fareed, before beginning the activity, to reduce pain in his LUE and improve his tolerance for movement, the OT practitioner applied heat to his shoulder using hot packs as a preparatory method of intervention.

5. Education is described as "imparting of knowledge and information about occupation, health, well-being, and participation that enables the client to acquire helpful behaviors, habits, and routines that may or may not require application at the time of the intervention session"[1] (OTPF-3, p. S30).

6. Training is described as "facilitation of the acquisition of concrete skills for meeting specific goals in a real-life, applied situation"[1] (OTPF-3, p. S30).

7. Advocacy is described as "efforts directed toward promoting occupational justice and empowering clients to seek and obtain resources to fully participate in daily life occupations"[1] (OTPF-3, p. S30).

Occupational Analysis and Activity Analysis

Participation in everyday occupation is quite complex when one stops to consider all the aspects that must work smoothly together to be successful. Careful analysis is essential to the selection of appropriate intervention strategies. Analysis should yield information about various occupations and activities as potential intervention strategies for addressing physical dysfunction and facilitating health and wellness. As discussed previously, analysis as a part of intervention planning should be done at the person level, the environment level, and finally the occupation level.

Activity analysis and occupational analysis are important for many reasons. Baum and Christiansen[3] state that "people are naturally motivated to explore their world and demonstrate mastery within it." They go on to state that "situations in which people experience success help them feel good about themselves." Analysis of clients' desired occupations will allow practitioners to create intervention sessions that motivate their clients and help clients experience success. Having done the analysis, practitioners can anticipate and address potential barriers at the person level and the environment level to facilitate self-efficacy in their clients. When people perceive themselves as competent and capable, they are more likely to want to continue to participate in the therapy process.[3] A thorough analysis facilitates OT practitioners' abilities to design and implement intervention strategies that help clients engage or reengage in occupations, roles, and routines that are meaningful and valuable to everyday life.

Occupational and activity analyses facilitate the ability to understand the complex nature of the things we do on a daily basis. For example, understanding the interaction of multiple factors is needed for Fareed to return to his prior level of function in self-care or his computer skills to stay in touch with his family. In addition, this type of analysis allows practitioners to consider the potential meaning that occupations have for clients. As such, intervention choices cannot be chosen or designed without careful and thorough analysis, the process of looking at all the components and requirements of an activity/occupation, and synthesis, the process of combining all of those factors to facilitate performance.[14]

Activity Analysis

Activity analysis considers activities and tasks in the abstract, or how these things might be done within a certain culture or a given situation.[1,6] Through activity analysis, OT practitioners can begin to anticipate what may facilitate a client's performance and participation. OT practitioners can anticipate where barriers to performance and participation may exist and, through careful selection of intervention strategies, can increase the likelihood of a "just right challenge" for the client in intervention.[32] The just right challenge occurs when OT practitioners design interventions that challenge the client just enough so that he or she does not become bored or does not see the need for therapy, but the challenge does not result in the client feeling defeated or a loss of self-efficacy. Completing a general analysis of a variety of activities and tasks allows OT practitioners to prepare options and generate ideas/strategies that may or may not work for clients. Additionally, it provides practitioners with a starting point from which they can then individualize assessment, intervention, and discharge plans. Thomas[32] states that activity analysis can help us to:

- Determine what equipment, materials, space, and time are needed for the activity
- Consider how we might prepare for instructing another by having knowledge of the steps involved in the activity
- Think about how the activity might be therapeutic and for what type of client
- Consider grading and or adapting the activity for greater success
- Identify options for clear documentation
- Think about how context might influence performance
- Consider the just right challenge
- Consider where the client may need help or where he or she will most likely do well

Occupational analysis, in contrast to activity analysis, helps OT practitioners understand the specific situation of the client with whom they are working.[6] In occupational analysis the practitioner considers several questions: What the client wants or needs to do, how he or she did things before coming to occupational therapy, what he or she feels has changed, what environments are typical for the occupations, and where the client envisions occupations taking place in the future. Occupational analysis is about how the individual engages in his or her daily life. Once OT practitioners have completed the analysis, the next step in designing appropriate intervention is to determine how to structure the intervention strategies to facilitate improvement and participation. One way to do this is through grading and adapting of intervention strategies.

Grading and Adapting Occupations and Activities

Grading and adapting of occupations, activities, and preparatory tasks is the crossroad where client-centered practice and clinical reasoning meet. The overall goal of **grading** is to find the just right challenge for the client; that is, one that encourages progress without causing the person to become frustrated or lose self-efficacy, but at the same time creates enough challenge so that the client does not become bored, lose interest, or fail to see the value in participating in the OT session. The overall goal of **adapting** a client's participation in an occupation or activity is to increase the individual's performance within that occupation or activity.

Adapting (Compensating)

As stated previously, the overall goal of adapting, or compensating, an intervention strategy is to change the occupation or activity to enable a client to continue to participate in that valued occupation and/or activity. When practitioners adapt an activity or occupation, the intent is to allow for greater participation and independence within the chosen occupation.

The use of adaptation as an intervention strategy requires flexibility on the part of the clinician and the client. Some clients will not want to participate in an occupation if they cannot do so the way they have always participated, "their typical way." For some this means that they may continue to participate in a way that increases their symptoms; for others it may mean that they will give up valued occupations. One concern OT practitioners have is being aware of clients' safety if they choose to continue with previous patterns.

Adaptations to occupations must maintain the intrinsic value and meaning for the client. Many clients will find meaning in new occupations once they see what is possible. In the OTPF-3,[1] adapting is also seen as modifying or compensating.

It may be necessary to adapt activities to suit the special needs of the client or the environment. An occupation may have to be performed in a special way to accommodate the client's abilities; for example, eating using a special orthosis with a utensil holder fitted to the hand (Fig. 29.1). An occupation may have to be adapted to the positioning of the client or to the environment; for instance, by setting up a special reading stand and providing prism glasses to enable a client to read while supine in bed. The problem-solving ability, creativity, and ingenuity of OT practitioners in making adaptations are some of their unique skills.

FIG 29.1 Eating with a special orthosis using a utensil holder fitted to the hand.

Practitioners should remember that for adaptations to be effective, the OT practitioner should collaborate with the client to develop adaptations that will be most applicable to his or her situation. The client must understand the need and purpose of the activity and the adaptations and must be willing to perform the activity with the simple modifications. Complicated adaptations that require frequent adjustment and modification should be avoided.[27,30] In most cases simpler adaptations are more useful for the client compared to complicated adaptations. The complexity of the adaptation must be decided with the client, not for the client.

Grading (Remediating)

The overall goal of grading is to "increase or decrease the activity demands on the person while he or she is performing an activity."[32] Grading participation or engagement in an occupation or activity within your intervention allows for the just right challenge.[32] As such, OT practitioners grade the client's participation incrementally. Grading allows for the development of skills while at the same time assuring the client's success within individual sessions. In other words, grading refers to structuring an activity such that the challenge or demand will gradually facilitate improvement in the client's function and participation. It may be necessary to start by making an intervention strategy easier. There is no one correct way to grade an occupation or activity because multiple factors can be considered in terms of how participation is graded. The clients' goals, current level of function, and the occupational model or frame of reference a therapist uses will help determine how and what aspects of the occupation or activity are graded within intervention choices.

How does a practitioner begin to grade an intervention strategy? First, the practitioner needs to understand the strengths and needs of the client. Second, the practitioner needs to thoroughly understand the multiple demands of the chosen intervention. Finally, there is the need to determine what factors support the client's participation and what factors hinder his or her participation. In the OTPF-3, grading may also be seen as establishing, restoring, or remediating a skill.[1]

Grading Down

When choosing to "grade down," the OT practitioner seeks to make components or aspects of an intervention strategy easier for the client. For an adult experiencing difficulty with clothing fasteners secondary to muscle weakness or incoordination, the strategy may be to use pull-on clothing or clothing items with large fasteners (eg, large buttons), making it easier for the client to hold and manipulate the button through the buttonhole. For a client with muscle weakness due to a long-term hospitalization, the OT practitioner may begin morning ADLs at the bedside, as opposed to the bathroom, to conserve strength and energy. These are both examples of grading to make participation easier for a client the therapy practitioner believes has the potential to work up to a higher level of skill within these occupations.

Grading Up

When choosing to "grade up," the OT practitioner seeks to make components or aspects of an intervention more challenging for the client. A client recovering from a post-traumatic brain injury who demonstrates the ability to make decisions about meal choices in a quiet clinic environment from a set menu with limited choice needs to be able to do so in the community. To grade up, the intervention session moves from the clinic to working on making meal choices in the hospital cafeteria or a local restaurant, where choices are greater and the client must deal with multiple factors. This is a busier and more complex environment, thereby increasing the demands on the client. An additional example might be the case of a client with decreased activity tolerance who heretofore has been dressing at the bedside, with all items arranged for him or her. The OT practitioner now changes the intervention's focus to work on accessing clothing from the closet and carrying clothing items to a chair beside the bed to increase the demands on the client, with the expectation that he or she will be able to improve his or her level of function.

Caution!

When grading an intervention, be sure you don't grade down to the extent that the client is not engaged, challenged, or motivated. Conversely, be sure not to grade up such that the client experiences unnecessary struggles, resulting in frustration, a loss of self-efficacy, or loss of motivation. In addition, select only one or two aspects to grade within the occupation/activity at any one time. Grading or changing too many aspects of any intervention/occupation will make it difficult to know what is working or not working as the practitioner documents the client's progress. The example of the client working on meal choices first in the therapy setting and then in the hospital cafeteria or community may change too many parts of the task at one time. If the client is asked to work on making choices in a quiet, therapy setting while seated, the task demands are limited compared to maneuvering through a hospital cafeteria or restaurant and making choices for a meal. This client might be experiencing difficulties not only with meal choice, but also with mobility, following directions, balance, or sensory integration concerns. It then becomes difficult to determine which factor to grade for improved performance. The practitioner needs to know that he or she is confident the client can handle the other factors that have changed in the context. This is where the connection between activity/occupational analysis and grading and adapting becomes most apparent.

Examples of Grading

Strength

Strength may be graded by an increase or decrease in resistance. Methods to modify the resistance for strengthening can include changing the plane of movement from gravity eliminated to gravity minimized to against gravity; by adding weights to the equipment or to the client, or by using tools of increasing weights. For example, a weight attached to the wrist by a strap increases resistance to arm movements during needlework or leatherwork (Fig. 29.2) to improve muscle strength while engaged in occupation. When grasp strength is inadequate, grasp mitts may be used to fasten the hand to a tool or equipment handle to assist grip strength and allow arm motion.

FIG 29.2 Weight attached to the wrist increases resistance during needlework or crocheting.

Range of Motion

Activities for increasing or maintaining joint ROM may be graded by positioning materials and equipment to demand greater reach or excursion of joints. As the work progresses, the activity itself establishes increased demands on active range. Positioning objects, such as dominos used in a game, at increasing or decreasing distances from the client changes the range needed to reach the materials (Fig. 29.3). Tool handles, such as those used in eating or painting, may be increased in size by padding the handle with foam tubing to accommodate limited ROM or to facilitate grasp for clients the practitioner believes will gain ROM as they progress in therapy (Fig. 29.4). Reducing the amount of padding as range or grasp improves is an example of grading up, changing the participation to require increased range of motion as ROM becomes available to the client. Reaching for clothing items hung in a closet as opposed to items in a bureau drawer can be used to increase a client's shoulder ROM.

FIG 29.3 Placing objects at alternate distances changes the range needed to reach materials.

FIG 29.4 The size of tool handles may be increased by padding the handle with foam tubing.

Endurance and Tolerance

Endurance may be graded by moving from light to heavy work and increasing the duration of the work period. Standing and walking tolerance may be graded by an increase in the time spent standing to work, perhaps at first at a standing table (Fig. 29.5), and an increase in the time and distance spent in activities requiring walking, such as home management and gardening activities. Medical conditions that are progressively degenerative, such as muscular dystrophy, multiple sclerosis, or Parkinson's disease, require grading endurance task demands down to make aspects of participation easier for the client. The practitioner and client may decide to begin by discussing how to adapt participation instead of changing participation to an occupation or activity that requires less effort.

FIG 29.5 Midland Electric Stand-In Table. Four-point support system stabilizes clients at the feet, knees, buttocks, and chest. (Courtesy Performance Health, Warrenville, IL.)

Coordination

Coordination and muscle control may be graded by decreasing the gross resistive movements and increasing the fine controlled movements required. An example for a client with an interest in craftsmanship is progressing from sawing wood with a crosscut saw to using a jeweler's saw. Dexterity and speed of movement may be graded by practicing at increasing speeds once movement patterns have been mastered through coordination training and neuromuscular education. OTs may wish to consider aspects of motor control theory (see Chapter 19) as a way to grade the demands on motor coordination within participation.

Perceptual, Cognitive, and Social Skills

In grading cognitive skills, the practitioner can begin the treatment program with simple one- or two-step activities that require minimal judgment, decision making, or problem solving and progress to activities with several steps that require some judgment or problem-solving processes. A client in a lunch preparation group may butter bread that has already been placed on the work surface. This task could be graded to increase task demands by asking the client to position the bread, butter it, and place a slice of lunch meat on it, and, ultimately, to make several sandwiches.

For grading social interaction, the intervention plan may begin with an activity that demands interaction only with the OT practitioner. The client can progress to activities that require dyadic interaction with another client and, ultimately, to small group activities. The practitioner can facilitate the client's progression from the role of observer to that of participant and then to leader. At the same time, the practitioner decreases his or her supervision, guidance, and assistance to facilitate more independent functioning in the client.

There are a number of factors that influence the decision to adapt or grade intervention strategies to support a client's occupational performance. Knowing the client's desired outcomes and understanding the client's ability to change may determine whether the OT practitioner grades or adapts. If there is a belief that the client's condition can change for the better or the diagnosis is static in nature, the choice may be to grade participation with increasing demands. If it is determined that the client's condition will likely not improve, the decision may be to adapt participation. The OT practitioner, in collaboration with the client, will determine the client's interest in new ways of participating in previous occupations through adaptation. The OT practitioner may choose to adapt if the client's skill level is not likely to change or change in the near future or if the diagnosis is degenerative in nature. The choice to grade or adapt may also depend on the length of time established for the client's OT services. If there are multiple visits, the goal may be to grade participation as improvements occur. If there are limited visits, the decision may be made to adapt for safety or independence within an occupation.

The second half of this chapter will focus on the intervention strategies of preparatory tasks and preparatory methods, more specifically the topics of therapeutic exercise, therapeutic activity, and physical agent modalities. The concepts of analysis, grading, and adapting can be applied to all of these intervention strategies.

Preparatory Tasks and Preparatory Methods

Preparatory tasks and preparatory methods are used by the OT practitioner to prepare the client for occupational performance. **Preparatory tasks** are carefully selected to address or remediate client factors or performance skills that the OT practitioner and the client have identified as barriers to the client's desired occupational performance. Preparatory tasks typically include active client participation and occur in a clinical or simulated setting. Examples of preparatory tasks may include using resistive Thera-Bands to increase strength, performing active stretching to restore ROM, opening and closing various-sized jars to improve hand strength and dexterity, or folding and sorting towels on a linen cart.

Preparatory methods are also used to prepare the client for occupational performance. The main difference between preparatory tasks and preparatory methods is that the client is typically passive during the administration of preparatory methods. An example of a preparatory method is the application of heat to prepare soft tissue for movement or stretch. Other examples of preparatory methods may include the use of physical agent modalities, such as paraffin or ultrasound, to influence soft tissue extensibility and prepare muscles for stretch or movement; the application of a mechanical device, such as a continuous passive motion machine to restore ROM and improve flexibility; and the use of various manual techniques to prepare the client for occupational performance, such as manual edema mobilization or manual lymphatic drainage.

The following sections will further discuss the use of preparatory tasks such as therapeutic exercise and therapeutic activity. Additionally, preparatory methods, which include physical agent modalities, manual interventions, and the application of mechanical devices and orthoses, will be discussed.

Preparatory Tasks: Therapeutic Exercise and Therapeutic Activity

Therapeutic exercise and **therapeutic activity** are preparatory tasks that often complement one another in a single intervention plan. Therapeutic exercises and therapeutic activities are used to remediate sensory and motor dysfunction and augment purposeful activity. It is important to remember that preparatory tasks, such as exercise and simulated activities, are used to prepare the client for occupational engagement and should always be performed in connection with the restoration of the client's desired occupations.

In practice, therapeutic exercise and therapeutic activities are considered to be different therapeutic approaches and are coded and billed differently. Although both are preparatory tasks as defined by the OTPF-3, they take on slightly different meanings clinically. The term therapeutic exercise usually describes interventions that are used to develop strength and endurance, ROM, and flexibility. Therapeutic activity usually describes dynamic activities to improve functional performance. Therapeutic exercises tend to include rote exercises, such as resistive Thera-Band exercises or pinching Theraputty. Therapeutic activities tend to include simulated occupations or components of occupations. For example, pinching clothespins to improve finger strength or manipulating coins to improve dexterity. In both of these examples, the activities performed are possible components of large occupations, such as the instrumental daily activities (IADLs) of laundry and manipulating money while paying for items at a store.

The occupational therapist must have a comprehensive understanding of the principles of kinesiology and exercise physiology in order to develop and apply therapeutic exercise and therapeutic activity. Therapeutic exercise and therapeutic activities are carefully selected to target body movements and/or muscle actions in order to prevent or correct a physical impairment, improve musculoskeletal function, and maintain a state of well-being.[19] A wide variety of exercise options is available, and each should be tailored to meet the goals of the intervention plan and the specific capacities and precautions relative to the client's physical condition.

Purposes

The general purposes of therapeutic exercise and therapeutic activity are:

- To develop or restore normal movement patterns and improve voluntary, automatic movement responses
- To develop or restore strength and endurance in patterns of movement that are acceptable and necessary and do not produce deformity
- To improve, develop, or restore coordination
- To increase muscle power
- To increase muscle endurance
- To remediate ROM deficits
- To increase work tolerance and physical endurance through increased strength
- To prevent or eliminate contractures

Indications for Use

Therapeutic exercises and therapeutic activities can be implemented when the client is experiencing limitations in ROM, decreased strength, decreased coordination, and/or decreased endurance. These deficits may be observed in orthopedic disorders resulting in contractures and arthritis and in lower motor neuron disorders that produce weakness and flaccidity. Examples of the latter are peripheral nerve injuries and diseases, Guillain-Barré syndrome, infectious neuritis, and spinal cord injuries and diseases.

The candidate for therapeutic exercise must be medically able to participate in the exercise regimen, able to understand the directions and purposes, and interested and motivated to perform the exercise. The client must have available motor pathways and the potential for recovery or improvement of strength, ROM, coordination, or movement patterns, as applicable. Some sensory feedback must be available to the client; that is, sensation must be at least partially intact so that the client can perceive motion and the position of the exercised part and sense superficial and deep pain. Muscles and tendons must be intact, stable, and free to move. Joints must be able to move through an effective ROM for those types of exercise that use joint motion. The client should be relatively free of pain during motion and should be able to perform isolated, coordinated movement. The type of exercise selected depends on the client's muscle grade, muscle endurance, joint mobility, diagnosis and physical condition, treatment goals, position of the client, and desirable plane of movement.

Contraindications

Therapeutic exercise and therapeutic activity are contraindicated for clients who are in a fragile medical state. Other contraindications include, but are not limited to, recent joint surgery, recent tendon or nerve repair, inflamed joints, and certain cardiopulmonary diagnoses and surgical interventions. Therapeutic exercise and therapeutic activities may not be useful where joint ROM is severely limited, as in the case of a long-standing, permanent contracture. Careful consideration is required to determine the appropriateness of the use of therapeutic exercise and therapeutic activities with those who have severe spasticity and severe lack of controlled movement. If the motor control in such cases is severely impaired, the therapeutic exercise or therapeutic activity cannot be executed in a controlled fashion, and therefore benefit from engagement in the preparatory task will not be gained.

Exercise Programs

Progression of Exercise Programs

If a client lacks both ROM and strength, it is important that the therapeutic exercise program focus on restoration of the available joint ROM prior to emphasis on progressive strengthening. When therapeutic exercises and therapeutic activities are performed, the most effective strength benefit will be gained if the individual is able to exercise the muscle or muscles through the full range of motion. Therefore, the progression of therapeutic exercises and therapeutic activities begins with resolution of ROM deficits and then progresses to muscle strength and endurance. The emphasis on improving coordinated movement occurs last in this progression because the individual would have to be able to move freely (resolution of ROM deficits) and be able to tolerate movement (muscle strength and endurance) prior to achieving the ability to develop or improve coordinated movement.

Range of Motion and Joint Flexibility

There are three main types of movement the OT practitioner may use to improve or maintain joint ROM and flexibility. The three main types of movement include passive ROM, active-assistive ROM, and active ROM.

Passive range of motion (PROM) occurs when the client does not exert any effort to move independently, but rather an outside force, typically the OT practitioner, moves the client's body segment for him or her. The purpose of PROM is to improve or maintain joint ROM and to prevent joint contracture or capsular adhesion. During PROM no muscle contraction occurs within the body segment being moved, either because the client is unable to generate a muscle contraction independently (muscle grade 0 or 1) or because it is contraindicated for the client to produce muscle force and/or active movement because generation of muscle force could cause damage to intracapsular or extracapsular joint structures (as in the case of tendon repair or rotator cuff repair). Passive range of motion may be performed in several different ways. First, PROM may be performed when the therapist moves the client's body part through the range of motion. The joint proximal to the joint being exercised should be stabilized during the procedure (Fig. 29.6). Next, the client may perform self-initiated PROM. During self-initiated PROM, the client uses the unaffected extremity to move the affected extremity when no active movement of the affected extremity is available or permitted. Our case study client, Fareed, would be able to support his LUE with his RUE and gently perform PROM to his left shoulder. Last, PROM may be performed by an external mechanical force, such as a continuous passive motion (CPM) machine. A CPM machine is an electrically powered mechanical device that is attached to the client's affected extremity and moves the extremity through a preset ROM. A CPM machine is considered to be a preparatory method that is used when a client is unable to generate active muscle force independently or when it is contraindicated for the client to generate internal active muscle force. It is important to note that the use of such a mechanical device requires skillful application and careful monitoring, which are achieved through specialized training.

FIG 29.6 Passive exercise of the wrist with stabilization of the joint proximal to the one being exercised.

Active-assistive range of motion (AAROM) occurs when the client is able and permitted to move the affected extremity under his or her own muscle power but requires the assistance of an outside force to complete the range of motion. The outside force needed to complete the ROM may be provided by the therapist or by the client's unaffected extremity. As Fareed gains control over his LUE, the support provided by his RUE can be reduced. The outside force needed to complete the ROM may also be provided by a mechanical device or external force, such as pulleys.

Active range of motion (AROM) is performed when the client is able to generate enough muscle force to independently move the extremity through the range of motion without the assistance of an outside force. AROM is performed when the client is able to generate muscle force independently and when generating internal muscle force is not contraindicated. AROM can be used to maintain full joint ROM.

Active and Passive Stretch

If the OT practitioner determines that the client has limited joint ROM during the initial evaluation, the practitioner may opt to perform passive stretch or active stretching to restore the joint movement. Passive stretch, like PROM, may be performed in several different ways, including passive stretch performed by the practitioner, passive stretch performed by the client, or passive stretch performed by an external mechanical device. Passive stretch is performed by the practitioner when he or she moves the client's body segment through the available joint ROM and holds the segment at the end of the ROM while applying gentle but firm force or stretch. Passive stretch may also be performed by the client. This is performed when the client uses his or her unaffected extremity to move the affected extremity through the available range of motion and holds the stretch at the end of the ROM. Last, passive stretch may be performed through the use of an outside mechanical device, which may include CPM machines, pulleys, or static or dynamic orthotic devices.

It is important to note that passive stretch is meant to increase ROM and is not needed when full range of motion is available within the joint. It is used only when a loss of joint ROM is evidenced through comparison to the contralateral side and stretching is not contraindicated. Passive stretching requires a good understanding of joint anatomy and muscle function because incorrect stretching may cause damage to the joint and/or surrounding structures. Passive stretching should be carried out cautiously and is often specifically prescribed by the referring medical professional. The therapist should never force movement when pain is present unless ordered by the physician to work through pain. Slow, gentle, and firm stretching held at the end of the range of motion is required to elongate the soft tissue responsible for limiting the joint ROM and to increase the joint angle. The amount of time a stretch should be held at the end of the range of motion is somewhat controversial and largely depends on the velocity, force, and frequency of the stretch. Current evidence suggests that effective stretching can occur when the limb is held in the maximal end range position for as little as 15 seconds or for as long as 2 minutes.[18] It is important to stabilize the body parts around the joint being stretched in order to prevent extraneous or compensatory movements.

As with passive stretching, the OT practitioner may choose to initiate active stretching. The purpose of active stretching is also to increase joint ROM. In active stretching the client uses the force of the agonist muscle to increase the length of the antagonist muscle. This requires good to normal strength of the agonist muscle, relatively good coordination, and motivation of the client. For example, forceful contraction of the triceps could be used to stretch the bicep muscles. Another stretching technique is the proprioceptive neuromuscular facilitation (PNF) technique referred to as contract relax stretching (CR) or contract relax-agonist stretching. To perform this technique, the practitioner passively brings the muscle to the point of stretch, and the client is asked to contract and hold the muscle in an isometric contraction. This procedure is followed by relaxation of the isometric contraction and manual stretch toward the end of the range of motion.[15,16] Research has shown that the contract relax method is an effective technique that can be used to increase joint ROM; however, there is controversial evidence regarding the length of time the stretch and/or the isometric contraction should be held and the intensity of the isometric contraction and stretch performed.[7]

When performing passive or active stretching, the OT practitioner must take care not to overstretch joints. Thorough assessment of the joint mobility and end feel must be performed, with careful comparison to the contralateral side, prior to initiating stretching. A thorough evaluation will inform the OT practitioner of preexisting joint hypermobility or instability. Such conditions easily allow for overstretching with little force, resulting in injury and damage to the surrounding soft tissue.

It is important that the OT practitioner begin to include functional activities and meaningful occupations that use the target movement or movements in order to maintain joint ROM gains achieved through passive and active stretching. Such gains will not last unless the client continues to move through the full available range of motion, which is most effectively accomplished through engagement in meaningful occupations.

Muscle Strengthening

The OT practitioner may opt to use muscle strengthening exercises when the client's muscle strength has decreased due to inactivity or disuse secondary to injury or disease. The OT practitioner may also choose to perform strengthening exercises when joint instability is present. Strengthening the muscles on either side of an unstable joint can improve the stability of that joint. The OT practitioner is particularly concerned with muscle weakness when it prevents or inhibits the client's ability to engage in meaningful occupations. Three primary types of muscle actions may be used to improve muscle strength: isometric contractions, concentric contractions, and eccentric contractions.

During an isometric contraction the muscle fibers generate tension; however, no joint motion occurs, and the muscle length remains the same. The limb is set or held taut as agonist and antagonist muscles are contracted simultaneously such that the joint ROM remains constant. This action may be performed without resistance or against some outside resistance, such as the therapist's hand or a fixed object. Isometric exercises are appropriate to use under a variety of circumstances. First, isometric exercises are useful when AROM, which produces joint movement, is contraindicated, as in the case of tendon rehabilitation or an unhealed fracture. Performing isometric exercise under these circumstances, when prescribed by the referring medical professional, will improve muscle strength while producing controlled stress, which has the potential to facilitate tendon and bone growth and improved function in the early stages of recovery.[9,31] Isometric exercises are also useful when first initiating active movement and strengthening in the early stages of the rehabilitation process, particularly in clients in whom the bone may be fragile due to prolonged immobilization or when extremely gentle exercises are indicated in order to prevent reinjury. Isometric exercises may also be used when it is not possible to apply resistance to the targeted muscle or muscle groups, as in the case of Kegel exercises to strengthen the pelvic floor.

There are many ways to incorporate functional tasks while performing isometric exercises. For example, isometric strengthening of the bicep occurs when an individual is holding a grocery bag draped from the forearm while maintaining elbow flexion. Isometric strengthening of the shoulder can be achieved while an individual maintains shoulder flexion, external rotation, and abduction to perform hair care tasks. Isometric grip strengthening can be achieved while an individual maintains a static grasp on an object during a functional activity such as holding onto a spoon while stirring.

Isometric exercises may be graded as the individual's strength increases. This is done by altering the amount of external resistance needed to maintain the targeted static contraction and/or the amount of time the client is able to maintain the contraction. For example, to facilitate grip strength during cooking tasks, the therapist may opt to begin with using an isometric contraction on a spoon to stir soup and progress to an isometric contraction to maintain grasp on a mixing spoon to stir cookie batter. The amount of force needed to maintain the grasp on the spoon is greater when stirring cookie batter than it is to stir soup. It is important to note that isometric exercises may affect the cardiovascular system, which may be a contraindication for some clients.

Muscle strengthening may also be accomplished through the use of concentric contractions. Exercising muscles using concentric contractions is a very common method of strengthening and can be performed with or without resistance, depending on the client's muscle grade. During concentric contractions the muscle fibers generate force, which shortens the muscle and creates joint movement, provided the force generated by the muscle is strong enough to overcome the resistance provided by the outside force. If the client's strength allows movement through the full ROM against gravity (muscle grade 3/5), the therapist may use AROM to strengthen a particular muscle or muscle group. Depending on the muscle or muscles targeted for strengthening, the OT practitioner may need to position the client correctly in order to challenge the muscle or muscles to move the body segment against the force of gravity. For example, when aiming to strengthen the wrist flexors, the practitioner must position the forearm in supination so that the wrist flexors have to overcome the force of gravity in order to pull the wrist up into flexion. If the client can tolerate resistance during manual muscle testing (muscle grades 3+/5 or 4/5), resistance may be added to the movement against gravity. Outside resistance may be added by using dumbbells or resistive elastic bands. In a more occupation-based approach, resistance may be added by applying wrist weights while the client performs a functional task or meaningful occupation. In order to strengthen the targeted muscle or muscles, the contraction must be forceful enough to overcome the pull of gravity with the additional weight. It is important that the weight be heavy enough to challenge the muscle but not too heavy, such that the individual cannot complete the full movement. Optimal strengthening occurs when resistance is overcome throughout the entire range of motion.

If the client cannot move through the full ROM against gravity (muscle grade below 3/5), the OT practitioner may still opt to use concentric strengthening; however, rather than have the client move against gravity, the practitioner places the targeted muscle or muscles in a gravity-modified position. For example, if the aim is to strengthen the elbow flexors (the bicep muscles), the client could be given a task that would require AROM with the arm supported on the table in front of him or her. In this example, as the client performs elbow flexion and extension, the arm is supported by the table, and therefore the client does not need to overcome the force of gravity in order to complete elbow flexion. When the client is performing exercises in a gravity-modified position, the OT practitioner must monitor for and eliminate friction that may occur between the client's extremity and the table or mat surface he or she is working on. If the friction is significant, it will generate resistance and prohibit movement. Friction may be reduced by using a powder board, placing a cloth under the extremity, or resting the extremity on a skateboard.

In some instances the OT practitioner may opt to have the client perform exercises through the use of eccentric muscle contractions. During an eccentric muscle contraction, the muscle generates force that creates a change in the joint angle; however, during an eccentric contraction the muscle belly is actually elongating, rather than shortening (as happens in a concentric contraction). For example, if a client is lowering a can of soup from a shelf to the countertop and the elbow is extending, the bicep muscle is elongating as it controls the descent of the soup can toward the counter.

Although eccentric contractions are a typical component of normal movement patterns, the use of resistive eccentric exercises is somewhat controversial. There is some evidence that eccentric exercise programs generate superior results in muscle strength compared to concentric strengthening.[29] Additional evidence indicates that eccentric exercise may also be useful in the rehabilitation of tendon pathology and for strength training around arthritic joints.[7,13] Conversely, there are also studies that indicate that more research is needed to conclude that eccentric exercises are superior to concentric exercises in regard to strength training, the management of tendinopathies, and the prevention of injuries.[12,15] It is recommended that the OT practitioner stay abreast of the current evidence in regard to the use of concentric and eccentric resistive strength training to understand the proper application of each technique in order to prevent soft tissue damage and injury to the client.

When a client performs ROM or strengthening exercises, it is important that the OT practitioner watch for compensatory movements or substitution patterns of movement made by the client. For example, if the exercises are targeted to strengthen shoulder flexion, the therapist should watch that the client does not use shoulder elevation and/or protraction to complete the movement. Another example is using shoulder abduction to achieve a hand-to-mouth movement if elbow flexors cannot move through the ROM against gravity (Fig. 29.7). Such substitutions do not strengthen the targeted muscles and can perpetuate muscle imbalance or weakness, which may further inhibit functional performance. Typically, it is the practitioner's aim to prevent or correct compensatory movements; however, when muscle loss is permanent, some substitution patterns may be desirable. For example, the therapist may work on tenodesis as a compensatory measure to develop a functional grasp, which in turn will enable engagement in occupations such as self-feeding.

FIG 29.7 Using shoulder abduction as compensation to achieve hand-to-mouth movement.

It is important for the OT practitioner to remember that performing ROM and strengthening exercises is a preparatory task. Preparatory tasks are intended to prepare the client for occupational performance and should always be performed in connection to the restoration of the client's ability to perform functional tasks and meaningful occupations. Whenever possible, the OT practitioner should incorporate functional tasks and/or meaningful occupations into the treatment plan to improve client motivation, facilitate carryover of the exercises and, ultimately, enhance long-term functional gains.

Implementing Therapeutic Exercises and Therapeutic Activities

The OT practitioner may choose to use therapeutic exercises or therapeutic activities for several reasons. Therapeutic exercise and therapeutic activities may be used to increase muscle strength, increase muscle endurance, provide overall physical conditioning and improve cardiovascular endurance, or to improve coordination and neuromuscular control. Prior to initiating therapeutic exercises or therapeutic activities, the occupational therapist must thoroughly evaluate the client's muscle strength and occupational desires in order to determine the most appropriate therapeutic exercises or therapeutic activities to use.

Improving Muscle Strength

If the aim of the exercise is to increase muscle strength, the client is asked to perform exercises with a relatively high load over few repetitions. In order to correctly strengthen a muscle, the amount of resistance must allow the client to overcome the resistance force and perform exercise through the entire range of motion. The type of exercise must suit the muscle grade and the client's fatigue tolerance level. It is important to note that there are specific techniques used in strength training known as progressive resistive exercises. Progressive resistive exercises are specific protocols that are performed by incrementally increasing or decreasing the amount of resistance applied during the exercise. Progressive resistive exercises have been found to improve muscle strength in individuals with a wide variety of musculoskeletal injuries and disorders.[17]

Muscle strengthening exercises are graded by gradually increasing the amount of resistance as the client's strength improves. For example, if the client enjoys painting, the OT practitioner may opt to apply 3-pound wrist weights while the client participates in painting on a vertical surface using several large brush strokes. As the client's strength progresses and his or her strength improves, the wrist weight may be increased to 5 pounds with the same number of repetitions. When grading muscle strengthening exercises and activities, the occupational therapist gradually increases the amount of weight used but the number of repetitions remains the same.

Improving Muscle Endurance

Muscle endurance is the ability of the muscle to tolerate activity over time, work for prolonged periods, and resist fatigue. If the aim of the exercise is to increase muscle endurance, the exercises are performed in a relatively low-load, high-repetition regimen that is generally performed over an extended period of time.[17] It is important to differentiate muscle strength from muscle endurance because the two are not always correlated with one another.[17] For example, an individual who is able to lift a 25-pound bag of dog food one time to fill his or her dog's dish may not necessarily be able to carry several 5-pound grocery bags into the house, over two or three trips to and from the car, without experiencing extreme fatigue in the muscles of the upper extremities. In order to grade muscle endurance exercises and activities, the OT practitioner will increase the length of time the client performs an exercise or activity and/or the number of repetitions.

Physical Conditioning and Cardiovascular Fitness

Improving general physical endurance and cardiovascular fitness requires the use of large muscle groups in sustained, rhythmic aerobic exercise or activity. Examples are swimming, walking, bicycling, jogging, and some games and sports. This type of activity is often used in cardiac rehabilitation programs in which the parameters of the client's physical capacities and tolerance for exercise should be well defined and medically supervised. To improve cardiovascular fitness, exercise should be done 3 to 5 days per week at 60% to 90% of maximum heart rate or 50% to 85% of maximum oxygen uptake. Between 15 and 60 minutes of exercise or rhythmic activities using large muscle groups is desirable.[5] Grading of exercises and activities used to target overall physical conditioning and cardiovascular fitness involves gradually increasing the aerobic demands of the activity with careful monitoring of the client's response to activity, especially in the acute rehabilitation phases.

General Exercise and Activity Precautions

During therapeutic exercises and activities the OT practitioner must carefully monitor the client's response to the intervention. Excessive repetitions of strengthening exercises may result in muscle fatigue, pain, and temporary reduction of strength. If a muscle is overworked, it becomes fatigued and is unable to contract. Other signs of fatigue include slowed performance, distraction, perspiration, an increase in the rate of respiration, performance of an exercise pattern through a decreased ROM, and inability to complete the prescribed number of repetitions. It is important to realize that various disease states may significantly alter a person's endurance capacity and tolerance for activity. Many clients may not be sensitive to fatigue or may push themselves beyond tolerance in the belief that this approach hastens recovery. Therefore, the occupational therapist must carefully assess the client's muscle power, capacity for performance, and response to the therapeutic exercise or activity.

Neuromuscular Control and Coordination

Coordination is the combined activity of many muscles into smooth patterns and sequences of motion. Coordination is an automatic response monitored primarily through proprioceptive sensory feedback. Kottke[21] defined control as "the conscious activation of an individual muscle or the conscious initiation of a pre-programmed engram." Control involves conscious attention to and guidance of an activity.

A preprogrammed pattern of muscular activity represented in the central nervous system (CNS) has been described as an engram. An engram is formed only if many repetitions of a specific motion or activity occur. With repetition, conscious effort by the client is decreased and the motion becomes more and more automatic. Ultimately the motion can be carried out with little conscious attention. It has been hypothesized that when an engram is excited, the same pattern of movement is produced automatically.

Procedures for the development of neuromuscular control and neuromuscular coordination are briefly outlined in the following paragraphs. The reader is referred to original sources for a full discussion of the neurophysiologic mechanisms underlying these exercises. Neuromuscular education or control training involves teaching the client to control individual muscles or motions through conscious attention. Coordination training is used to develop preprogrammed multimuscular patterns or engrams.[20]

Neuromuscular Control

It may be desirable to teach control of individual muscles when the muscle is so weak that it cannot be used normally. The purpose is to improve muscle strength and muscle coordination to new patterns. To achieve these ends, the person must learn precise control of the muscle, an essential step in the development of optimal coordination for persons with neuromuscular disease.

To participate successfully the client must be able to learn and follow instructions, cooperate, and concentrate on the muscular retraining. Before beginning, the client should be comfortable and securely supported. The exercises should be carried out in a nondistracting environment. The client must be alert, calm, and rested. He or she should have an adequate, pain-free arc of motion of the joint on which the muscle acts, in addition to good proprioception. Visual and tactile sensory feedback may be used to compensate or substitute for limited proprioception, but the coordination achieved will never be as great as when proprioception is intact.[20]

Awareness of the desired motion and the muscles that produce it is first taught to the client using passive motion to stimulate the proprioceptive stretch reflex. This passive movement may be repeated several times. The client's awareness may be enhanced if the therapist also demonstrates the desired movement and if the movement is performed by the analogous unaffected part. The skin over the muscle belly and tendon insertion may be stimulated to enhance the effect of the stretch reflex. Stroking and tapping over the muscle belly may be used to facilitate muscle action.[20]

The occupational therapist should explain the location and function of the muscle, its origin and insertion, line of pull, and action on the joint. The therapist should then demonstrate the motion and instruct the client to think of the pull of the muscle from insertion to origin. The skin over muscle insertion can be stroked in the direction of pull while the client concentrates on the sensation of the motion during the passive movement performed by the therapist.

The exercise sequence begins with instructions to the client to think about the motion while the therapist carries it out passively and strokes the skin over the insertion in the direction of the motion. The client is then instructed to assist by contracting the muscle while the therapist performs passive motion and stimulates the skin as before. Next the client moves the part through ROM with assistance and cutaneous stimulation while the therapist emphasizes contraction of the prime mover only. Finally the client carries out the movement independently, using the prime mover.

The exercise must be initiated against minimal resistance if activity is to be isolated to prime movers. If the muscle is very weak (trace to poor muscle grade), the procedure may be carried out entirely in an active-assisted manner so that the muscle contracts against no resistance and can function without activating synergists. Progression from one step to the next depends on successful performance of the steps without substitutions. Each step is carried out 3 to 5 times per session for each muscle, depending on the client's tolerance.

Coordination Training

The goal of coordination training is to develop the ability to perform multimuscular motor patterns that are faster, more precise, and stronger than those performed when control of individual muscles is used. The development of coordination depends on repetition. Initially in training, the movement must be simple and slow so that the client can be conscious of the activity and its components. Good coordination does not develop until repeated practice results in a well-developed activity pattern that no longer requires conscious effort and attention.

Training should take place in an environment in which the client can concentrate. The exercise is divided into components that the client can perform correctly. Kottke[21] calls this approach desynthesis. The level of effort required should be kept low, by reducing speed and resistance, to prevent the spread of excitation to muscles that are not part of the desired movement pattern. Other theorists offer contrary advice, which emphasizes the integration of movements that customarily occur during activity. The therapist's experience and judgment are important in determining which method to use.

When the motor pattern is divided into units that the client can perform successfully, each unit is trained by practice under voluntary control, as described previously for training of control. The therapist instructs the client in the desired movement and uses sensory stimulation and passive movement. The client must observe and voluntarily modify the motion. Slow practice is imperative to make this monitoring possible. The therapist offers enough assistance to ensure precise movement while allowing the client to concentrate on the sensations produced by the movements. When the client concentrates on movement, fatigue occurs rapidly and the client should be given frequent, short rests. As the client masters the components of the pattern and performs them precisely and independently, the sequence is graded to subtasks or several components that are practiced repetitively. As the subtasks are perfected, they are linked progressively until the movement pattern can be performed.

The protocol can be graded for speed, force, or complexity, but the therapist must be aware that the increased effort put forth by the client may result in incoordinated movement. Therefore, the grading must remain within the client's capacity to perform the precise movement pattern. The motor pattern must be performed correctly to prevent the development of faulty patterns.

If CNS impulses are generated to muscles that should not be involved in the movement pattern, incoordinated motion results. Constant repetition of an incoordinated pattern reinforces the pattern, resulting in a persistent incoordination. Factors that increase incoordination are fear, poor balance, too much resistance, pain, fatigue, strong emotions, prolonged inactivity,[20] and excessively prolonged activity.

Physical Agent Modalities

According to the OTPF-3, **physical agent modalities (PAMs)** are preparatory methods that the OT practitioner may use to prepare the client for occupational engagement.[1] The AOTA recognizes and supports the use of PAMs by OT practitioners as outlined in its position paper on physical agent modalities.[2] If an OT practitioner chooses to implement a PAM in treatment, it must be connected to a preparatory task or occupation. The AOTA's position paper clearly states that "[the] exclusive use of PAMs as a therapeutic intervention without direct application to occupational performance is not considered occupational therapy."[2] Furthermore, the application of PAMs by an OT practitioner is not considered to be an entry-level skill and is only permitted after the practitioner has obtained foundational education and training through continuing education and has demonstrated competence in the use of PAMs.[2] Before an OT practitioner may use PAMs, it is mandatory that he or she comply with the guidelines outlined by the AOTA.

PAMs may be used before or during functional activities to enhance the effects of the OT intervention program in order to facilitate occupational engagement . PAMs are often used by OT practitioners working in orthopedic settings (eg, hand therapy) but may also be used in other settings, such as neurological rehabilitation and wound management. This section introduces the reader to basic techniques and when and why they may be applied. The following sections are divided into the four main areas outlined in the AOTA position paper on PAMs: superficial thermal agents, deep thermal agents, electrotherapeutic agents, and mechanical devices. Because modalities are commonly used by OT practitioners for treatment of hand injuries and diseases, the examples provided are focused on intervention to improve upper extremity function. The use of PAMs is not limited to the treatment of hands, however.

Thermal Agents

Thermal agents may be divided into two overarching categories: superficial thermal agents and deep thermal agents. The AOTA position paper states:

Superficial thermal agents include but are not limited to hydrotherapy/whirlpool, cryotherapy (cold packs, ice), Fluidotherapy, hot packs, paraffin, water, infrared, and other commercially available superficial heating and cooling technologies. Deep thermal agents include but are not limited to therapeutic ultrasound, phonophoresis, short-wave diathermy, and other commercially available technologies.[2]

The following sections will further discuss the various thermal agents, their properties, and their applications within the practice of occupational therapy.

Superficial Thermal Agents

There are two primary ways by which superficial thermal agents may alter the temperature of soft tissue. Superficial thermal agents may change soft tissue temperature through a process known as convection or through a process known as conduction. The process of convection and the process of conduction each have the ability to cool soft tissue, known as cryotherapy, or to heat soft tissue.

Convection

Convection includes superficial thermal modalities such as hydrotherapy and Fluidotherapy. Convection transfers heat or cold to the tissues by fluid motion around a body segment. The practitioner may choose to use convection techniques to cool the soft tissue (heat abstraction) or to heat the soft tissue (heat transmission), depending on the aim of the modality. The most common example of convection for cryotherapy (cold therapy) is cold whirlpool.[10] When a cold whirlpool is used, the client's extremity is submerged in a tub of cold water and turbine jets are used to circulate the cold water around the extremity. The OT practitioner may choose to use a cold whirlpool to decrease inflammation, decrease pain, and/or decrease edema. Cold whirlpools are typically used for cooling distal extremities, such as the wrist or elbow, particularly when the aim is to cool large portions of the extremity evenly.[10] The client's comfort with and tolerance to the cold temperatures will serve to guide the therapeutic use of this modality. Additional uses of cryotherapy will be discussed in the following section.

As previously stated, convection may also be used to heat soft tissue. The most common example of convection for heating soft tissue is Fluidotherapy. Fluidotherapy involves a machine that agitates finely ground cornhusk particles by blowing warm air through them. This modality feels similar to a water whirlpool, but corn particles are used instead of water. The temperature is thermostatically maintained, with the therapeutic range between 102° and 118°F.[29] Fluidotherapy units are available in various sizes to accommodate various body parts,[29] but heating the elbow or hand is the most common use of this heat modality. An additional benefit of Fluidotherapy is its effect on desensitization. The agitator can be adjusted to decrease or increase the flow of the corn particles, thus controlling the amount of stimulation to the skin. Because an extremity can be heated gradually, this technique is effective as a warm-up before exercises, dexterity tasks, functional activities, and work simulation tasks.

Conduction

Conduction includes superficial thermal modalities such as cold packs (cryotherapy), hot packs, and paraffin. Conduction transfers heat or cold from one object to another through direct contact.

Cryotherapy, the use of cold therapy, is often used in the treatment of edema, pain, and inflammation. The cold produces a vasoconstriction, which decreases the amount of blood flow into the injured tissue. Cold decreases muscle spasms by decreasing the amount of firing from the afferent muscle spindles. Cryotherapy is contraindicated for clients with cold intolerance or vascular repairs. The use of cryotherapy may be incorporated into intervention programs provided in the clinical setting; however, it is particularly useful in a home program.

Cold packs can be applied in a number of ways. Many commercial packs exist, which range in size and cost. An alternative to purchasing a cold pack is to use a bag of frozen vegetables or to combine crushed ice and alcohol in a plastic bag to make a reusable slush bag. Ice packs should be covered with a towel to prevent tissue injury. The benefit of commercial packs is that they are easy to use, especially if the client must use them frequently during the day. When clients are working, it is recommended that they keep cold packs at home and at work to increase the ease of use.

Other forms of cryotherapy include ice massage and cooling machines. Ice massage is used when the area to be cooled is small and very specific; for example, inflammation of a tendon specifically at its insertion or origin. The procedure entails using a large piece of ice (eg, water frozen in a paper cup) to massage the area with circular motions until the skin is numb, usually for 4 to 5 minutes. Care must be taken to keep the ice moving to prevent damage to tissues that are most superficial. Cooling devices, which circulate cold water through tubes in a pack, are available through vendors. These devices maintain their cold temperatures for a long time, but they are expensive to rent or purchase. They are effective in reducing edema immediately after surgery or injury, during the inflammatory phase of wound healing.

Contrast baths combine the use of heat and cold. The physical response is alternating vasoconstriction and vasodilation of the blood vessels. For example, the client is asked to submerge the arm, alternating between two tubs of water. One contains cold water (55° to 65°F), and the other contains warm water (100° to 110°F).[4] The purpose is to increase collateral circulation, which effectively reduces pain and edema. As with the use of cold packs, contrast baths are a beneficial addition to a home therapy program. This technique is contraindicated for clients with vascular disorders or injuries.

Alternatively, the OT practitioner may choose to use heat as a therapeutic modality. Hot packs and paraffin provide heat through conduction. Heat may be used to increase circulation and promote healing. The increase in blood flow will also increase elasticity of soft tissue and improve soft tissue extensibility before stretch. This will more easily allow for permanent soft tissue elongation, resulting in improved joint movement and decreased joint stiffness. Heat may also be used to relieve muscle spasms and decrease pain.[29] To obtain maximum benefits from heat, the tissue temperature must be raised to 104° to 113°F.[29] Precautions must be taken with temperatures above this range to prevent tissue destruction.

Contraindications to the use of heat include acute inflammatory conditions of the joints or skin, sensory losses, impaired vascular structures, malignancies, and application to the very young or very old. The use of heat may substantially enhance the effects of orthotic interventions and therapeutic activities that attempt to increase ROM and functional abilities.

Paraffin is another form of heat modality. Paraffin is stored in a tub that maintains a temperature between 113° and 129°F.[29] The client repeatedly dips his or her hand into the tub until a thick, insulating layer of paraffin has been applied to the extremity. The hand is then wrapped in a plastic bag and towel for 15 to 30 minutes.[28] This technique provides an excellent conforming characteristic, so it is ideal for use in hands and digits. Partial hand coverage is possible. The paraffin transfers its heat to the hand, and the bag and towel act as an insulator against dissipation of heat to the air. An additional benefit to the use of paraffin is that it provides moisturization to the skin, which is especially beneficial in scar management or for improving skin elasticity, as in the case of scleroderma.

Care must be taken to protect insensate parts from burns. To prevent excessive vasodilation, paraffin should not be applied when moderate to severe edema is present. It cannot be used if open wounds are present. Paraffin can be used in the clinic or incorporated into a home program. The tubs are small, and the technique is safe and easy to use in the home. It is an excellent adjunct to home programs that include dynamic splinting, exercises, or general ADLs. It may be used in the clinic before therapeutic exercises and functional activities.

Hot packs contain either a silicate gel or a bentonite clay wrapped in a cotton bag and submerged in a Hydrocollator, a water tank that maintains the temperature of the packs at 158° to 167°F.[29] Because tissue damage may occur at these temperatures, the packs are separated from the skin by layers of towels. As with paraffin, precautions should be taken in application of hot packs to insensate tissue that has sustained vascular damage. Hot packs are commonly used for myofascial pain, before soft tissue mobilization, and before any activities aimed at elongating contracted tissue. For a client with a hand injury the packs may be applied to the extrinsic musculature to decrease muscle tone caused by guarding, without also heating the hand. Unless contraindicated, hot packs can be used (with precautions) when open wounds are present.

Deep Thermal Agents

Deep thermal agents use conversion to apply heat deep into the tissues. Conversion occurs when energy is converted from one form to another. For example, in ultrasound therapy, acoustic energy (sound waves) are converted internally to heat. As the sound waves penetrate the tissue, they vibrate the tissue molecules, causing them to rub against one another and create fiction, which in turn generates heat.[24] The energy of sound waves is thus converted to heat energy. The sound waves are applied with a transducer, which glides across the skin in slow, continuous motions. Gel is used to improve the transmission of the sound waves to the tissues. Ultrasound is considered a deep heating agent. Most ultrasound machines are dual frequency units, allowing the therapist to choose between a 1-MHz or a 3-MHz sound head or transducer. The OT practitioner selects the frequency of the sound head based on the depth of the structures targeted for treatment. The 3-MHz transducer is selected when the target tissue is relatively superficial (1 to 3 cm below the skin), and the 1-MHz transducer is selected to heat tissues more than 2 cm below the skin.[31] Because of its ability to heat deeper tissues, ultrasound is excellent for treating problems associated with joint contractures, scarring and its associated adhesions, and muscle spasms. When ultrasound is used, the OT practitioner should apply a stretch to the tissues while they are being heated. The gains made through this type of stretching are best maintained when they are followed by activities, exercises, or the application of an orthosis to maintain the stretch.

Ultrasound may also be used in a nonthermal application. For example, ultrasound has been shown to increase circulation, promote healing, and reduce inflammation.[24] Evidence suggests that nonthermal ultrasound is effective to facilitate wound healing, peripheral nerve healing, and soft tissue repair after injury. Nonthermal ultrasound has also been shown to facilitate tendon and bone healing.[24] One additional use of ultrasound involves using the sound waves to drive antiinflammatory medications into the tissue. This process is called phonophoresis.

There are many useful and effective applications for ultrasound; however, the OT practitioner must have a good understanding of this modality and be well aware of the precautions and contraindications for its use. Ultrasound at frequencies higher than recommended standards or failure to continually move the applicator during treatment can generate too much heat and can destroy tissue. Ultrasound can be used to facilitate bone healing, but if it is used with the wrong parameters, it can vibrate the bone, cause pain, and delay the healing process. When ultrasound is used over bone in children, precautions must be taken to avoid the growth plates in the client's bones. Ultrasound should never be used over an unprotected spinal cord or freshly repaired structures such as tendons and nerves. If ultrasound is being used to facilitate wound healing, the wound should be free from infection because increasing circulation has the potential to spread the infection. Last, because ultrasound can facilitate cell proliferation, it should never be used over a malignancy.

Electrotherapeutic Agents

The AOTA has defined electrotherapeutic agents in this way:

Electrotherapeutic agents use electricity and the electromagnetic spectrum to facilitate tissue healing, improve muscle strength and endurance, decrease edema, modulate pain, decrease the inflammatory process, and modify the healing process. Electrotherapeutic agents include but are not limited to neuro-muscular electrical stimulation (NMES), functional electrical stimulation (FES), transcutaneous electrical nerve stimulation (TENS), high-voltage galvanic stimulation for tissue and wound repair (HVGS), high-voltage pulsed current (HVPC), direct current (DC), [and] iontophoresis …[2]

As with all physical agent modalities, the OT practitioner must use these interventions to improve the client's functional performance and facilitate engagement in occupation. Many techniques are available; those most commonly used are presented here. It is important to note that electrical modalities should never be used with clients with pacemakers or cardiac conditions.

Transcutaneous Electrical Nerve Stimulation

Transcutaneous electrical nerve stimulation (TENS) uses electrical current to decrease pain. Pain is a very complex phenomenon and can cause severe functional impairment. Pain is considered to be acute when it immediately follows trauma. Individuals may also experience chronic pain, which is longstanding. When trauma occurs, an individual responds to the initial pain by guarding the painful body part, often by restricting motion of the body part or assuming a posture that limits use of the painful body part. This guarding may result in muscle spasms and fatigue of the muscle fibers, especially after prolonged guarding. The supply of blood and oxygen to the affected area decreases, and resultant soft tissue and joint dysfunction may occur. These reactions magnify and compound the problems associated with the initial pain response. The therapist's goal after an acute injury is to prevent this cycle. In the case of chronic pain, the goal is to stop the cycle that has been established.

TENS is commonly used to decrease acute pain and to control chronic pain. It should be noted that there is inconclusive evidence regarding the use of TENS for pain control. The lack of such evidence is likely due to the fact that pain is a difficult construct to study because it is a subjective measure and manifests very differently, depending on a wide variety of individual factors.[26] Many individuals respond favorably to TENS and report effective pain relief without the side effects of medications. TENS units are portable, safe to use, and clients can be educated in independent home use.

TENS units provide constant electrical stimulation with a modulated current that is directed to the peripheral nerves through electrode placement. The therapist can control several attributes of the modulation waveform, such as the frequency, amplitude, and pulse width. When TENS is applied at a low-fire setting, it creates an "electroanalgesia" effect.[26] When this occurs, the brain releases endorphins, which in turn reduce the sensation of pain. The effects of high-frequency TENS are based on the gate control theory. This theory describes how the electrical current from the TENS unit, applied to the peripheral nerves, blocks the perception of pain in the brain. Nociceptors (pain receptors) transmit information to the CNS through the A-delta and C fibers. A-delta fibers transmit information about pressure and touch. It is thought that TENS stimulates the A fibers, effectively saturating the gate to pain perception, and the transmission of pain signals via the A-delta and C fibers is blocked at the level of the spinal cord.[23] TENS can be applied for acute or chronic pain. TENS is frequently used postsurgically for orthopedic conditions when it is mandatory that ROM be initiated within 72 hours following surgery, such as in tenolysis and capsulotomy surgeries, or when it is important to maintain tendon gliding through the injured area after fractures. In these cases TENS may be useful in controlling pain so that the client can tolerate immediate, postsurgical movement. TENS can be especially helpful for clients with a low threshold to pain by making exercising easier. TENS may also be useful when working with clients with complex regional pain syndrome.

TENS can be used to decrease pain from an inflammatory condition such as tendonitis or a nerve impingement; however, the client must be educated in tendon and nerve protection and rest, with a proper home program of symptom management, positioning, and ADL and work modification. Without the sensation of pain the client may overdo and stress the tissues; therefore, education regarding activity level is important.

Neuromuscular Electrical Stimulation

Neuromuscular electrical stimulation (NMES) is the use of electrical current to activate muscles. It is applied through an electrode to the motor point of innervated muscles to provide a muscle contraction. The current is interrupted to enable the muscle to relax between contractions, and the durations of the on and off times can be adjusted by the therapist. Adjustments can also be made to control the rate of the increase in current (ramp) and intensity of the contraction.

NMES is used to increase ROM, facilitate muscle contractions, and strengthen muscles.[16] It may be used postsurgically to provide a stronger contraction for improved tendon gliding, for example, after a tenolysis. It also may be used later in the tendon repair protocol, once the tendon has healed sufficiently to tolerate stress. NMES may be used to lengthen a muscle that has become weakened because of disuse. During the reinnervation phase after a nerve injury this technique may be used to help stimulate and strengthen a newly innervated muscle. Care must be taken not to overfatigue the muscle. NMES can be applied during a dexterity or functional activity, which allows the muscle to be retrained in the purpose of its contraction. NMES is particularly beneficial when it is used to facilitate movement during functional activities or meaningful occupations. As with TENS, there are portable NMES units that can be prescribed for home use.

Other techniques that use an electrical current include high-voltage galvanic stimulation (HVGS) and inferential electrical stimulation. These techniques are applied to treat pain and edema.[25] Iontophoresis is yet another electrotherapeutic agent. Iontophoresis uses electrical current to drive ionized medication into the tissue. The medications most often used are antiinflammatory drugs and agents to decrease scar tissue. The technique uses an electrode filled with the medication of choice. The medicine is transferred by applying an electric field that propels the ions into the tissues.

Mechanical Devices

The OT practitioner may also choose to use a mechanical device to increase ROM in order to facilitate functional movement and engagement in occupational performance. The most common device used by OT practitioners is the continuous passive motion (CPM) machine. A CPM machine is a mechanical device that is electrically powered and provides passive movement to the client's extremity. The machine can be programmed to move the extremity through a specific ROM according to the parameters the therapist sets. CPM machines are particularly useful when a joint must be moved immediately after surgery to prevent stiffness and soft tissue scarring or when the client has difficulty performing full ROM independently.

Summary

Engagement in occupation is the primary tool and objective of occupational therapy practice. OT practitioners use occupational analysis, activity analysis, adaptation, grading of activities, therapeutic exercise, and adjunctive modalities in the continuum of intervention, and they may use these methods simultaneously toward these ends. Through this breadth of practice skills, based on the client's personal and social needs, the OT practitioner helps the client apply newly gained strength, ROM, and coordination during the performance of occupation and activity to assume or reassume life roles. Appropriate intervention strategies are individualized and designed to be meaningful to the client while meeting therapeutic goals and objectives designed collaboratively by the client and the practitioner.

Intervention strategies may be adapted to meet the individual needs of the client or the environment. Strategies may be graded for a number of factors, including physical, perceptual, cognitive, and social factors, to keep the client functioning at maximal potential at any point in the intervention program. The uniqueness of occupational therapy lies in its extensive and intentional use of occupation and goal-directed strategies as treatment modalities.

In practice, OT therapists' roles may not be clearly defined because they are subject to variations in expectations that stem from regional differences, healthcare developments, legislation, institutional philosophy, and the roles and responsibilities assigned by the treatment facility. In all instances, OT practitioners must be well trained and well qualified to deliver all aspects of practice. They should not hesitate to refer clients to experts for treatment whenever appropriate.

Review Questions

1. Define modality.
2. Define occupation, activity, preparatory tasks, and preparatory methods.
3. Name two reasons occupation is valuable.
4. Compare and contrast activity analysis and occupational analysis.
5. What term best describes how activities and environments are modified to meet the individualized needs of clients?
6. What is used to create the "just right" challenge in performance?
7. When are adjunctive modalities appropriately used by occupational therapists?
8. For which types of disabilities would therapeutic exercise (as defined in this chapter) be inappropriate?
9. List and define three types of muscle contraction.
10. Identify an activity that can be used to provide resistive exercise, and describe how it could be done.
11. List four general categories of physical agent modalities.
12. What kinds of symptoms are treated with cryotherapy?

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Orthotics

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CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Identify basic hand anatomy.
2. Describe the difference between single-axis and multi-axis joints, and explain how they relate to orthotic use.
3. Define torque, and describe how an orthosis produces torque.
4. Discuss the relationship of angle of approach to dynamic orthosis use.
5. Describe the three major purposes and goals of orthotics and when they should be employed.

6. Demonstrate an understanding of the principles of making an orthosis pattern.
7. Identify three characteristics of low-temperature thermoplastic material.
8. Discuss two ways in which orthotics may apply force.
9. Demonstrate how to determine the proper length of a forearm-based orthosis.
10. Identify clients who may benefit from dynamic arm supports.
11. Describe general physical principles of dynamic arm supports.
12. Describe three types of dynamic arm supports and how they differ.
13. List the challenges of using dynamic arm supports for ambulatory people and for individuals who use a wheelchair.
14. Describe the occupations that a client with very weak arms can engage in with a mobile arm support (MAS) that they otherwise could not do.
15. Identify the advantages of a freestanding MAS over a wheelchair-mounted MAS.
16. Identify the benefits of robot-assisted therapy.
17. List the client factors that must be considered prior to recommending a MAS for home use.

KEY TERMS

Axis of motion
Dynamic arm supports
Dynamic orthoses
Force
Freestanding dynamic arm supports
Friction
Immobilization orthoses
Mobile arm supports
Mobilization orthoses
Orthosis
Restriction orthoses
Robot-assisted therapy
Serial static orthosis
Static arm supports
Static orthosis
Static progressive orthoses
Suspension arm devices
Tenodesis
Torque
Translational forces

Section 1 Hand Orthotic Fabrication: Principles, Practice, and Decision Making

Donna Lashgari

According to *Mosby's Medical, Nursing, & Allied Health Dictionary*, orthotics is "the design and use of external appliances to support a paralyzed muscle, promote a specific motion, or correct musculoskeletal deformities"; an **orthosis** is "a force system designed to control, correct, or compensate for a bone deformity, deforming forces, or forces absent from the body … [and] often involves the use of special braces"; and a splint is "an orthopedic device for immobilization, restraint, or support of any part of the body."[3] Splints and suspension arm devices (see Section 2 of this chapter) can be considered orthoses. Occupational therapists (OTs) often design and construct orthoses. *Occupational Therapy Practice Framework: Domain & Process*, 3rd edition,[2] supports occupational therapy's role in this intervention, stating that "occupational therapy practitioners… design occupation based intervention plans that facilitate change or growth in the client factors (body functions, body structures…..) and skills (motor, process, and social interaction) needed for successful participation." According to the framework, the practice of orthotics falls into the category of preparatory methods: splints (more recently referred to as *orthotics*) are used "to enhance participation in occupation" as well as assist in recovering the client's ability to engage in desired occupations (pp. S29–S35). [2] Thus splints, or orthoses, can offer support to a weak upper extremity or protection of an injury in order to allow the client to participate more fully in occupations that are meaningful to him or her. An orthotist typically designs and constructs suspension arm devices, and OTs adjust them and train clients to use them. In practice, the term *orthosis* historically was used more frequently to refer to suspension arm devices than splints; however, now the term is used for any custom fabrication of a splint by a therapist. Hand splinting, or orthosis fabrication, is the topic of Section 1 of this chapter, and suspension arm devices are described in Section 2.

Threaded Case Study

Alexei, Part 1

Alexei is a delightful, witty gentleman of 78 years who resides in a retirement complex since the passing of his wife 5 years ago. The complex offers three levels of care: independent apartment living, assisted living, and nursing care. At the time of his injury, Alexei was living in the independent area, had his own self-furnished apartment, took the van transportation provided by the complex once a week for grocery shopping, and took public transportation to his weekly computer class at a nearby senior center. The complex offers extra services for a fee, and Alexei paid for monthly housekeeping. He does his own laundry, cooking, and light cleaning. He has diabetes and takes care of his own testing and insulin injections. His beloved parakeet recently died, and he was shopping for another. He had trained the parakeet to do several tricks, and it was his pride and joy.

It was outside a pet store that he fell and suffered a comminuted distal radius and ulna fracture of his right dominant wrist. After open reduction and internal fixation (ORIF), he was discharged to the nursing care level of his complex for 2 days, then to the assisted living level. Unless he could quickly become independent with managing his activities of daily living (ADLs) and medical needs, in his case diabetic testing and injections, he would lose his apartment and be transferred to the assisted living level permanently. This level would not allow him to keep a pet.

Alexei was 5 weeks post ORIF when he was referred to hand therapy for beginning active range of motion (ROM) and edema reduction. He was wearing a protective removable splint. Because of maximal edema in his hand, he had only 20% total active motion of his fingers and thumb and was assisted with most self-care and ADLs; was eating with his left, nondominant hand; and was dependent on nursing for his diabetic needs. Alexei's goal was to regain enough range of motion and dexterity in his right dominant hand to be independent with all ADLs and medical needs so he could return to his apartment, which would allow him to keep his own furniture, get another bird, and set his own schedule.

Although Alexei's insurance would cover any needed therapy, he was able to attend only once a week because of transportation issues. Because his therapy time would be limited, our focus in OT was to work toward his goals by using dynamic splinting to regain ROM for functional grip and pinch, and to collaborate with the nursing staff at his assisted living residence to help him meet his goal of managing his medical needs. Alexei attended therapy six times over the following 5 weeks. We worked closely by telephone with the nurse in assisted living, who carried out our recommended contrast baths and nightly Isotoner glove application to reduce edema. We fabricated a volar-based dynamic flexion orthosis for metacarpophalangeal (MP) and proximal interphalangeal (PIP) flexion and a dorsal-based finger extension orthosis, which he alternated during the day for approximately 2 to 3 hours. We adjusted his orthoses each visit for greater ROM and proper 90-degree angle of pull on each finger; he was quick to learn his exercise regimen and followed it religiously. By his third visit, Alexei was independent in all self-care and hygiene tasks using built-up utensil handles and a zipper pull. At this time, we were able to discontinue his extension splint and focus on flexion and dexterity.

At this point, Alexei became assertive with his wish to return to his own apartment and was allowed to move back, with his assurance that soon he would once again be independent in all areas. He partnered with the nurse to work toward independence with medical needs—a difficult task because insulin needles are small and smooth. As his ROM and dexterity improved through the use of his dynamic orthoses, he was able to test his sugar levels and walk to the assisted living area to receive insulin as needed. At 14 weeks postop, he was once again independent with his own injections using coban or rubber finger cots for traction on the needle, and he was once again shopping for a parakeet.

Critical Thinking Questions

1. What would have happened to Alexei if therapy had consisted of just the 45-minute ROM and edema reduction sessions once a week, without the addition of the dynamic orthoses for home use?

2. How critical was the team approach of the client, the therapist, and the nurse in achieving this client's ultimate goals?

3. What part did ascertaining the client's main goal during the initial interview play in using limited time and resources to achieve that goal?

4. What would have happened if weekly therapy were conducted without that goal as the primary focus?

A client-centered focus is vital for any type of therapy. The case of Alexei illustrates how the use of dynamic orthoses helped to achieve a good outcome in a difficult case.

The human hand is the brain's most important instrument for exploring and mastering the world. We read with our hands if we suffer loss of vision; we communicate with our hands in the absence of speech or hearing. Our hands give us expression and console us. We first explore our hands and explore with our hands as infants. The wonder of the human hand is the precision with which it functions and the extremes of abuse it tolerates. We can and do take our hands for granted as they complete a multitude of functional tasks such as dressing, cooking, or typing, because they seem to function effortlessly—that is, until we experience some level of impairment or dysfunction.

The hand does not function independently of the whole human organism. It is connected to the brain via a complex system of nerves and is dependent on precise synaptic connections. The hand does not function independently of the upper extremity (UE); stability and control of the shoulder, elbow, and wrist are needed to position the hand in space. Dysfunction anywhere from the brain to the fingertips may impair function of the hand.

Humans achieve mastery and independence over their environment because of the superiority of the human brain and the dexterity of the hand. Tying a knot, opening a necklace clasp, wielding a hammer, and throwing a ball are abilities unique to the human hand. That we can close a necklace with our vision occluded is testament to the sensibility of the hand. That we can wield a hammer to drive a nail is testament to the integrity of the skin and the strength of the muscles that power the hand. That we can speak volumes with a sweep of our hands or a caressing touch is testament to the aesthetics of the hand. It is a remarkable instrument indeed. As Mary Reilly, one of the profession's most recognized leaders, stated in her 1961 Slagle lecture, "Man, through the use of his hands as they are energized by mind and will, can influence the state of his own health."

OTs deal with the human being as a whole, not just as a hand, a toe, or a shoulder. With the human hand, even the smallest impairment may affect function. Loss of placement of the hand may mean an inability to achieve a hand-to-mouth pattern, which makes independent feeding impossible. Pain and fear can and do accompany injury, and when independence or livelihood is threatened by hand dysfunction, the outcomes are often dramatic, affecting that person and the family members who rely on him or her. The hand is perhaps most valued only when it ceases to function and we must give it attention.

An orthosis is one of the most important tools therapists use to minimize or correct impairment and to restore or augment function. Little else so readily calls attention to the hand as an orthosis. An individual may not receive comments on a new ring or a recent manicure, but put an orthosis on the hand and all will take notice. The decision to provide or fabricate an orthosis requires an in-depth understanding of the pathologic condition to be affected and of the many orthotic designs available.

Section 1 of this chapter introduces the anatomic and biomechanical principles necessary to understand the basic concepts and models of orthotic fabrication. This section briefly reviews the anatomy of the hand and the biomechanical principles involved in orthotic design and fabrication, and introduces an orthotic fabrication process involving pattern making, material choices, types of traction, and techniques of fabrication.

Role of the Occupational Therapist

The education an OT receives in analysis of activity and assessment of human occupation and function leads naturally to the use of orthoses as one therapeutic tool in the intervention regimen. OTs most commonly fabricate orthotics for the hand and UE, but they may be called on to design and fabricate orthoses for the lower extremity (LE) and even for the back or spine. The basic principles of orthotic design and fabrication apply, regardless of which body part is being addressed.

Involvement of the OT in all phases of orthotic fabrication is recommended from the initial assessment of need, through the design phase, the fabrication, and the training and follow-up necessary to ensure proper use and fit of the splint. This involvement requires an understanding of the anatomy and biomechanics of the normal, unimpaired hand and of the pathology of the impaired hand. Many excellent texts describe both hand anatomy and biomechanics in extensive detail and should be included in the library of any OT treating the hand. This chapter briefly reviews the anatomy and biomechanics of the hand most pertinent to orthotic fabrication. The list of references at the end of this chapter provide excellent selections for further study.

One reference of note that should be included in every therapist's library is *Clinical Mechanics of the Hand*,[9] 3rd edition, by Paul W. Brand and Anne Hollister. This text is an exceptional source for a straightforward explanation of the mechanics of muscles, joints, and skeletal structures and how they contribute to the remarkable dexterity and strength of the hand. Brand and Hollister discuss clinical approaches and how they affect the natural biomechanics of the hand.[18]

Anatomic Structures of the Hand

Wrist

The hand and wrist are a complex of 27 bones that contribute to the mobility and adaptability of the upper extremity; the 54 bones that make up both hands and wrists account for approximately one fourth of the total bones of the human body. The wrist is a complex that consists of the distal ulna and radius and the eight carpal bones arranged in two rows. The carpal bones form the concave transverse arch and, with the configuration of the distal radius, contribute substantially to the conformability of the hand.[32] The distal ulna does not articulate with any carpal bone, and its contribution to wrist stability is made through the attachments of the ulnar collateral ligament, which places a check on radial deviation (Fig. 30.1).

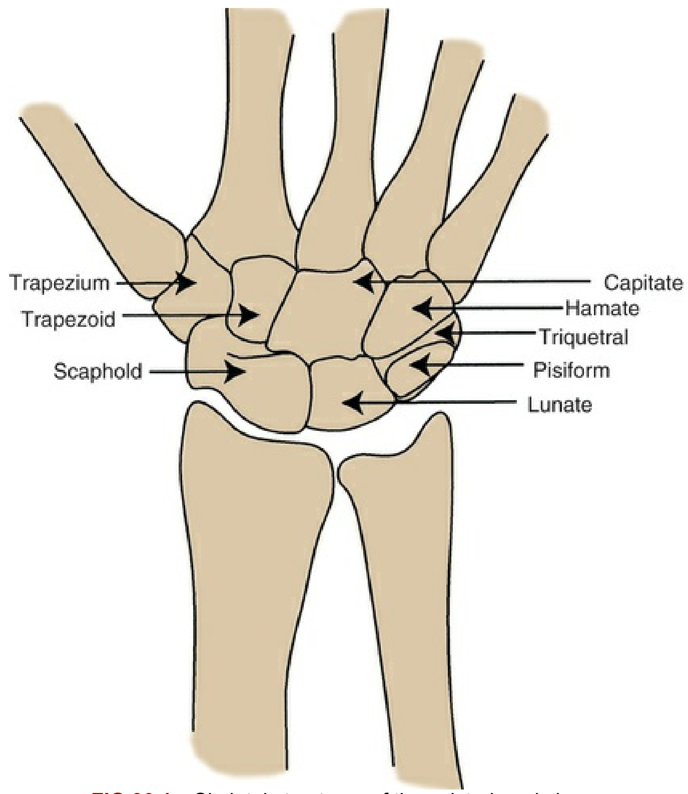


FIG 30.1 Skeletal structures of the wrist, dorsal view.

The wrist complex allows a greater arc of motion than any other joint complex except the ankle. This mobility is the result of a unique skeletal configuration and an involved ligamentous system. All motion at the wrist is component motion that occurs in more than one anatomic plane; no pure or isolated motions occur. This concept is key in any treatment directed at the wrist. Extension occurs with a degree of radial deviation and supination. Wrist flexion includes ulnar deviation and pronation. The wrist is contiguous and continuous with the hand. The distal carpal row (the trapezium, trapezoid, capitate, and hamate) articulates firmly with the metacarpals. Motion is produced across these articulations by muscles that cross the carpals and attach to the metacarpals. The proximal carpal row (the scaphoid, lunate, and triquetrum) articulates distally with the distal carpal row and proximally with the radius and the triangular cartilage. Gliding motions occur between the carpal rows during flexion, extension, and deviation, and the carpal ligaments check excessive motion.

Placement of the hand for functional tasks is reliant on the stability, mobility, and precision of placement permitted by the wrist complex. Any mechanism of injury or disease that alters this complex system, such as rheumatoid arthritis, translates into some level of dysfunction. Even the simplest splint that crosses the wrist alters in some way the functional abilities of the hand.

OT Practice Note

Splint designs that attempt to augment or substitute for wrist motion are likely to limit component motions or are too complex to fabricate or wear.

Wrist Tenodesis

Tenodesis is the reciprocal motion of the wrist and fingers that occurs during active or passive wrist flexion and extension. Tenodesis is the action of wrist extension producing finger flexion and wrist flexion producing finger extension. It is caused by a lack of change in length of the long finger muscles during wrist flexion or extension (Fig. 30.2). The extrinsic finger muscle tendon units have a fixed resting length; because they cross multiple joints before inserting onto the phalanges, they can affect the position of several joints with no contraction or length change required of the muscles. This concept is crucial for understanding how passive positioning of the wrist affects the resting position of the digits. In the nerve-injured hand, tenodesis is often harnessed by orthoses to provide function. The client with spinal cord injury with sparing of a wrist extensor (C6 or C7 functional level) gains considerable function from a tenodesis, or wrist-driven flexor hinge hand orthosis. In a dynamic orthosis, such as a tenodesis orthosis, the effect that tenodesis has on tendon length will dictate in part the wrist position that will optimize forces directed at the digits.

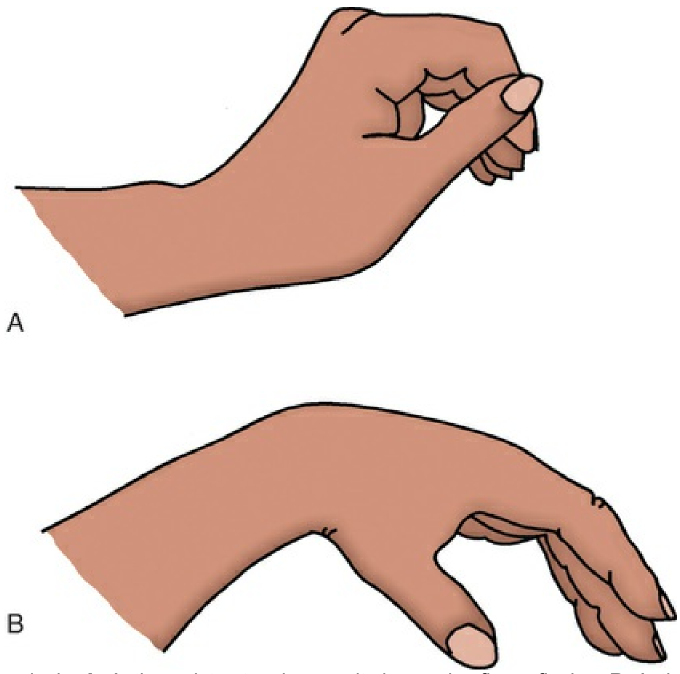


FIG 30.2 Tenodesis. **A,** Active wrist extension results in passive finger flexion. **B,** Active wrist flexion results in passive finger extension.

Metacarpal Joints

The metacarpals articulate with the carpal bones proximally and with the phalanges distally. The first metacarpal, the thumb, articulates with the saddle-shaped trapezium and is considered separately. The second metacarpal fits into the central ridge of the trapezoid, and the third articulates firmly with the facets of the capitate. These articulations form the immobile central segment of the hand around which the other metacarpals rotate. The fourth and fifth metacarpals articulate with the concave distal surface of the hamate. The shorter length of the ulnar two metacarpals and their greater mobility form the flexible arches of the hand; this allows it to conform and fold around objects of various shapes.

The distal transverse arch of the hand lies obliquely across the metacarpal heads. This obliquity is critical to the ability of the hand to adapt its shape to objects. The hand does not form a cylinder as it closes but instead assumes the position of a cone. In making a fist, the ulnar two digits of the hand contact the palm first, and the radial two digits follow. This cascade of the fingers is a direct result of the oblique angle formed at the metacarpal heads (sloping angle, not parallel to the wrist). This concept is most important when determining the distal trim lines for a wrist support when full MP flexion is desired. The orthosis in Fig. 30.3, A, is improperly trimmed distal to the MP creases. Distal trim lines should be established proximal to the MP creases, as in Fig. 30.3, B.

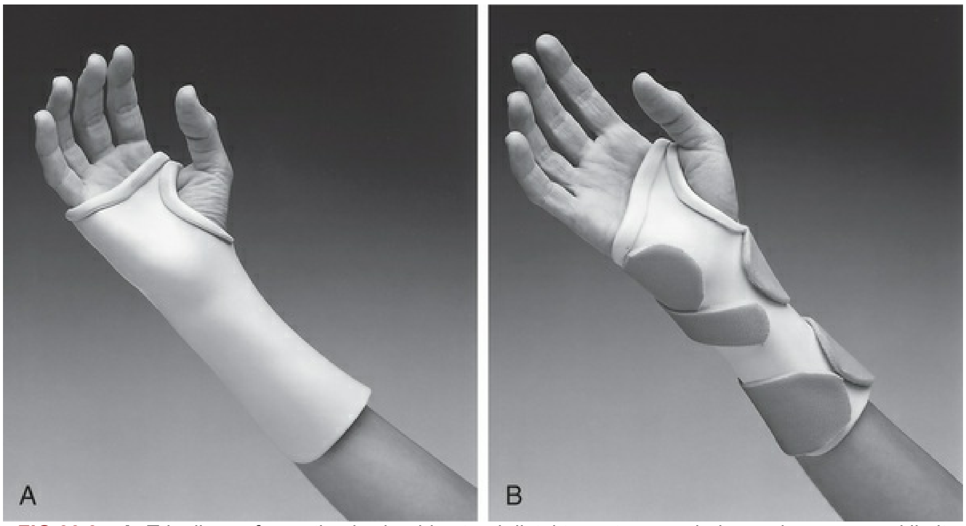


FIG 30.3 **A,** Trim lines of an orthosis should extend distal to metacarpophalangeal creases and limit finger flexion. **B,** The distal trim lines fall proximal to metacarpophalangeal creases (following the oblique angle of the metacarpal heads) and permit full finger flexion.

Metacarpophalangeal Joints

The distal heads of the metacarpals articulate with the proximal phalanges to form the MP joints. Active motion is possible along an axis of flexion and extension and along an axis of abduction and adduction. In addition, a small degree of rotation is present at the MP joints. These axes of motion allow for expansion or spreading of the hand and contribute to the ability of the hand to conform to different shapes and sizes of objects. An attempt to hold a softball without abduction of the fingers shows the importance of this motion. An orthosis with trim lines along the ulnar border of the hand that extend too far distally limits flexion and abduction of the fourth and fifth digits. As a result, the hand will have a limited ability to grasp large objects, and function will be restricted (Fig. 30.4, A). Distal trim lines that fall proximal to the MP creases will allow for full MP flexion (Fig. 30.4, B).

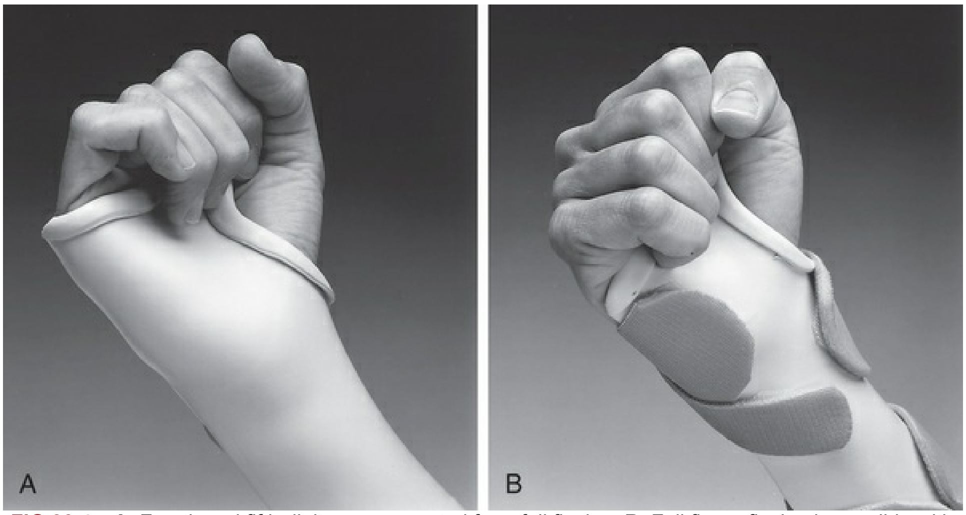


FIG 30.4 **A,** Fourth and fifth digits are prevented from full flexion. **B,** Full finger flexion is possible with proper trim lines.

Thumb

The base of the first metacarpal articulates with the trapezium to form a highly mobile joint that often is compared with the shape of a saddle. The base of the first metacarpal is concave in the anteroposterior plane and convex in the lateral plane. This surface is met by reciprocal surfaces on the trapezium. This configuration allows for a wide arc of motion, with the thumb able to rotate not only for pad-to-pad opposition but also for full extension and abduction to move away from the palm.[32] Both motions are important to function—that is, a thumb posted in permanent opposition may make grasp possible but release of objects impossible. This concept is crucial to an understanding of orthoses that augment the tenodesis action of the hand by posting the thumb in opposition to the index and long fingers. With such orthoses, the therapist must carefully consider the degree of abduction and opposition in which the thumb is posted to maximize both grasp and release.

Interphalangeal Joints

The proximal interphalangeal (PIP) and distal interphalangeal (DIP) joints are true hinge joints, with motion in only one plane. This limitation of motion ensures greater stability in these joints, which contributes to their ability to resist palmar and lateral stresses and so imparts strength and precision to functional tasks.

Forearm Rotation

Close consideration of forearm rotation (i.e., supination and pronation) is necessary because of the importance of these motions to function and to the fitting of splints. Forearm rotation occurs at the elbow and at the distal forearm, with axes of rotation through the center of the radial head and capitulum and along a line extending through the base of the ulnar styloid (Fig. 30.5). During pronation, the ulnar styloid moves laterally as the radial styloid travels medially. During supination, the opposite occurs, with the ulnar styloid moving medially. This movement displaces the styloids, which in turn alters the architecture of the forearm in supination as compared with pronation.

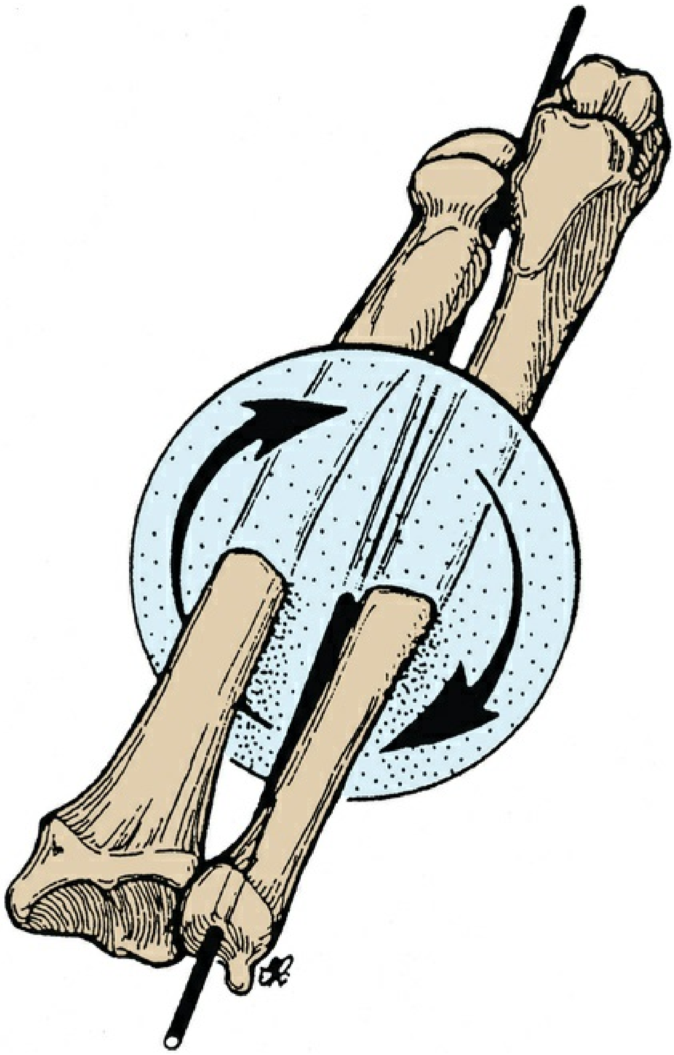


FIG 30.5 The axis of motion for supination and pronation extends the length of the forearm and is centered through the radial head and capitulum and the distal ulnar styloid. (From Hunter JM, Schneider LH, Mackin EJ, et al, editors: *Rehabilitation of the hand: surgery and therapy,* ed 3, St. Louis, 1990, Mosby.)

The way in which this change in dimensions affects orthosis trim lines is shown in Fig. 30.6. Lines drawn at midline along the supinated forearm shift dramatically upon pronation. Orthoses are generally used for function with the forearm in pronation, but they are easier to fabricate with the forearm in supination. Important to note is that if the forearm is not pronated before the orthotic material is set, the trim lines will be high on the radial border and low on the ulnar border.

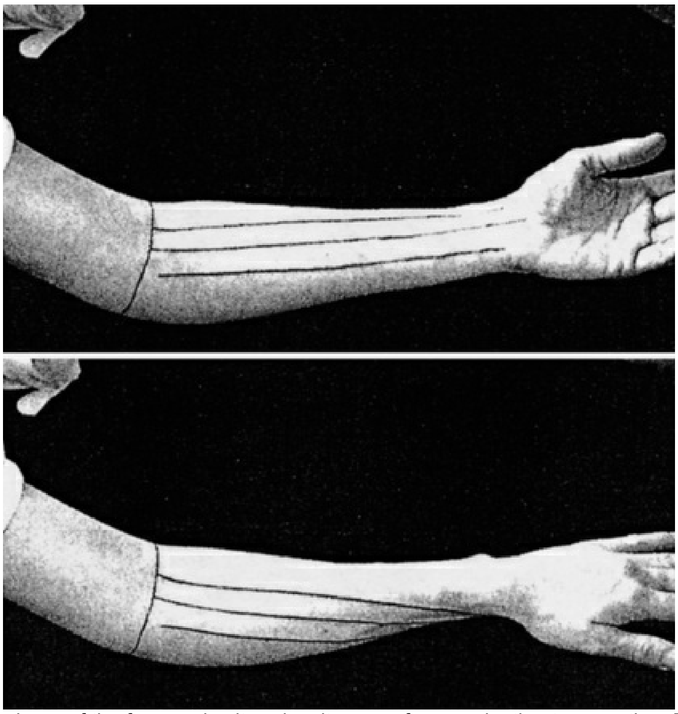


FIG 30.6 The shape of the forearm is altered as it moves from supination to pronation. Forearm-based orthoses must be repositioned to accommodate this if the forearm is rotated during the fabrication process. (From Wilton JC: *Hand splinting, principles of design and fabrication*, Philadelphia, 1997, Saunders.)

One final active demonstration highlights the importance of forearm position for hand function. Place a coin of any size on a tabletop, and while holding the forearm in neutral (thumb straight up), attempt to pick up the coin. It becomes rapidly apparent that the ability to position the hand for function relies in great part on the more proximal joints of the forearm.

Ligaments of the Wrist and Hand

The ligamentous structures of the hand act as checkreins for the hand and wrist; this limits extremes of motion and provides stability. The complex motions of the wrist depend in large part on the ligaments that restrain them, rather than on the contact surfaces between the carpals and metacarpals. Three groups of ligaments are discussed briefly to highlight their contribution to wrist stability and mobility.

The palmar ligaments include the radioscaphocapitate ligament, which contributes support to the scaphoid; the radiolunate ligament, which supports the lunate; and the radioscapholunate ligament, which connects the scapholunate articulation with the palmar surface of the distal radius. The stability and mobility of the thumb and radial carpus depend on the integrity of these ligaments. Disruption of the ligaments results in instability and pain at the wrist and in significant dysfunction of the thumb. Use of orthotics is frequently the treatment of choice to supply stability for pain reduction.

The radial and ulnar collateral ligaments provide dorsal stability. These capsular ligaments, along with the radiocarpal and dorsal carpal ligaments, provide carpal stability and permit ROM. Disruption of any of these ligaments may result in pain, loss of strength, and functional impairment.

The triangular fibrocartilage complex (TFCC) includes the ligaments and the cartilaginous structures that suspend the distal radius from the distal ulna and the proximal carpus. Tears or strains in this complex are evidenced by pain and weakness with resultant loss of function in resistive tasks. The advent of new imaging techniques has made the diagnosis of TFCC tears more common; splinting is often ordered for support and pain relief.

Metacarpophalangeal Joints

Soft tissue structures that surround the MP joints include the joint capsule, the collateral ligaments, and an anterior fibrocartilage or volar plate. The capsule covers the head of the metacarpal and is reinforced by the collateral ligaments. The collateral ligaments are configured to allow side-to-side motion when the MP is in extension and to tighten as the MP is flexed. The volar plate is attached to the base of the proximal phalanx and is loosely attached to the base of the neck of the metacarpal through the joint capsule. This configuration allows the plate to slide proximally during MP flexion. The plate returns to its lengthened state with the MP in extension and acts as a checkrein for volar displacement of the MP joint when it is extended.

When MPs are immobilized in extension, a strong tendency exists for secondary shortening of the lax collateral ligaments, in addition to contraction and adherence of the volar plate, which results in limited MP flexion and loss of functional grasp patterns. The commonly accepted resting position splint, which places the wrist in 25 degrees to 35 degrees of extension, the MP joints at 60 degrees to 70 degrees of flexion, and the PIP and DIP at 10 degrees to 35 degrees of flexion, is designed to prevent shortening and to maintain the joints in midrange for optimal function. An important consideration is to ensure that the mobile fourth and fifth digits are positioned in the orthosis to accommodate their additional degree of mobility by allowing somewhat greater flexion at their MP joints (Fig. 30.7).

FIG 30.7 Oblique angle of transverse arch at metacarpophalangeal joints must be accommodated to ensure maintenance of more mobile fourth and fifth digits.

Proximal Interphalangeal Joints

The PIP joint capsule and ligaments provide stability and allow mobility in one plane only. Collateral ligaments on each side of the joint run in a dorsal-to-palmar direction, inserting into the fibrocartilage plate of the PIP. These ligaments and the plate are lax with the PIP joint in flexion and taut with it in extension. The seemingly simple joint is made more complex by inclusion of the extensor mechanism passing through the capsule dorsally and contributing slips to the system of ligaments affecting this joint. The potential for disruption of the extensor mechanism is high. Many of the most commonly fabricated finger orthoses are used to correct PIP boutonniere (Fig. 30.8, A) and swan-neck (Fig. 30.8, B) deformities.

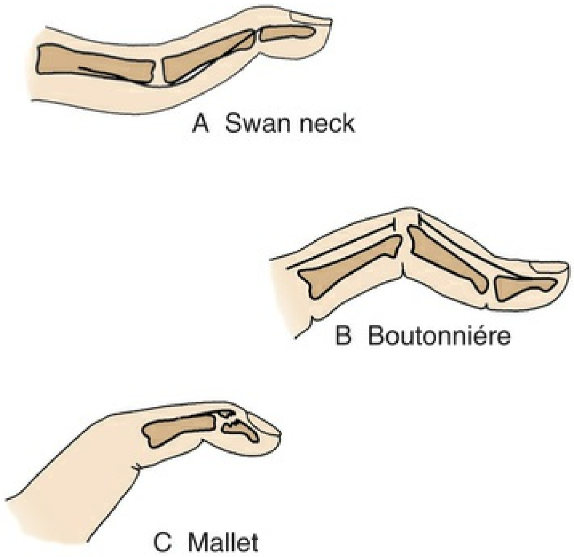


FIG 30.8 **A,** Swan-neck deformity, or joint change, with proximal interphalangeal joint hyperextension and distal interphalangeal joint flexion. **B,** Boutonnière deformity, or joint change, characterized by proximal interphalangeal joint flexion and distal interphalangeal joint hyperextension. **C,** Mallet finger with distal interphalangeal joint flexion and loss of active extension.

Distal Interphalangeal Joints

The DIP joint capsule and ligaments are similar to the PIP joint but have less structural strength to the terminal insertions of the palmar plate and collateral ligaments. As the structures become smaller, they lose integrity and strength. One of the most frequent injuries to the digits is disruption of the terminal end of the extensor tendon, which results in a mallet or "baseball" finger (Fig. 30.8, C).

Muscles and Tendons of the Forearm, Wrist, and Hand

Balance in the hand must be considered when the hand is assessed for an orthosis. Two groups of muscles act on the wrist and hand: (1) the extrinsic muscles that arise from the elbow and the proximal half of the midforearm and (2) the intrinsic muscles with origins and insertions entirely in the hand. The extrinsic muscles include both a flexor and an extensor group acting on the wrist and on the digits. The intrinsics include the lumbricals, the dorsal and palmar interossei, and the thenar and hypothenar groups. Smooth, coordinated motions of the hand in functional activities depend on a well-integrated balance between and within these two muscle groups. Many of the contractures that OTs attempt to correct with orthosis use are caused by neurologic dysfunction (central or peripheral), which results in an imbalance of muscle tone or innervation.

Nerve Supply

A discussion of the nerve supply to the hand should include mention of the continuity of the brachial plexus from its origins in the spinal cord to its terminal innervations in the hand. Injuries or compressions that occur anywhere along this continuum may result in motor or sensory dysfunction. When splinting the UE, the therapist must give attention to the pathways of the nerves that supply the UE and to potential sites for nerve entrapment. In the fabrication of any orthotic device, care must be taken to avoid applying pressure over sites where the nerves are superficial and prone to compression. These sites include the ulnar nerve at the elbow in the cubital tunnel and in Guyon's canal at the ulnar border of the wrist, the radial nerve at the elbow and in the thenar snuffbox, and the digital nerves along the medial and lateral borders of the digits (Fig. 30.9).

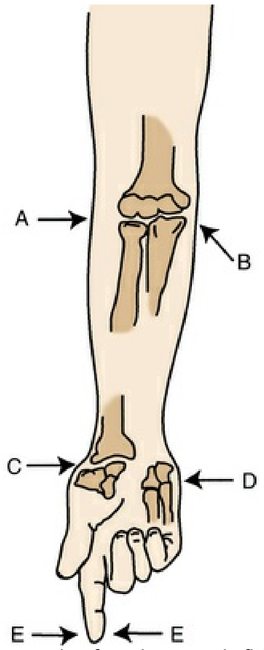


FIG 30.9 Potential sites for nerve compression from improperly fitted orthoses. **A,** Radial nerve. **B,** Ulnar nerve. **C,** Radial digital nerve in anatomical snuffbox. **D,** Ulnar nerve in Guyon's canal. **E,** Digital nerves.

Three peripheral nerves supply motor and sensory function to the hand (Fig. 30.10). The radial nerve is the primary motor supplier to the extensor and supinator muscles. The sensory fibers of the radial nerve supply the dorsum and the radial border of the hand. The median nerve provides motor supply to the flexor-pronator group, which includes most of the long flexors and the muscles of the thenar eminence. The sensory distribution of the median nerve is functionally the most important because it includes the palmar surface of the thumb, index, and long fingers and the radial half of the ring finger. The ulnar nerve supplies most of the intrinsic muscles, the hypothenar muscles, the ulnarmost profundi, and the adductor pollicis brevis. The sensory supply of the ulnar nerve includes the palmar surface of the ulnar half of the ring finger, the little finger, and the ulnar half of the palm.

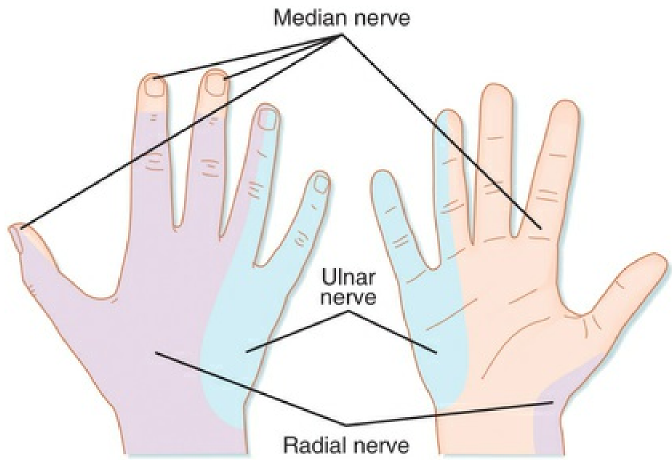


FIG 30.10 Sensory distribution in hand. Median nerve distribution includes most of the prehensile surface of the palm. (From Adams JG: *Emergency medicine: clinical essentials*, ed 2, Philadelphia, Saunders, 2013.)

Nerve dysfunction presents a challenge when fabricating an orthosis. Muscle imbalance leads to dysfunctional posturing of the hand, and muscle atrophy reduces the natural padding of the hand. Abrasions or ulcerations may occur in persons who do not remove their splints, because they do not feel pain caused by shearing forces or pressure areas inside the splint. Finally, skin with marked sensory impairment lacks natural oils and perspiration, leading to dry skin that abrades easily.

These factors must be assessed and considered carefully when orthotics are being fitted on persons with sensory impairment.

Fabrication of orthotics for the neurologically impaired hand is directed at preventing joint and soft tissue contractures and restoring functional positioning. Orthoses cannot restore sensibility, and care must be taken to prevent damage to sensory-impaired skin and to limit further reduction of sensory feedback by covering sensate surfaces (those surfaces that have sensation) and consequently reducing functional use of the hand in ADLs.

Little consensus has been reached on whether or not using orthoses for the neurologically impaired hand is best practice and should or should not be done, and for what long-term goals. Lohman and Coppard have provided an excellent summary of this debate in *Introduction to Splinting: A Clinical Reasoning and Problem-Solving Approach.*[23]

Blood Supply

Blood supply to the hand is contributed by the radial and ulnar arteries. The ulnar artery lies just lateral to the flexor carpi ulnaris tendon, where it divides into a large branch that forms the superficial arterial arch and a small branch that forms the lesser part of the deep palmar arch. The ulnar artery is vulnerable to trauma where it passes between the pisiform and the hamate (Guyon's canal). The radial artery divides at the proximal wrist crease into a small, superficial branch and a larger, deep radial branch. The superficial arterial arch further divides into common digital branches and then into proper digital branches.

Venous drainage of the hand is accomplished by two sets of veins: a superficial and a deep group. Therapists are more likely to be concerned with the superficial venous system because it lies superficially in the dorsum of the hand. Disruption of this superficial system may result in extensive fluid edema in the dorsum of the hand, which requires the therapist's intervention. Care must be taken not to strap orthotics too tightly over the dorsum of the hand; this traps fluids from draining.

Skin

The mobility of the hand is directly related to the type and condition of the skin. Anyone who has put on a ring that is slightly too small, only to be unable to remove it, has experienced the redundancy of the skin on the dorsum of the hand. The skin on the dorsum of the hand is loosely anchored to underlying structures and moves easily to allow flexion and extension of the digits. The ring problem occurs because of a greater degree of elasticity in the dorsal skin when it is pulled distally, as opposed to when it is pulled proximally. This fact should be considered when the use of finger splints is contemplated.

The palmar skin, by contrast, is thicker and relatively inelastic. It is firmly connected to the underlying palmar aponeurosis for stability and protection during prehension activities. Furthermore, the underlying fascia of the palmar skin is thicker and protects the nerve endings while it supplies adequate moisture and oils to the skin surface.

Superficial Anatomy and Landmarks

When fabricating an orthosis, therapists must consider where to apply force without causing further trauma. Despite its deftness and power, the hand's lack of protective fascia means that it tolerates external pressures poorly and shearing stresses not at all. The prominent ulnar styloid, the distal radial styloid, and the thumb carpometacarpal joint are common sites for pressure. A truism that will always hold in orthosis fabrication is that padding adds pressure. The softest padding added to a too-tight orthosis will only add more pressure. Pressure is relieved by the creation of a relief in the orthosis or by application of padding and material molded over the pad to make it an integral part of the orthosis (Fig. 30.11). Added padding to relieve pressure after the orthosis is formed should be avoided.

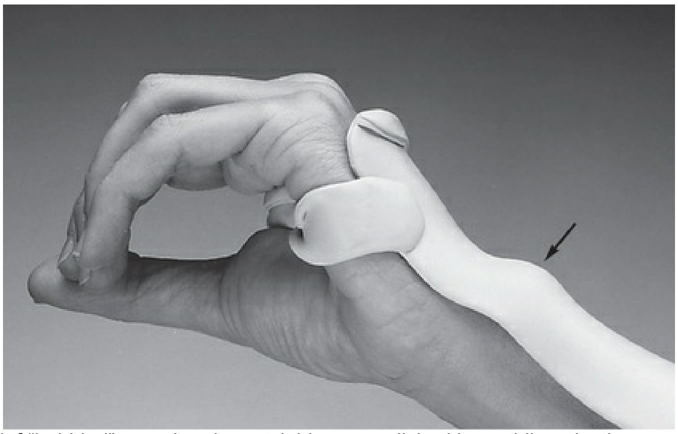


FIG 30.11 Relief "bubbled" over the ulnar styloid, accomplished by molding plastic over a pad placed on the styloid.

Prehension and Grasp Patterns

The ability of the human hand to assume myriad functional positions and to apply only the precise amount of pressure necessary to hold an object is a result of the mobility and stability supplied by the skeleton, the power of the muscles, and the remarkable degree of sensory feedback received from the nerves. This sensory feedback is used to assess the size, shape, texture, and weight of an object. The brain then determines which type of prehension to use to complete a functional task while using this object. The feedback used in grasping and lifting an object is dependent both on the brain interpreting correctly what is seen and on the hand responding appropriately. Once an object is in the hand, further adaptation in prehension will occur if the initial visual assessment was faulty.

Orthotics can maximize functional prehension. In achieving this goal, the therapist must be aware of what an orthosis can and cannot do: an orthosis can stabilize an unstable part, position a thumb in opposition, and even assist or substitute for lost motion. An orthotic with added dynamic components can even gradually revise tissue along its lines of pull by applying slow gentle stretch to gain increased functional range of motion. However, the therapist must be aware that an orthosis may negatively limit mobility at uninvolved joints, reduce sensory feedback, add bulk to the hand, and transfer stresses to the free joints proximal or distal to the part being addressed.

The prehension patterns the hand is able to achieve are as exhaustive as the objects that are available to grasp or pinch. Several authors have contributed to classifications of normal prehension, and the presentation by Flatt[14] is recommended for further study of the subject. It is possible to reduce the many patterns to two basic classifications—prehension and grasp—from which other patterns may be derived. *Prehension* is defined as "a position of the hand that allows finger and thumb contact and facilitates manipulation of objects." *Grasp* is defined as "a position of the hand that facilitates contact of an object against the palm and the palmar surface of partially flexed digits."

The thumb is involved in all but one type of grip, that of hook grasp. Carpometacarpal and MP rotation is crucial to prehension and cannot be overstressed in terms of its importance in splinting to achieve function. This rotation allows for full contact of the thumb in pad-to-pad prehension; this motion is used in a normally active person hundreds of times daily in performance of all areas of occupation, including ADLs, instrumental activities of daily living (IADLs), work, leisure, and social participation.

Lateral Prehension

In lateral prehension, the pad of the thumb is positioned to contact the radial side of the middle or distal phalanx of the index finger (Fig. 30.12, A). Most commonly, this pattern of prehension is used in holding a pen or eating utensil and in holding and turning a key. The short or long opponens splint is used to stabilize the thumb to achieve this prehension pattern.

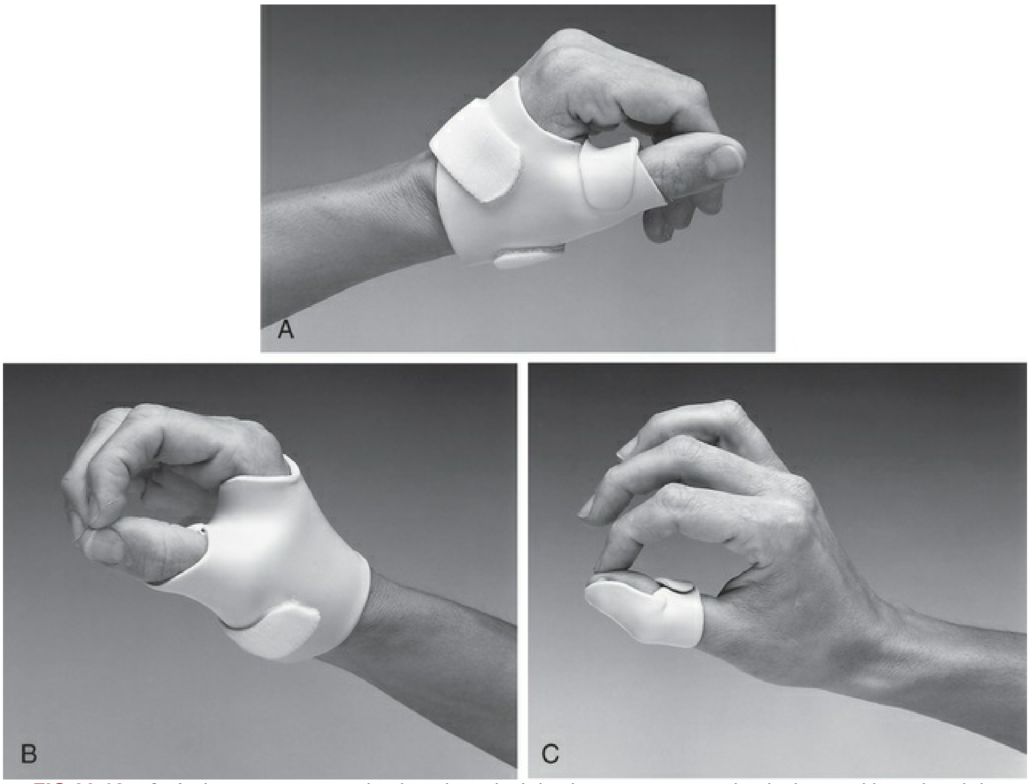


FIG 30.12 **A,** A short opponens orthosis or key pinch in short opponens orthosis that positions thumb in lateral opposition to index finger. **B,** Palmar prehension or three-jaw chuck pinch in short opponens that positions thumb in opposition to index and long fingers. **C,** Tip prehension with thumb and index finger in interphalangeal blocker that secures interphalangeal joint in slight flexion to assist tip prehension.

Palmar Prehension

Palmar prehension is also called *three-jaw chuck pinch.* The thumb is positioned in opposition to the index and long fingers (Fig. 30.12, B). The important component of motion in this pattern is thumb rotation, which allows for pad-to-pad opposition. This prehension pattern is used to lift objects from a flat surface, to hold small objects, and to tie a shoe or bow. The short and long opponens splints may be fabricated to position the thumb in palmar prehension.

Tip Prehension

In tip prehension, the interphalangeal (IP) joint of the thumb and the DIP and PIP joints of the finger are flexed to facilitate tip-to-tip prehension (Fig. 30.12, C). These motions are necessary for picking up a pin or a coin. It is difficult to substitute for tip prehension because it is rarely a static holding posture. Once a pin is in the hand, tip prehension will convert to palmar prehension to provide more skin surface area to retain a small object. A thumb IP hyperextension block is useful in limiting IP hyperextension and in facilitating the IP flexion required for tip prehension. In the case of Alexei, maximal edema and stiffness prevented him from achieving the tip or palmar prehension needed for his diabetes management, which included manipulation of small objects.

Cylindrical Grasp

Cylindrical grasp, the most common static grasp pattern, is used to stabilize objects against the palm and the fingers, with the thumb acting as an opposing force (Fig. 30.13, A). This pattern is assumed for grasping a hammer, a pot handle, a drinking glass, or the handhold on a walker or crutch. Static orthoses offer little to restore this grasp directly, although positioning the wrist in extension offers greater stability to the hand as it assumes this grasp pattern. However, a dynamic outrigger component can be added to a volar orthosis to gently gain increased MP and PIP flexion to enhance cylindrical grasping ability, as was found to be successful for Alexei. A dorsal wrist stabilizer alone offers stability while minimizing palm coverage.

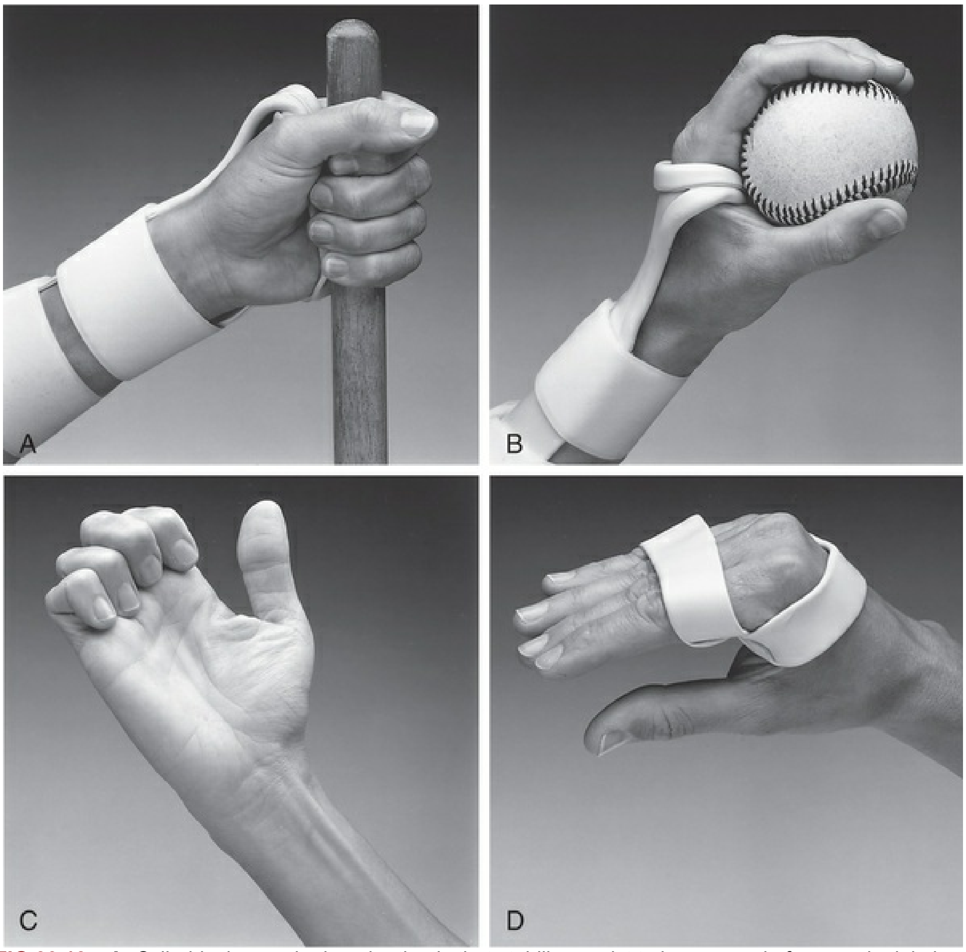


FIG 30.13 **A,** Cylindrical grasp in dorsal orthosis that stabilizes wrist to increase grip force and minimizes palm covering. **B,** Spherical grasp in dorsal orthosis. Orthosis stabilizes wrist to increase grip force and to permit metacarpal mobility required for spherical grasp. **C,** Hook grasp does not involve thumb. Grasp pattern is seen in median and ulnar neuropathy. Orthotics use is aimed at correcting rather than augmenting grasp. **D,** Figure-eight splint substitutes for loss of intrinsic function with median and ulnar neuropathy.

Spherical Grasp

Also called *ball grasp,* this pattern is assumed for holding a round object, such as a ball or an apple. It differs from cylindrical grasp primarily in positioning of the fourth and fifth digits. In cylindrical grasp, the two ulnar metacarpals are held in greater flexion. In spherical grasp, the two ulnar digits are supported in greater extension to allow a more open hand posture (Fig. 30.13, B). In orthosis fabrication, to facilitate or support this pattern of grasp, the wrist-stabilizing orthosis must be trimmed proximal to the distal palmar crease and contoured to allow for obliquity at the fourth and fifth metacarpal heads.

Hook Grasp

Hook grasp is the only prehension pattern that does not include the thumb to supply opposition. The MPs are held in extension, and the DIP and PIP joints are held in flexion (Fig. 30.13, C). This is the attitude the hand assumes when holding the handle of a shopping bag, a pail, or a briefcase. In the nerve-injured hand, splinting is directed more commonly at correcting this posture by flexing the MPs than at facilitating it.

Intrinsic Plus Grasp

Intrinsic plus grasp is characterized by positioning of all MPs of the fingers in flexion, the DIP and PIP joints in full extension, and the thumb in opposition to the third and fourth fingers (Fig. 30.13, D). This pattern is used to grasp and hold large, flat objects such as books or plates. Intrinsic plus grasp is often lost in the presence of median or ulnar nerve dysfunction, and a figure-eight or dynamic MP flexion orthosis is used for substitution.

Mechanics of the Hand and Principles of Orthotic Fabrication

McCollough and Sarrafian stated that the three basic motor functions of the upper limb are “prehension and release, transfer of objects in space, and manipulation of objects within the grasp.”[27] These functions depend on the structural integrity of the skeleton, the muscles that provide power, and the feedback to which the brain responds when enabling the limb to meet functional demands. The task of restoring any one of these basic functions through the application of an orthosis is complex and relies on an understanding of the biomechanics of the hand and the mechanics involved in orthotic design. It is beyond the scope of this chapter to present this topic in depth. However, here is an introduction to those tenets of clinical mechanics deemed necessary for the beginning orthotic fabricator.

Mechanics deals with the application of force, and biomechanics may be viewed as the body's response to those forces. In the hand, muscles supply the force required to produce motion. The force then is transmitted by the tendons to the bones and joints, with control supplied by the skin and pulp of the fingers and palm.[14] How the application of an orthotic affects the transmission of force to produce motion depends on the relationship between the axis of rotation of joints and anatomic planes and the forces imposed on the hand.

Axis of Motion

Hollister and Giurintano[18] define **axis of motion** as “a stable line that does not move when the bones of a joint move in relation to each other” (Fig. 30.14). This stable line is illustrated by Fig. 30.14, B, which shows a tire perfectly balanced around its axis of motion. When a tire is perfectly balanced, it does not wobble; it has pure motion around a single point.

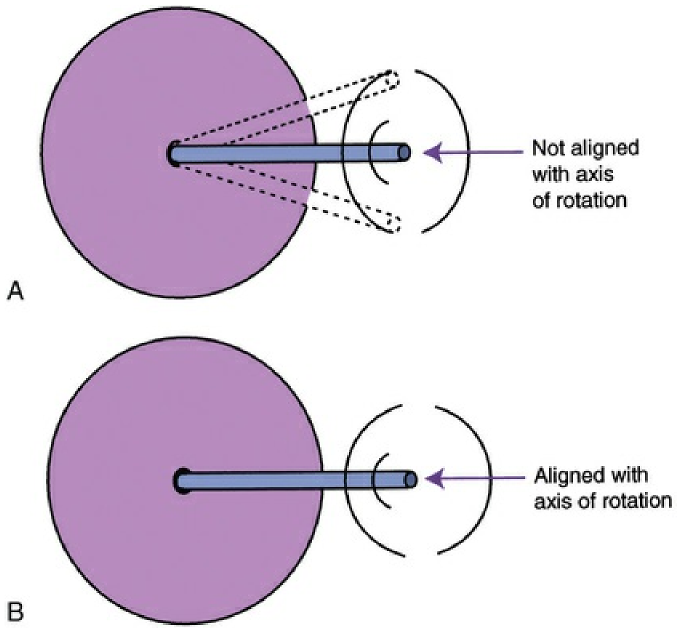


FIG 30.14 **A,** If a tire is not balanced around its axis, it wobbles. If an orthotic hinge is not aligned with the joint axis, wobble is seen as binding of the joint. **B,** Proper alignment of a tire or of a hinge with an anatomical joint results in smooth, unimpeded motion.

In a single-axis joint, motion occurs in only one plane. The PIP joint is an example of a single-axis joint in alignment with an anatomic plane. It moves only in the plane of flexion and extension.

Joints that have more than one axis of motion may move in more than one plane at a time. For example, the wrist complex has two axes of motion: flexion-extension and radial-ulnar deviation. A joint with multiple axes has conjoint motions that occur in addition to the primary motions described by the joint. Wrist flexion occurs with a moment of ulnar deviation and with a small degree of pronation. Wrist extension occurs with radial deviation and slight supination. These conjunct motions are what make circumduction of the wrist possible. They are also what make splinting the wrist with hinged joints a challenge.

An orthotic with a movable hinge or coil has a single axis. When used to splint a single-axis joint such as a PIP joint, a hinge can and should be properly aligned to avoid binding that will limit motion. If a single-axis hinge or coil is used to reproduce motion in a multiaxis joint, some binding or friction will always occur, no matter how well aligned, because the hinge or coil does not allow for, or reproduce, the conjunct motions available in the unsplinted joint.

Force

It is crucial to understand basic principles of **force** and apply them correctly in the fabrication of orthotics. An understanding of the forces applied by levers and the stresses that occur between opposing surfaces can help to explain what happens as forces are applied within the body by muscles and externally by splints.

Definitions

The term *force,* as it relates to splinting, describes the effects that materials and dynamic components have on bone and tissue. *Force* is a measure of stress, friction, or torque. *Stress* is resistance to any force that strains or deforms tissue. Shear stress occurs when force is applied to tissues at an angle or in opposing directions. Pinching skin between the surface of a splint and the underlying bony structures causes shear stress.

Friction occurs when one surface impedes or prevents gliding of a surface on another. Friction is produced in the stiff or contracted joint when soft tissue restriction prevents gliding of the bones. Orthotics may contribute to friction if they are misaligned in relation to a joint axis. For example, a hinged orthosis that is not properly aligned with the axis of rotation will limit motion by producing friction as the joint attempts to move.

Torque is a measure of the force that results in rotation of a lever around an axis. The torque created when a lever rotates depends on the force used and the length of the lever employed. In the body, muscles are the levers that create torque when they act to move a joint. Externally, orthoses may act as levers to apply the force necessary to move a bone around its axis. The measure of torque is given by the following formula:

$$\text{Torque} = (\text{amount of})\ \text{Force} \times (\text{length of})\ \text{Lever arm}$$

Internally, the length of the lever arm is measured as the perpendicular distance from the axis of the joint to the tendon. Externally, the length of the lever arm is measured as the estimated distance from the joint axis to the attachment of force. In orthotics, the attachment point of the force is usually a soft or molded cuff. If the orthosis includes an outrigger with a finger cuff, as shown in Fig. 30.15, the lever arm is the distance from the axis of the joint to the finger cuff, as indicated in line M.

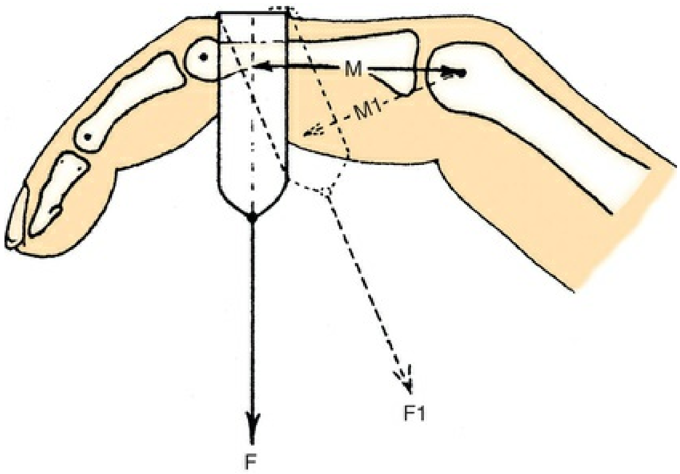


FIG 30.15 Tension F on the phalanx has a moment arm of M acting on the joint. Tension F1 has a smaller moment arm, M1 (with less resulting torque), when the angle of approach is not 90 degrees. (Adapted from Brand PW, Hollister A: *Clinical mechanics of the hand,* ed 3, St. Louis, 1999, Mosby.)

Fig. 30.15 demonstrates that the angle of approach of the force to the finger also affects the length of the lever arm and ultimately the torque applied. The angle of approach is the angle that the line of traction makes as it meets the part being splinted. When the approach is at a right angle (90 degrees) to the long axis of the phalanx, the lever arm is M. When the cuff is at less than 90 degrees to the long axis of the phalanx, the lever arm is shortened to M1. This shorter lever arm produces less torque and therefore less rotation unless greater force is applied.

Given an equal amount of resistance or load, a 2-foot lever will require half as much force to create motion around an axis as will a 1-foot lever. The important principle in orthotic fabrication is that as the distance between the attachment of the cuff or strap and the joint axis increases, less force is required to achieve motion.

Translational Forces

In addition to the angle of approach affecting the length of the lever arm, an approach of less than or greater than 90 degrees results in **translational forces**. The outrigger splint in Fig. 30.16, A, shows a 90-degree angle of approach between the nylon line and the phalanx, demonstrating the correct angle of pull.

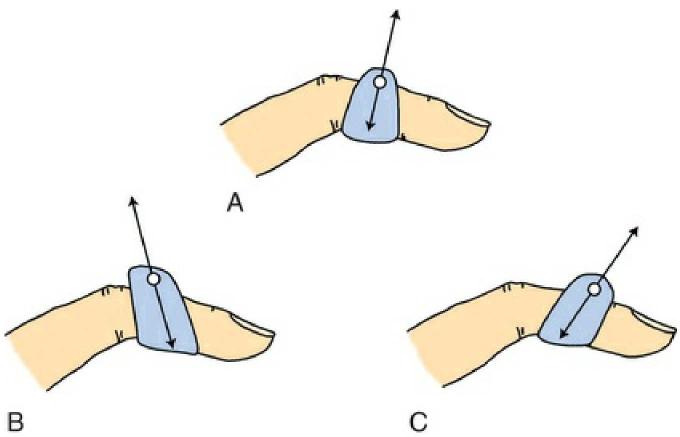


FIG 30.16 **A,** Angle of approach is 90 degrees to middle phalanx, ensuring that force pulling the proximal interphalangeal joint into extension is not causing distraction or compression. **B,** Angle of approach less than 90 degrees to middle phalanx causes joint compression. **C,** Angle of approach greater than 90 degrees distracts joint.

When force is applied at any angle other than 90 degrees, translational forces are created. This alteration of the angle of approach translates some of the rotational force away from producing joint extension and directs the force into joint compression or joint distraction (Fig. 30.16, B and C). The greater the deviation from 90 degrees, the greater is the translational force. Depending on the type of orthosis and the condition of the joint, joint compression or distraction may lead to mere discomfort or to actual joint damage. Translational force is also undesirable because it undermines the effectiveness of the orthosis by shortening the lever arm.[9]

The challenge in splinting with an outrigger is to position the splint so that a 90-degree angle of approach exists. In the outrigger in Fig. 30.17, as long as the finger does not move, the 90-degree angle will remain. As soon as the finger moves, however, the 90-degree angle changes. Because few outriggers allow for this automatic readjustment in position, the outrigger must be adjusted as the contracture lessens to maintain the 90-degree angle of approach.

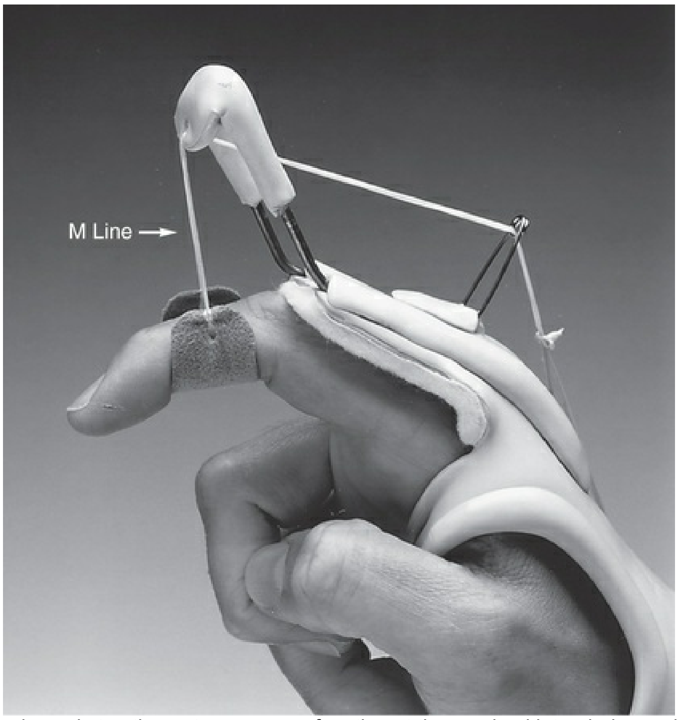


FIG 30.17 As dynamic traction acts on range of motion at the proximal interphalangeal joint, orthosis must be adjusted to maintain 90-degree angle of approach.

Alexei required weekly adjustments of his flexion outrigger to maintain the 90-degree angle of approach as his MP and PIP flexion increased. As his finger flexibility and functional hand motion improved, he was able to lessen time spent in the splint.

Orthosis Classifications

Orthoses may be described in various ways. Terminology varies, and it is useful to understand some of the ways that orthoses may be described. For purposes of clarity, orthoses classifications are described here according to type, purpose, and design.

Historically, one reference to be considered when classification is discussed is the Splint Classification System (SCS),[1] as published by the American Society of Hand Therapists (ASHT). An excellent summary of the Splint Classification System can be found in Jacobs and Austin's *Splinting the Hand and Upper Extremity, Principles and Process* (Chapter 1).[19]

However, the 2012 position statement of ASHT 2 describes the correct use of the term *splint* as a cast or strap and the use of the terms *orthosis, orthoses, orthotic,* and *orthotics* to describe custom-molded, custom-fitted, and prefabricated orthoses fabricated by therapists. The terms *splint* and *orthosis* can no longer be used interchangeably.

Orthoses Classified by Type

Dynamic orthoses include one or more resilient components (elastics, rubber bands, or springs) that produce motion. The force applied from the resilient component is constant even when tissues have reached end range. Dynamic orthoses are designed to increase passive motion, to augment active motion by assisting a joint through its range, or to substitute for lost motion. Dynamic splints generally include a static base on which movable, resilient components can be attached (Fig. 30.18). A common use of dynamic orthotics is to gain greater finger range of motion by adding dynamic MP extension or MP flexion components. Fig. 30.18 shows the type of dynamic orthotic fabricated for Alexei to gain finger extension. Fig. 30.19 shows the type of dynamic orthotic fabricated for Alexei to gain finger flexion.

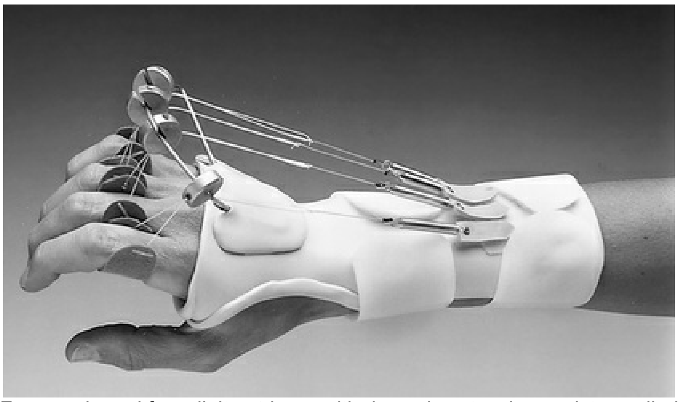


FIG 30.18 Forearm-based four-digit outrigger with dynamic extension assist supplied by springs.

FIG 30.19 Dynamic outrigger for finger flexion. (From Sahrmann S: *Movement system impairment syndromes of the extremities, cervical and thoracic spines,* St. Louis, 2011, Mosby. Used with permission from Ann Kammien, PT CHT, St. Louis, MO.)

A **static orthosis** has no movable components and immobilizes a joint or part. Static orthoses are fabricated to rest or protect, to reduce pain, or to prevent muscle shortening or contracture. An example of a static orthosis is a resting pan splint that maintains the hand in a functional or resting position (Fig. 30.20).

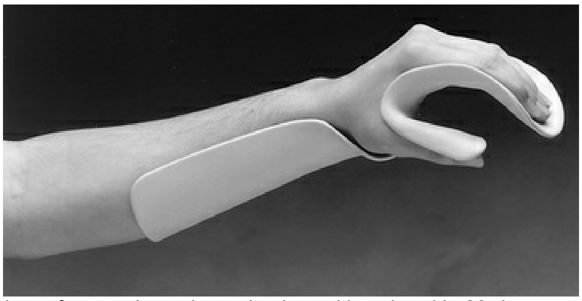


FIG 30.20 Single-surface static resting orthosis positions hand in 20-degree to 30-degree wrist extension, 45-degree to 60-degree metacarpophalangeal flexion, and 15-degree to 30-degree proximal interphalangeal and distal interphalangeal flexion.

A **serial static orthosis** achieves a slow, progressive increase in ROM by repeated remolding of the orthosis or cast. The serial static orthosis has no movable or resilient components but rather is a static orthosis whose design and material allow repeated remoldings. Each adjustment repositions the part at the end of the available range to progressively gain passive motion. A cylindrical cast designed to reduce a PIP joint flexion contracture through frequent removal and recasting is a classic example of a serial static orthosis (Fig. 30.21).

FIG 30.21 A series of cylindrical plaster casts is made to reduce flexion contracture at proximal interphalangeal joint.

Static progressive orthoses include a static mechanism that adjusts the amount or angle of traction acting on a part. This mechanism may be a turnbuckle, a cloth strap, nylon line, or a buckle. The static progressive orthosis is distinguished from the dynamic orthosis by its lack of a resilient force. It is distinguished from a serial static orthosis in having a built-in adjustment mechanism, so that the part can be repositioned at end range without the need to remold it. Generally, the client can adjust the static progressive mechanism as prescribed or as tolerated (Fig. 30.22).

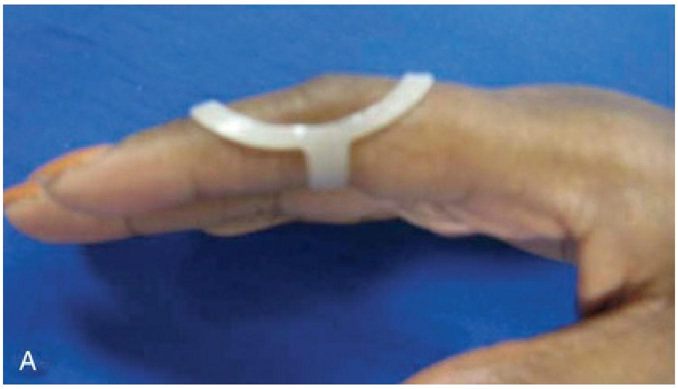
FIG 30.22 Static progressive web strap adjusts with hook closure. Client is taught to adjust strap as tolerance permits.

Orthoses Classified by Purpose

Although nomenclatures may vary, orthoses are usually described in functional terms.[1] They are broadly described first as articular or nonarticular, then by location and direction, and then divided into three overriding purposes: restriction, immobilization, and mobilization. The publication also lists many functions of orthotics, each of which is placed in one of three categories. Orthoses may fulfill more than one function or purpose, depending on the method of fabrication and the problems they address.

Restriction Orthoses

Restriction orthoses limit joint ROM but do not completely stop joint motion. One example is the orthosis in Fig. 30.23, which blocks PIP joint hyperextension while allowing unlimited PIP joint flexion. Semiflexible orthoses are available that limit motion at the extremes of range but allow motion in the middle of the range. Although the orthosis may be restrictive, the goal or function may vary.



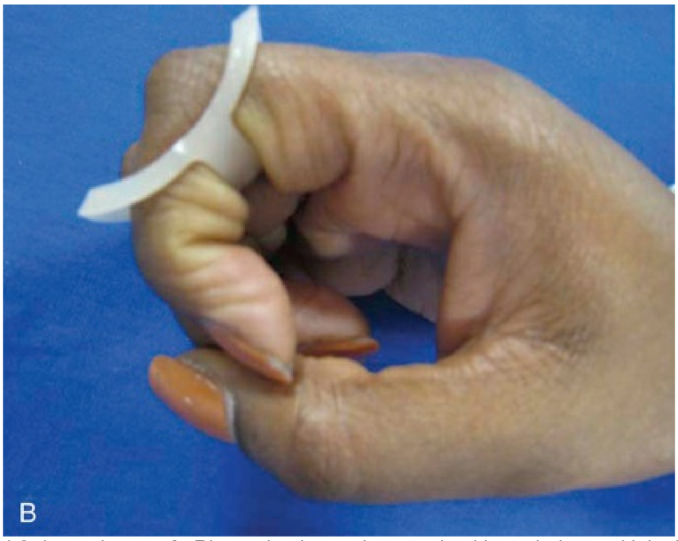


FIG 30.23 Oval-8 ring orthoses. **A,** Ring orthosis restricts proximal interphalangeal joint hyperextension. **B,** Ring orthosis allows full flexion. (From Skirven TM, et al, editors: *Rehabilitation of the hand and upper extremity,* ed 6, Philadelphia, 2011, Mosby.)

Immobilization Orthoses

Immobilization orthoses may be fabricated for protection to prevent injury, for rest to reduce inflammation or pain, or for positioning to facilitate proper healing after surgery. The classic example is the resting pan orthosis (see Fig. 30.20), which serves two of the three functions. A resting orthosis fabricated for a client after a cerebrovascular accident (CVA) positions the wrist and digits to maintain soft tissue length and can protect the insensate hand against damage.

Mobilization Orthoses

Mobilization orthoses are designed to increase limited ROM or to restore or augment function. A mobilizing orthosis may assist a weak muscle or substitute for motion lost because of nerve injury or muscle dysfunction (Fig. 30.24). The orthosis may attempt to balance the pull of unopposed spastic muscles to prevent deformity or joint changes and to assist function. An orthosis may provide resistance against which a weak muscle can exercise to improve its strength or to facilitate tendon gliding after tendon surgery. Frequently, mobilizing orthoses are used to increase the ROM of contracted joints, as in the case of Alexei, who experienced severe finger stiffness as a result of edema, which pooled in his hand after his forearm fracture.

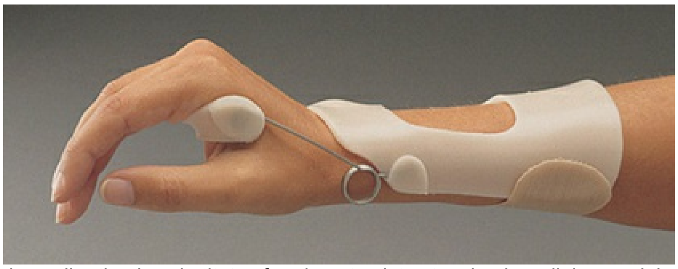


FIG 30.24 Spring coil orthosis substitutes for absent wrist extension in radial nerve injury. (Courtesy North Coast Medical, Inc., Gilroy, CA.)

Orthoses Classified by Design

After the purpose of the orthosis has been determined, the next decision relates to its design. Each of the types of orthoses described earlier (static, dynamic, serial static, and static progressive) may be fabricated as a single-surface design, a circumferential design, or a three-point design. A final category, the loop design, is generally limited to acting on finger IP joints by providing a loop of material that wraps around the joints to restore the final degrees of joint flexion.

All orthoses are designed to provide some degree of force. This force may be distributed as a continuous loop, with equal and opposing forces wrapping around two or more joints (Fig. 30.25, A). More commonly, the force is applied through three points of pressure (Fig. 30.25, B). Although the loop design generally is used only on finger IP joints, some variation of the three-point pressure design is used in all other splints.

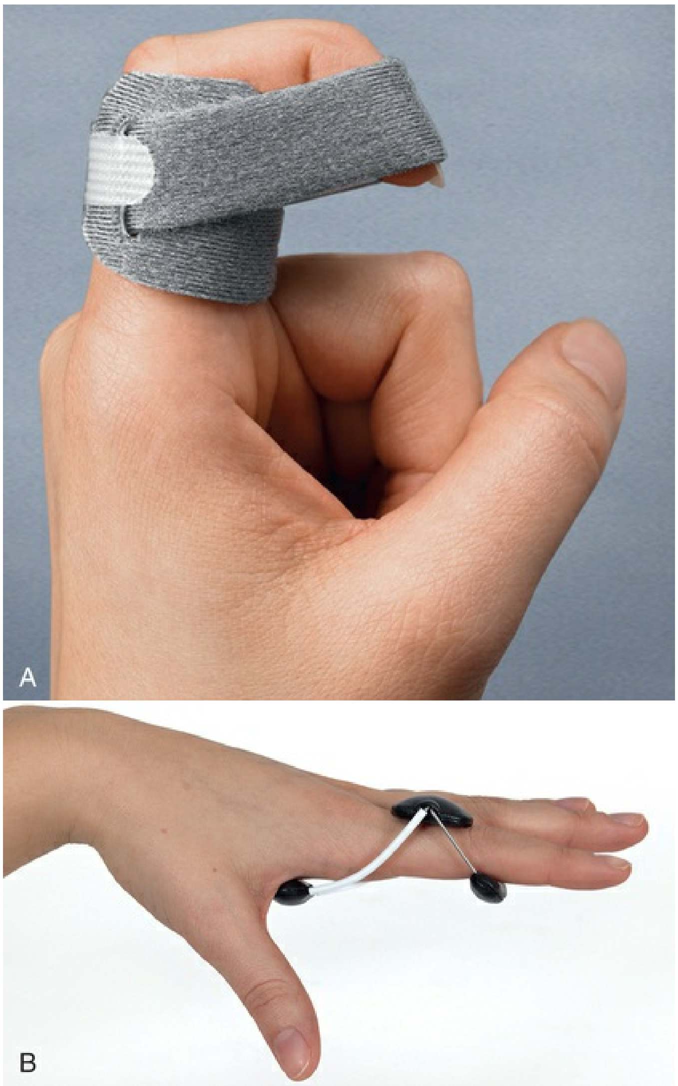


FIG 30.25 **A,** Final flexion strap designed to restore full interphalangeal joint flexion provides equal force on all surfaces of the digit. **B,** Three-point pressure orthosis with spring wire reduces proximal interphalangeal joint flexion contractures of 35 degrees or less. (*A,* Courtesy 3-Point Products, Inc., Stevensville, MD. *B,* Courtesy GettyImages.com.)

Three-point finger orthoses that incorporate springs, spring wire, or elastics are often used to correct DIP and PIP joint flexion contractures. A flexion contracture exists when a joint will not move passively out of a closed position into extension. These designs include two points of pressure—one proximal to the joint and one distal—and the third or central opposing force, acting directly over or close to the joint, as in Fig. 30.25, B. In a three-point finger orthosis, the force of the central point is equal to the sum of the two forces of the correcting points. This fact is clinically important because tissue tolerance under this central point may be insufficient and may react with pain and inflammation. This problem is seen frequently at the PIP joint, where limited surface area exists over which to distribute pressure. Pressure must be distributed with contoured surfaces that are as broad as possible, and the spring or elastic force and the wearing time must be adjusted to the client's tolerance. Proper padding incorporated into the orthosis can aid in distributing pressure.

The dynamic finger-based three-point orthosis just described is a unique design that does not adhere to the 90-degree rule—that is, when the splint is applied to a joint with a flexion contracture, the angle of approach of the line of traction is never 90 degrees. The more severe the contracture, the greater the translational force that is present; therefore it is less effective than a properly contoured outrigger orthosis that adheres to the 90-degree rule. This design should be fitted only in the presence of IP joint flexion contractures of 35 degrees or less. For finger contractures in excess of 35 degrees, a hand- or forearm-based outrigger orthosis is recommended because it can be positioned to apply force at a 90-degree angle of attack. Alternatively, a conforming, serial static orthosis can be used, as described in the section on traction.

Single-Surface or Circumferential Design

If a molded orthotic is to be fabricated, the next decision is whether to use a circumferential or single-surface design. Single-surface orthoses are fabricated to cover only one surface—the volar or dorsal surface of a limb or the ulnar or radial half of the hand or forearm. Straps are added to create the three points of pressure necessary to secure the orthosis (Fig. 30.26, A).

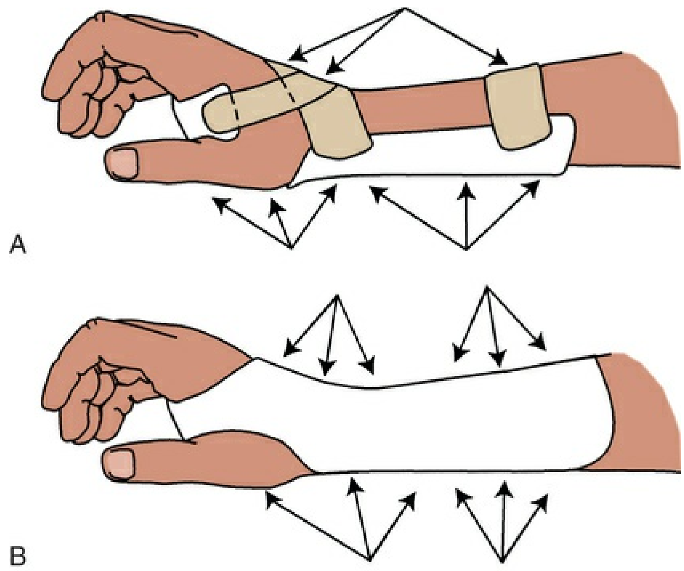


FIG 30.26 **A,** Single-surface orthosis requires properly placed straps to create three-point pressure systems to secure orthosis and ensure distribution of pressure. **B,** Circumferential orthoses create multiple three-point pressure systems to secure orthosis for immobilization.

Circumferential orthoses wrap around a part, covering all surfaces with equal amounts of pressure (Fig. 30.26, B). Straps are used solely to close the orthotic or to create an overlap. Thinner materials can be used in molding a circumferential orthosis, because increased contours in the material add to the rigidity. An example of added strength from contours is corrugated paper. Consequently, circumferential orthoses can be made lighter and out of highly perforated materials for air circulation without sacrifice of control.

Indications for Single-Surface Orthosis Fabrication

Single-surface orthoses are effective for supporting joints surrounded by weak or flaccid muscles, for instance, following a CVA or peripheral nerve injury. Because little or no active motion is available, the extra control given by circumferential orthotics is not needed, and donning and doffing the orthotic will be easier. A single-surface orthosis is also effective as the base for attaching outriggers in dynamic orthoses and for postoperative orthoses in which fabrication of a circumferential orthotic may damage repaired structures.

Indications for Circumferential Orthosis Fabrication

Circumferential orthoses are effective for immobilizing painful joints or for protecting soft tissue (see Fig. 30.25, B). Because the circumferential design gives comfortable, complete control, it is particularly helpful when the client will be wearing the orthosis during activity, when shear forces can be a problem. This comfortable, complete control also makes a circumferential design useful for serial static orthoses used to reduce contractures. The control that a circumferential design supplies makes it a good choice for stabilizing proximal joints when outriggers are applied to act on more distal joints.

When to Use and When Not to Use Orthotics

A first step in deciding which orthosis style and design to choose is to determine whether the client is a good candidate for wearing an orthosis. Several issues should be examined in this regard.

Compliance Issues

First, the therapist must consider whether or not the client is likely to comply with the orthosis wearing program. The orthosis may have a negative effect on the client's ability to be independent in self-care or to function at work. Some clients are sensitive about their appearance and may refuse to wear an orthosis if it offends their aesthetic sense or negatively affects their body image. Compliance with an orthosis wearing program may be poor if the client's general level of motivation to get better is low. On the other hand, some clients are so highly motivated that they will overdo the wearing program and cause themselves damage. Finally, the client's cognitive and perceptual ability to follow an orthosis wearing program should be considered, especially if no responsible care provider is available to supervise the orthosis-wearing precautions.

Ability to Don and Doff an Orthosis

Even if compliance is not an issue, the client may have problems donning and doffing (putting on and removing) the orthosis. For example, the client may have no one at home to assist in donning and doffing a difficult orthosis. The hospitalized client may not have adequate staff help to follow the wearing schedule or to apply the orthosis correctly.

Skin Tolerance and Hypersensitivity

The therapist must assess the client's skin condition before deciding to fit an orthosis. Clients who experience diaphoresis and produce excessive perspiration that may lead to skin maceration need to be evaluated more carefully for orthotic consideration and type, such as ventilated plastics and absorbent padding. Some clients are intolerant of any pressure because of extremely fragile skin or sensory dysfunction. If these issues arise and cannot be ameliorated, safe alternative therapeutic interventions must be substituted for the orthotic.

Wearing Schedule

If none of the preceding issues prevents the client from being a candidate for splinting, the therapist must decide on the optimum wearing schedule for the splint. Nighttime may be the best time for a client to wear a static splint designed to change ROM. It is also the time when clients need resting splints to prevent them from sleeping in positions that may damage the hand or allow nerve compression. During the daytime, the client may wear a dynamic splint or a splint designed to assist function. It is often best to minimize splinting during the day if possible, so that the client can use his or her hand as normally as possible. For some who must wear positioning hand splints at night, it may be advisable to alternate wearing splints on one hand at a time so that the individual is not left without the sensory input and function of a splint-free hand. Such a splint-wearing schedule, although not ideal for meeting therapeutic goals, may at least offer a compromise for better compliance.

Orthosis Fabrication Process

Step One: Creating a Pattern

Once the decision has been reached to fabricate an orthosis, arguably the most important step in the fabrication process is deciding on and creating a pattern. Although it may seem elementary even to the novice fabricator, this step can determine the success of the orthosis in terms of fit and function. Allowing the time to make a well-thought-out and properly fitted pattern gives the therapist the chance to deal with such issues as what he or she is trying to accomplish with the orthotic and how it is going to fit. Ultimately a properly fitted pattern makes the entire fabrication process easier and faster and increases the chance of success.

OT Practice Note

The process of making a pattern involves an understanding of the anatomy and biomechanics of the hand and the materials to be used, in addition to a bit of old-fashioned dressmaking. Understanding how positional changes alter length and how depth and width relate to the pattern is paramount to success.

The common technique of making a pattern starts with a tracing or outline of the hand. This generally is taken with the hand lying flat when possible, or by tracing the uninvolved hand if necessary. An amount is added to this outline to approximate the width and length needed for the orthotic. A common error in this technique is not taking into account the position in which the hand (or other body part) will ultimately be held in the finished orthotic.

Fig. 30.27, A and B, shows a pattern taken with the hand lying flat, with no length added to the pattern. In Fig. 30.27, C, when the pattern is fit on the volar surface of the hand with the hand in functional position (the wrist in 35 degrees of extension, the MP joints at 70 degrees of flexion, and the IP joints in 10 to 20 degrees of flexion), the pattern extends beyond the fingertips and in fact is too long. The same pattern on the dorsum of the hand (Fig. 30.27, D) with the wrist now in flexion illustrates that the pattern is now too short. Going from the volar surface of the hand to the dorsal surface is akin to driving around the inside of a curve as opposed to the outside of a curve. As any racecar driver knows, the inside of a curve is the shorter distance. Altering the position of the hand and the surface to which the orthotic will be fit alters the length of the pattern. The therapist must accommodate for this by checking the pattern on the hand in the position in which the hand will be held.

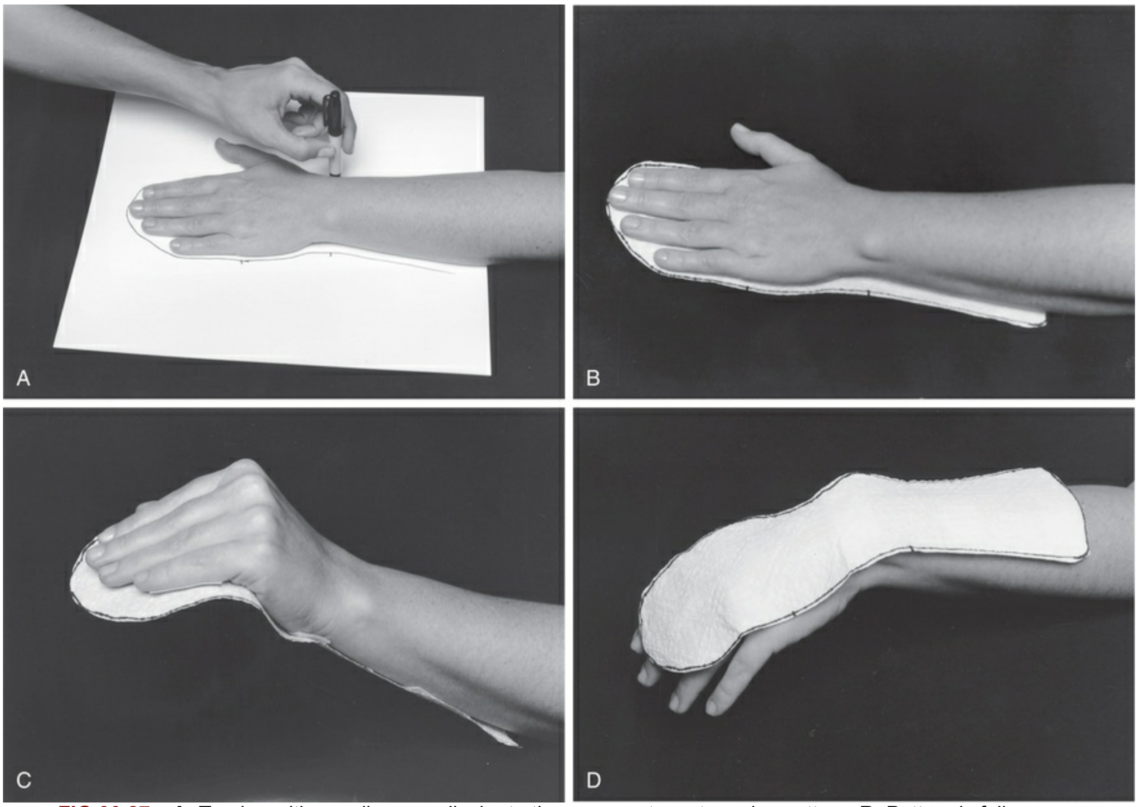


FIG 30.27 **A,** Tracing with pencil perpendicular to the arm creates a true size pattern. **B,** Pattern is full length with hand flat. **C,** Pattern is too long when fit on the volar surface with hand in resting position. **D,** Pattern is too short when fit on dorsum of hand with wrist and fingers in flexion.

Depth is the second dimension that must be considered when a pattern is made. The ideal trim lines of a single-surface orthotic fall at midline along the arm, hand, leg, or foot. An orthosis trimmed at midline provides optimal support and allows for proper strapping to help secure it in place (Fig. 30.28).

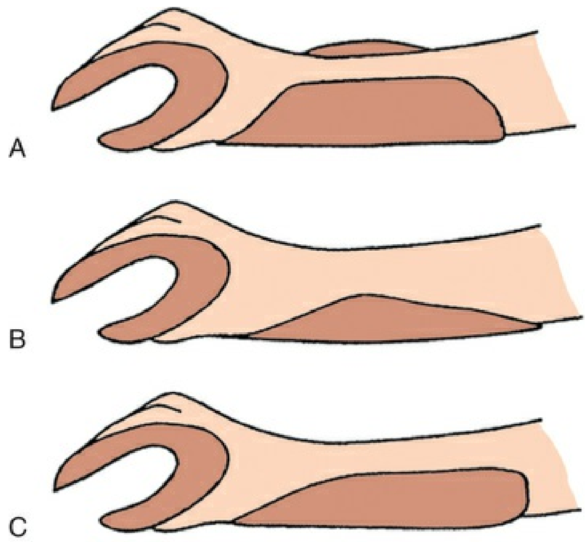


FIG 30.28 Forearm trim lines. **A,** Trim lines are too high, extending above forearm. Straps will bridge arm and will be ineffective. **B,** Trim lines are too low. Straps cannot substitute for too-low trim lines without applying excessive pressure. **C,** Midline trim lines ensure that straps properly secure splint on arm and hand.

To determine how much to add to the outline to achieve midline trim lines, the maker must observe the width and depth of the arm or hand. The forearm is cone shaped, not a straight cylinder, and it graduates in depth over the forearm muscle. Even the thinnest forearm graduates in width and depth proximally. Persons with significant muscle bulk may have graduation at quite an acute angle from the wrist to the proximal forearm. Determination of how much to add to a forearm trough must consider how much the orthosis must come out, around, and up the forearm to reach midline. The depth of the hand, particularly the depth of the hypothenar eminence, must be known to create the proper trim lines for a hand platform.

In the fit of any forearm-based orthosis, the proximal trim lines must take advantage of the soft muscle bellies that protect the radius and the ulna. The proximal borders of the orthosis should be flared so that the trim line remains at midline to help secure the orthosis in place on the arm (Fig. 30.29).

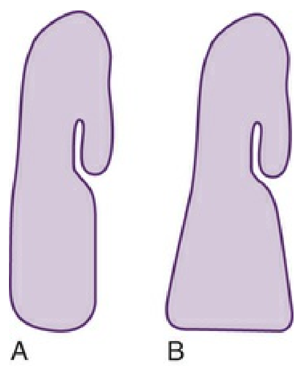


FIG 30.29 **A,** Narrowing the proximal pattern will cause trim lines to drop below midline. **B,** Flaring the proximal border of the splint maintains trim lines at midline.

A forearm-based orthosis should extend approximately two thirds of the length of the forearm, as measured from the wrist proximally. A good rule to remember is to bend the client's elbow fully and mark where the forearm and the biceps muscle meet. The orthosis should be trimmed one-quarter inch below this point to avoid limiting elbow flexion and to prevent the orthosis from being pushed distally when the elbow is flexed (Fig. 30.30).

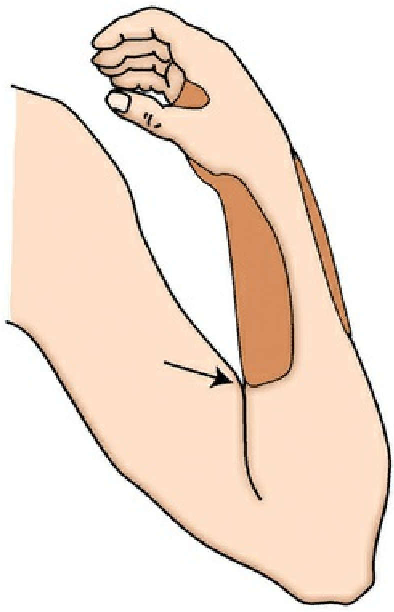


FIG 30.30 Length of forearm-based orthosis is checked by flexing elbow and noting where biceps meet forearm. Splint is trimmed 1/4 to 1/2 inch distal to point of contact.

Most low-temperature thermoplastics used to make orthotics will stretch to conform around angles and contours. When a pattern is created that will go around an acute angle, such as a 90-degree angle around a flexed elbow or wrist, the pattern should include a dart, where the material can be overlapped without causing undue bulk (Fig. 30.31). The pattern may be angled where necessary to accommodate acute angles. A well-fit and well-thought-out pattern translates to less material wasted, less expense, and shorter fabrication time.

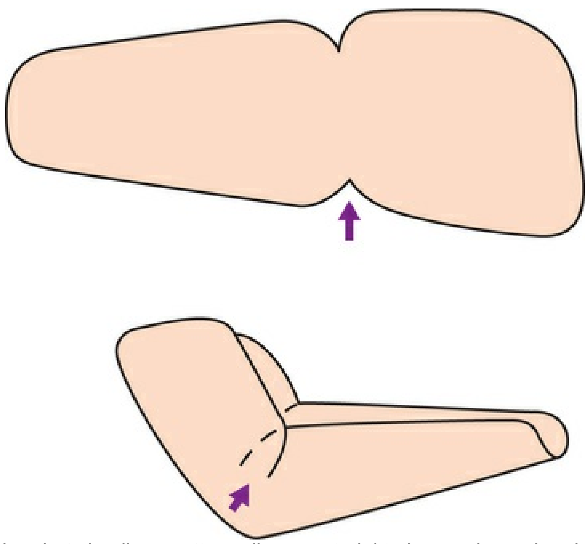


FIG 30.31 Drawing darts in elbow pattern allows material to be overlapped and contoured without excess material.

Step Two: Choosing Appropriate Material

The materials commonly used for custom-fabricated orthotics are those in a family of plastic polymers that become pliable at a temperature low enough for the material to be molded directly onto the skin. The low-temperature thermoplastics (LTTs) currently available have certain characteristics that can be defined according to how a material reacts or handles when warm and how it reacts once molded.

Choosing the optimal material for a given orthosis application can make the difference between a quick and easy fabrication process and one that requires extensive adjustments and reheating. It behooves every therapist, novice to advanced, to sample a variety of materials and test the handling characteristics so that no surprises occur when a material is heated and is ready to be cut and fitted to a client.

Characteristics of Orthotic Materials

Each LTT has some handling characteristics that apply when the materials are warm and pliable and others that apply when they are cold or molded. Following are the most common characteristics and a description of how each contributes to the choice of a material for a specific application.

Resistance to stretch.

Resistance to stretch describes the extent to which a material resists pulling or stretching. The greater the resistance, the greater is the degree of control that the fabricator will have over the material. Materials that resist stretch tend to hold their shape and thickness while warm and can be handled more aggressively without thinning. More resistant materials are recommended for large orthotics and for orthotics made for persons who are unable to cooperate in the fabrication process. In contrast, the less resistance to stretch a material has, the more the material is likely to thin during the fabrication process, and the more delicately it must be handled. The advantage of stretch is seen in the greater degree of conformability attained with less effort on the part of the fabricator.

Conformability or drape.

Resistance to stretch and conformability or drape describe nearly the same characteristic—that is, if a material stretches easily, it will have better drape and conformability. The great advantage of materials with a high degree of drape or conformability is that with a light, controlled touch or simply the pull of gravity, they readily conform around a part for a precise fit. The disadvantage of materials with a high degree of drape (and generally also low resistance to stretch) is that they tolerate only minimal handling, and care must be taken to prevent overstretching and fingerprints in the material. Materials with a high degree of drape are not recommended for large orthotics or for uncooperative clients. They are ideal, however, for use with postoperative clients when minimal pressure is desired, and for dynamic orthosis bases, in which conformability secures the orthosis against migration (movement distally) when components are attached. Materials with a low degree of drape must be handled continuously until the materials are fully cooled to achieve a contoured fit; often they will not conform intimately around small parts such as the fingers.

Memory.

Memory is the ability of a material, when reheated, to return to its original, flat shape after it has been stretched and molded. The advantage of high memory in a material is that the orthosis can be remolded repeatedly without thinning and weakening of the material. Materials with memory require handling throughout the fabrication process because until they are fully cooled and molded, they tend to return to a flat shape. This and the slightly longer cooling time of materials with high memory can be used to advantage with clients who require more aggressive handling to achieve the desired position. Disadvantages of materials with excellent memory are their tendency to return to a flat sheet state when an area is spot heated for adjustment and their need for longer handling to ensure that they maintain their molded shape until fully cooled.

Rigidity versus flexibility.

Rigidity and *flexibility* in orthotic splint material are terms that describe the amount of resistance a material gives when force is applied to it. A highly rigid material is very resistive to applied force and may, with enough force, break. A highly flexible material bends easily when even small force is applied to it, and it is not apt to break under high stress. Materials are available that fall all along this continuum.

Generally, the thicker a thermoplastic and the more plastic its formula contains, the more rigid the material will be. Thermoplastics come in thicknesses ranging from $\frac{1}{8}$ inch (3.2 mm) to as thin as $\frac{1}{16}$ inch (1.6 mm). Thinner materials and thermoplastics that contain rubber-like polymers in their formula tend to have greater flexibility in their molded state. Flexibility in a material allows for easier donning and doffing of orthotics and may be desirable for clients unable to tolerate the more unforgiving rigid materials. Rigidity is also a factor of the number and depth of contours included in the design. The same material may yield a semiflexible orthosis when used to make a single-surface orthosis with shallow contours or a rigid orthosis when used to make a tightly filled circumferential orthosis.

Bonding.

Bonding is the ability of a material to adhere to itself when warmed and pressed together. Many materials are coated to resist accidental bonding and require solvents or surface scraping to remove the coating to bond. Uncoated materials, which require no solvents or scraping, have strong bonding properties when two warm pieces are pressed together. Self-bonding is helpful when outriggers or overlapping corners are applied to form acute angles, but it can be a problem if two pieces adhere accidentally.

Self-sealing edges.

Self-sealing edges are edges that round and seal themselves when heated material is cut. This characteristic produces smooth edges that require no additional finishing, which adds time to the fabrication process. Materials with little or no memory and high conformability generally produce smooth, sealed edges when cut while warm. Materials with memory and those with high resistance to stretch resist sealing, requiring additional finishing.

Soft orthotic materials.

Soft, flexible materials such as cotton duck, neoprene, knit elastics, and plastic-impregnated materials may be used alone or in combination with metal or plastic stays to fabricate semiflexible orthotics. These materials allow fabrication of orthotics that permit partial motion around a joint yet limit or protect the part. Semiflexible orthoses are sometimes used during sporting activities and to assist clients with chronic pain in returning to functional activity. Semiflexible orthoses are also used for geriatric clients and for clients with arthritis, who often cannot tolerate rigid material.

Neoprene orthoses can be fabricated with the use of sealing glue or iron-on tapes. Careful attention must be given to the patterns for soft orthoses, because the support they offer relies primarily on achieving a secure fit without gapping or excess material. Most other soft materials require sewing, and the fully equipped OT department should include a sewing machine. A sewing machine is useful for adapting and adjusting prefabricated soft orthoses to ensure that each orthosis that leaves the clinic is indeed custom fit, if not custom fabricated.

Choosing the Best Category of Material for the Orthosis

Although an experienced therapist can make many types of orthoses from the same material, it is better to choose a material with appropriate handling characteristics for the type of orthosis being made. The following can be used as a guide from which to start choosing materials for different applications. The availability of materials and the experience level of the therapist assist in determining the most appropriate material.

Forearm-based and hand-based orthoses.

Orthoses need close conformability around a part when they serve as a base for a dynamic orthosis, stabilize a part of the body, reduce contractures, remodel scar tissue, or immobilize to facilitate healing of an acute condition. Such orthoses should be made from a material with a high degree of conformability to achieve a conforming fit. When conformability is not crucial, the orthosis can be made from a material with high resistance to stretch and low to moderate drape. Orthoses fabricated for burns and other acute trauma do not require as conforming a fit and can be made from low-drape materials. Materials that resist stretch and tolerate aggressive handling are recommended for positioning of a spastic body part, because such materials will not stretch and thin during the fabrication process. Experienced OTs who work without a formal pattern choose a material with a higher degree of drape and conformability and allow gravity to assist in the fabrication process.

Large upper and lower extremity orthoses.

Long orthoses fabricated for the elbow, shoulder, knee, or ankle generally should be made of materials that have high resistance to stretch, to provide the control necessary for dealing with large pieces of material. Such orthoses generally do not need to be highly conforming because they are molded over broad expanses of soft tissue. Care must be taken to provide relief for bony prominences or to provide padding to distribute pressure.

Circumferential orthoses.

An orthosis designed to wrap all the way around the part should be fabricated from materials that have a high degree of memory and that tolerate stretching without forming thin spots. The materials should be highly perforated, thin, and able to be stretched evenly. After being stretched, these materials will cinch in around the body part while still allowing sufficient flexibility for easy donning and doffing. These materials work well for fracture bracing and for circumferential orthoses that are used for contracture reduction and for stabilizing or immobilizing joints. Another choice for making less restrictive circumferential orthoses is the use of semiflexible materials, which facilitate easy donning and doffing and allow limited motion within the available arc of motion.

Serial orthoses.

Serial orthoses that require frequent remolding to accommodate increases in joint range of motion should be made from a material that has considerable memory or is highly resistant to stretch to avoid thinning with repeated remolding. The chosen material should have moderate to high rigidity when molded to resist forces from contracted joints or from spastic muscle tone.

Step Three: Choosing the Type of Traction

All orthoses provide some form of traction to move or stabilize a joint or joints. The traction mechanism may be dynamic, using a spring, hinge, or elastic. Traction may also be static, employing straps or turnbuckles or involving remolding of the splint base itself. If the mechanism moves or is resilient, the orthosis is called a *dynamic orthosis,* and if it does not move, it is called a *static orthosis.* The following section describes the various options for applying traction and discusses appropriate uses of each option.

Dynamic Traction

The purpose of dynamic orthoses is mobilization of a joint through the use of a resilient force attached to an outrigger or through the use of a spring coil. Each mechanism of force has advantages and disadvantages that make it suited for some uses and ill suited for others. Construction techniques differ substantially when spring coils are used versus outriggers with elastic components. Thus the indications for each style of orthosis will vary.

Spring coils are best suited to assist weak muscles or to substitute for paralyzed muscles (see Fig. 30.24). Clients with weak or paralyzed muscles will likely require the orthosis for a long time and will wear it while working or performing their ADLs. The low-profile, lightweight construction of a coil orthosis is recommended because it is less likely to interfere with hand function. Spring coils retain their force and alignment over time, rarely require adjustment, and are ideal for long-term conditions.

Orthoses with outriggers may be the optimal choice for splinting postoperative clients (Fig. 30.32). These splints allow frequent adjustments to maintain correct positioning and to accommodate changes in bandage thickness and edema as healing and rehabilitation progress. The postoperative client will likely use the orthosis for only a short time, generally 4 to 6 weeks. Such a client will not be returning to normal functional activities with the affected hand during that time. Thus the bulkiness and limited function associated with an outrigger orthosis are relatively unimportant, but it is vital that the orthosis be able to be self-donned, because it is usual for the client to remove it for periods of time or to alternate it with other orthoses. Alexei's dynamic extension outrigger (see Fig. 30.18) is an example. He alternated it with his dynamic flexion outrigger and discontinued it after 3 weeks, when his extension goal was met.

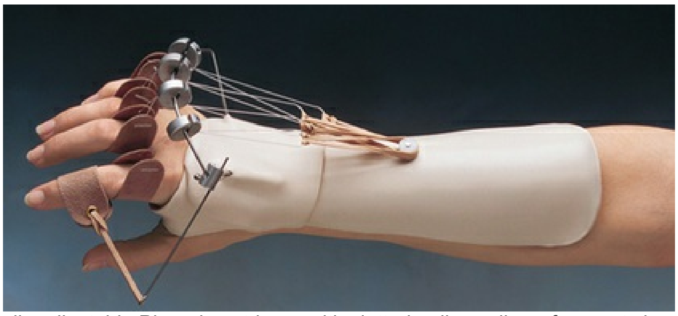


FIG 30.32 Easily adjustable Phoenix outrigger with slotted pulleys allows frequent changes in angle of approach. (Courtesy North Coast Medical, Inc., Gilroy, CA.)

Orthoses with outriggers are also used for contracture reduction. For this purpose, they are generally most effective when used during the early stages of healing, when the contracture feels soft and is easy to reduce.[6] Frequently, clients at this stage still have pain and inflammation. They cannot tolerate a rigid, static orthosis, but they will tolerate a light force provided by an outrigger.

Static Traction

The overall purpose of static traction orthosis is to apply traction to immobilize or restrict motion. When static orthoses immobilize, they are protecting, resting, or positioning. When they restrict, they are blocking motion, aligning joints, or limiting motion. When static orthoses are used to mobilize, they are used in a serial static or static progressive fashion to reduce contractures and remodel scars.

Serial Static Traction

A serial static orthosis is fabricated by repeated adjustments that position a joint at its end range of motion each time to achieve slow, progressive increases in ROM. For example, a cylindrical cast made for gaining PIP extension must be remade after a time (usually 1 to 3 days) to reposition the joint at the end of its range of motion (see Fig. 30.21).

Static Progressive Traction

A static progressive orthosis requires a built-in mechanism for adjusting the traction. Choosing which mechanism to use, be it a turnbuckle, a Velcro strap, or a buckle (see Figures 30-22 and 30-25, *A*), depends on availability, the therapist's experience, and the client's ability to manage the mechanism. A good rule to follow is to choose the simplest component that will achieve the desired goal.

Serial static orthoses and static progressive orthoses each have certain advantages and disadvantages. Serial static orthotics are useful for difficult clients who have high muscle tone or who are cognitively impaired and would have problems with the adjustment mechanisms. This orthotic choice also gives the therapist the control necessary for clients who are noncompliant or who would be overly zealous and would apply too much force. Disadvantages are that it requires more of the therapist's time because it must be remolded repeatedly, and if the client does not remove it for several days, some ROM may be lost in the direction opposite to that in which the orthosis is applying force.

Advantages of a static progressive orthosis are that the therapist has to make only one splint and that reliable clients with normal muscle tone may make more rapid progress because they can tailor the adjustment to their own pace and tolerance. The disadvantage of a static progressive orthosis is that it cannot be used on the client who has abnormal tone or who is unreliable.

Implications of application of force.

All orthoses, whether static or dynamic, apply force and to some degree stress on the structures they contact. The unimpaired hand tolerates a wide range of stresses by adaptation when possible and by avoidance when not. The client with sensory or cognitive impairment may lack the protective responses necessary to reposition the hand away from stresses applied by orthoses.

Pressure causes ischemia (localized anemia caused by obstruction of blood supply to tissues), and pressure increases when orthoses are contoured too sharply, when they do not conform uniformly, or when they do not cover a broad enough area of soft tissue. Orthoses that migrate or move on the hand because of insufficient strapping or contouring may actually apply pressure in areas that the orthosis was designed to relieve.

Amount of force to apply.

How much force can be applied safely? No absolute rules exist regarding the amount of force that can be applied for immobilization or to a restricted joint to produce motion. The therapist must apply sufficient force to create motion, but not so much as to cause ischemia. Much depends on the degree of the contracture, how long the restriction has existed, the age of the client, and the location of the restriction. This leaves the therapist with several options when choosing which force and how much force to apply.

For example, external force in dynamic orthoses generally is applied through the addition of rubber bands, elastic, or springs. No option is ideal, and all require careful selection, frequent adjustment, and client education on frequent skin checks. The amount of force supplied by rubber bands and springs depends on their thickness and their length. The thickness of the band or spring determines its potential force, whereas the length of the band or spring (or the number of coils in the spring) determines the ROM through which the force can be applied. When bands or springs are used, it is desirable to use the optimal force (i.e., the greatest tolerable force over the longest wearing time) that does not produce ischemia. To accomplish this goal, the midrange of the bands or springs should be used, rather than their end ranges, which may be too slack or too strong. A gauge is available for measuring the applied force of elastic, which generally should be between 100 and 300 g.

Techniques are available for avoiding pressure areas and shear forces in a dynamic orthosis, particularly when traction is applied to mobilize a finger joint. First, the joint(s) proximal to the finger joint being addressed must be stabilized. For instance, to mobilize a PIP joint with an outrigger and cuff, the MP joint must be held securely, so that no movement occurs to cause the orthosis to produce pressure points elsewhere on the hand or digits. Care must be taken in contouring the orthosis around the proximal phalanx, to distribute pressure and prevent motion that could cause shearing over the dorsum of the finger. In this case, padding may be necessary to help distribute pressure over the small and thinly padded phalanx (Fig. 30.33).

FIG 30.33 Felt padding distributes pressure over bony proximal phalanx.

Duration of traction.

Basic to answering the question "How long should traction be applied?" is an understanding of theories of tissue stretching versus tissue growth. Three key concepts aid in understanding these two different tissue responses. First, all materials, including human tissue, respond to applied stress. If stress is applied over time and then is relaxed, the tissue will no longer return to its original shape but will adapt to the new shape. This stretching phenomenon in skin is a result of its plastic behavior and is known as *creep.* The lengthening that occurs with creep is found to be the result of "a slippage of short collagen fibers on one another within the tissue. Some fibers may rupture, while others just slide on each other."[9]

The second concept is that of the elastic limit of tissue. Think of pulling on a rubber band. As the band is pulled, tension increases until the elastic limit is reached. If pulled beyond its elastic limit, the rubber band will break. In clinical terms, the end of the elastic limit is the point of tissue elongation at which pain will be felt and tissue damage may occur. Stretching tissue beyond its elastic limit does not lead to permanent lengthening, but it does cause unwanted tearing and probable further tissue contracture.[9] For creep to occur in living tissue, traction must hold the skin with sufficient force to exceed the elastic limit of the skin. This may cause tearing of small fibers, which leads to inflammation and additional scarring caused by fibrogen deposits.

The third concept is tissue growth. True growth occurs when "living cells will sense strain and collagen fibers will be actively and progressively absorbed and laid down again with modified bonding patterns with no creep and no inflammation."[9] This is the aim of splinting when the goal is contracture reduction or lengthening of restricted soft tissue.

Two approaches may be used to apply traction to lengthen soft tissue and reduce contractures. One approach is to position the tissue at the end range of its elastic limits and hold it statically for short periods, and then to relax and reposition it frequently. This approach is termed *stress relaxation*.[8] The second approach is to apply force within the elastic limits of the tissue, hold it for a long period, and then reposition it. Differences between these two approaches include time and ability to judge the elastic limits of tissue. The first approach relies on principles of stress relaxation, which theorize that tissues reach their elastic limit over a shorter period with frequent repositioning and will retain this newly set limit over time.[8] The second and more commonly used approach relies on the application of a low load over a long time to allow tissue growth to occur. Both approaches have merit, and it is up to the therapist, who develops this skill with experience over time, and the prescribing physician to determine the appropriate approach in each instance.

Step Four: Choosing an Orthosis Design for a Given Purpose

Mobilizing Orthoses to Remodel Scar Tissue and Reduce Contractures

Scar tissue is one of the major contributors to deformity or joint changes. Any time an insult to tissue occurs, as after an open injury or after surgery, the body to heal the wound produces scar tissue. The scar may be subcutaneous, superficial, or both. When it is subcutaneous, it often results in loss of motion, because scar tissue acts like glue, keeping tissue planes from gliding. Scar also contracts; when this contracture occurs over a joint, loss of joint motion results. To restore motion, scar tissue must be remodeled—that is, it must be softened and lengthened. If the contracture is caused by shortened soft tissue that is not scar, that soft tissue must also be lengthened. The process is the same for scar or soft tissue.

The effectiveness of using orthoses for remodeling scar and reducing contractures can be increased greatly by application of a deep heat modality, such as paraffin or moist heat, before application of the orthosis. When tissue is unheated, it is less elastic, meaning that it has a great deal of tension and is difficult to elongate. With the application of heat, tissue becomes temporarily more elastic, meaning that tension in the tissue is reduced and the tissue is much easier to elongate.

Many approaches are available for using orthoses for remodeling scar and reducing contractures. Three-point orthoses can be used for flexion contractures (extension ROM is decreased), loop splints for IP joint extension contractures (flexion ROM is decreased), and outriggers for metacarpophalangeal (MCP) extension contractures (lack full flexion ROM at the MCPs). Dynamic outriggers can be used to reduce early, soft tissue contractures, particularly when the client cannot tolerate a static orthosis. Static progressive orthoses or static orthoses can be used in a serial fashion.

Immobilizing and Restrictive Orthoses for Pain Reduction

Of the many uses of orthoses, perhaps the most common is to limit or reduce pain by providing rest and support. The most common orthotic prescriptions are written for orthoses to reduce the pain caused by the inflammatory processes of tendinitis or after sprain or strain injuries.

Several questions help determine which orthosis will best serve the client's needs. First, if the injury is caused by an acute sprain, the choice may be an immobilizing orthosis until pain and edema have subsided. If the pain is chronic in nature and is caused by the performance of a particular activity, a semiflexible orthosis may serve best. A semiflexible restrictive orthosis may sufficiently reduce pain by limiting ROM, yet still allow function without increasing stress on unaffected joints or tissue (Fig. 30.34).

FIG 30.34 Flexible thumb orthosis provides support yet allows midrange movement. (Courtesy GettyImages.com.)

A second question concerns the need for full-time orthosis wear versus intermittent wear. In the presence of an acute injury with orthopedic involvement or tissue damage, the orthosis may need to immobilize and to protect the part from further damage. Here, client tolerance and compliance will in part determine material and design choice. The therapist may also need to consider the integrity of the tissue and the need to accommodate bandages and bandage changes. If the orthosis is indicated only for intermittent wear, the design choice may depend more on the client's ability to readily don and doff the orthosis. The choice of materials may be dictated by the functional needs of the client. For intermittent orthoses used for vocational activities, lightweight, well-aerated materials may be indicated. For intermittent orthoses used for positioning, such as a resting orthosis designed to maintain functional position between exercise sessions, stronger materials may be indicated, and perforations may not be necessary.

A third important question in deciding on an orthotic design is, "What structures need to be immobilized or supported, and which should be left free?" When protective or pain-reducing orthoses are provided, care must be taken to immobilize only the involved structures without impeding motion elsewhere. If the purpose of the orthosis is to rest the tendons at the wrist to reduce inflammation, the orthosis must not limit carpometacarpal (CMC) or MP joint motion if these structures are not symptomatic. If used during the performance of ADLs, orthoses that fully immobilize a joint may transfer stress to joints proximal or distal to the immobilized joint. For this reason, semiflexible orthoses that restrict only end ranges of motion may be indicated during activity, whereas an immobilizing orthosis may be indicated for total rest at night.

Immobilizing Orthoses for Positioning

One of the orthoses most frequently fabricated by OTs is the resting pan (also known as the resting hand or functional position orthosis), which is used to maintain the hand in a functional position (see Fig. 30.20). The purpose of this positioning orthosis is to keep the soft tissues of the hand in midrange to maintain optimal mobility and to prevent shortening of the soft tissue structures around the joints. Occasionally, positioning orthoses are prescribed to position joints at end range to prevent contractures in the presence of severe tissue damage, as with burns. The important decision involves determining the optimal position for the most functional outcome.

Positioning orthoses may be fabricated for temporary use after surgery and may require frequent adjustment to accommodate changes in edema and bandages. The materials chosen for these orthoses should have memory to allow for remolding while keeping their thickness and strength. The choices of a dorsal versus a volar-based orthosis and a single-surface versus a circumferential orthosis depend on surgical and wound sites, the need for ease of donning and doffing, the client's available sensation, and the therapist's and physician's preferences and experience.

Step Five: Fabrication

The fabrication processes for single-surface and circumferential orthoses differ significantly. They do have a starting point in common: the pattern from which the orthosis will be made. Starting with a paper pattern is recommended, particularly for the novice therapist. One basic rule of orthotics fabrication is to get the pattern right before beginning to work with plastic. It is far less expensive to discard a few pieces of paper than even a small piece of LTT. Also, if one saves the paper pattern in the client's chart, it is easy to use to fabricate another should the orthosis be lost, or to enlarge it as a pediatric client grows. Pattern making, design principles, and principles of fit are important components of knowledge for orthosis fabrication; these concepts can be learned by going online to the Evolve website associated with this publication or by referring to a book such as *Hand and Upper Extremity Splinting: Principles and Methods.*[13]

Fabrication Techniques for Single-Surface Orthoses

Single-surface orthoses cover the volar surface, the dorsal surface, the ulnar half, or the radial half of the arm and hand. Generally, single-surface orthoses have gentle contours and cover as broad an area of tissue as is feasible to distribute pressure. The following steps should be used as a guide in the process of creating a single-surface orthosis. For the sake of demonstration, the single-surface and circumferential orthoses described and pictured are wrist extension (cock-up) orthoses (Fig. 30.35, A):

1. Except for the fingers, ⅛-inch–thick material is recommended to obtain sufficient rigidity to hold the joint firmly in position. The broad contours of single-surface orthoses require thicker materials to provide sufficient support.

2. Etch the pattern onto the cold thermoplastic material with a scratch awl or wax pencil before placing the material in a hot water bath. The water temperature required for most materials to soften properly is approximately 160°F. Temperature and time will vary, depending on the material and its thickness; this information is typically provided by the material's manufacturer in the accompanying literature. Most materials heat to the pliable stage in 1 to 2 minutes.

3. Carefully remove the material from the hot water bath and lay it flat on the table for cutting. To prevent stretching, avoid holding material unsupported while cutting (Fig. 30.35, B).

4. Starting at the neck of the scissors, cut with long, even strokes to prevent jagged edges.

5. Reheat the material if it has cooled too much to be formed. Place the material on the forearm and hand with the forearm in supination so that gravity can assist the initial molding. Some therapists prefer the elbow propped on a table with the hand in the air if the client is compliant. Check that the trim lines fall at the midline. If they do not, mark where excess material needs to be removed. Trim the material before it cools. Note areas that will need to be folded for clearance and for creation of smooth edges. Fold and secure the edges firmly in place (Fig. 30.35, C).

6. Reposition the orthosis on the forearm. Maintaining control on the wrist and forearm sections, carefully pronate the forearm. Maintain the wrist in extension at all times. The tendency for the wrist to drop into flexion when the forearm is pronated is universal. Controlling the wrist will ensure that the desired wrist position is maintained at all times (Fig. 30.35, D). If necessary, rotate the forearm section to ensure that the trim lines are at midline. Refer to Fig. 30.6 to review the importance of the changing shape of the forearm from a supinated to a pronated position.

7. Allow the material to cool until it holds its shape. It does not have to be held in place until completely cold. Remove, heat, and smooth any rough edges as needed, and apply the straps.

8. Strapping is critical to secure the part in the orthosis and to diminish shear forces and the possibility that pressure areas may develop. The orthosis may require several straps; wide or crossed straps are suggested to obtain the necessary control. Because the forearm is cone shaped, straps placed straight across the forearm will contact the skin effectively only on their proximal surface (Fig. 30.36). To have the forearm straps apply effective and well-distributed pressure, you may consider placing them at an angle.

9. Single-surface orthoses rely on strapping to hold them in place and to create one or more three-point pressure systems to securely hold the joint or joints being addressed (see Fig. 30.25, B). For straps to function properly, trim lines must fall midline along the arm and hand. If the trim lines are left too high, making the trough too deep for the part, the straps will bridge the part and sit up on the edge of the splint, where they are ineffective. The most effective way to secure an orthosis in place on the forearm is to apply pressure through the orthosis onto the soft tissue of the forearm muscle bellies. If the forearm trim lines angle below the muscle bellies, the orthosis will no longer be secured on the muscle bellies.

10. Instruct the wearer regarding the wearing schedule and proper care of the orthosis. To prevent ischemia and shear forces, check the fit of the orthosis regularly.

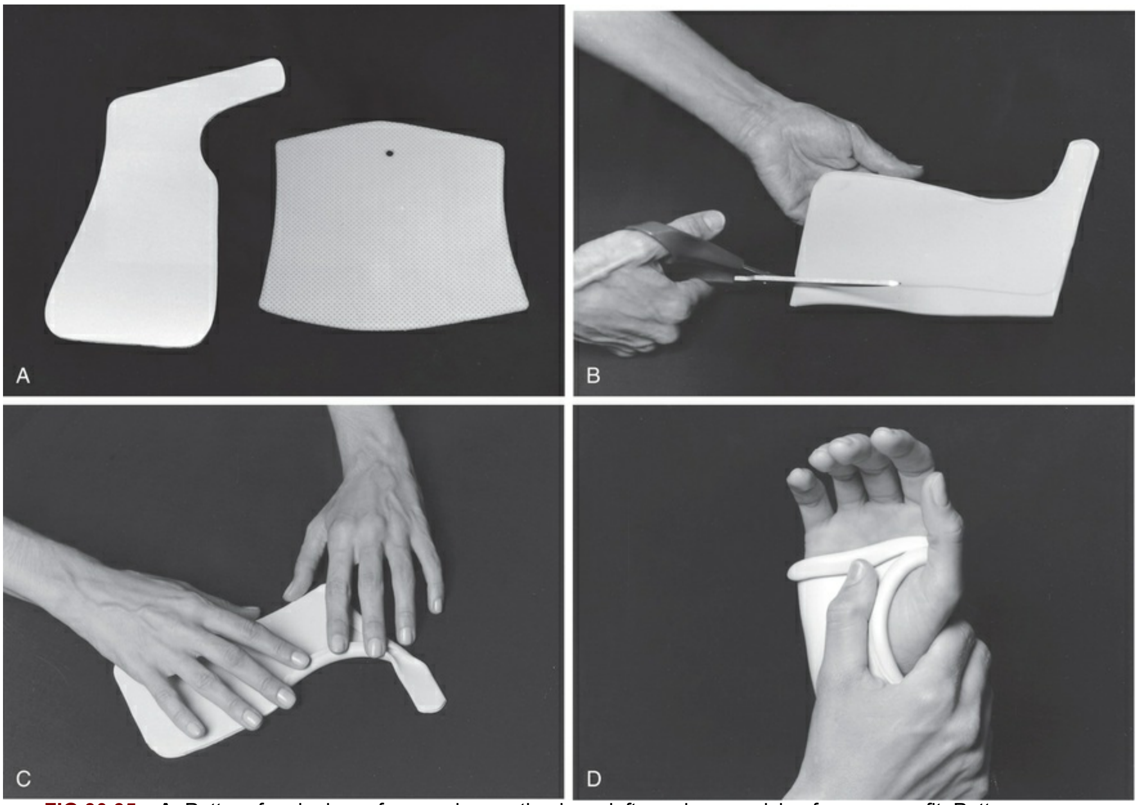


FIG 30.35 **A,** Pattern for single-surface cock-up orthosis on left requires precision for a proper fit. Pattern on right for circumferential orthosis does not need precise fit because material stretches and overlaps to achieve proper size. **B,** Support material on table to prevent stretching, and cut with long strokes of scissors. **C,** Fold edges of material and gently press flat to create thin, smooth edges that distribute pressure better. **D,** Gently support the wrist at all times to achieve proper fit.

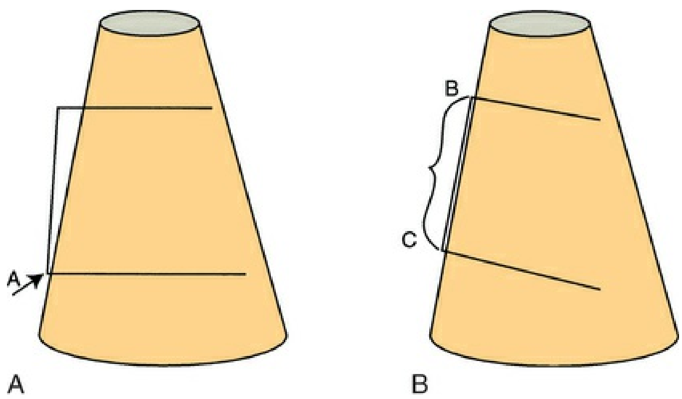


FIG 30.36 Forearm is cone shaped, gradually widening from wrist to elbow. **A,** Strap laced straight across broader proximal forearm contacts skin only at point *A* and does not secure orthosis. **B,** Strap placed at angle applies even pressure along line *BC* to secure orthosis.

Fabrication Techniques for Circumferential Orthoses

1. Use a thin or highly perforated elastic material or a flexible rubber material that has some memory. For hand- and forearm-based orthoses, thin elastic materials ($\frac{1}{16}$, $\frac{1}{12}$, or $\frac{3}{32}$ inch) provide sufficient strength because of the rigidity provided by the curves of the splint. For orthoses covering larger areas, a highly perforated $\frac{1}{8}$-inch material is recommended. Materials for circumferential orthotics should be coated to prevent permanent adherence when warm or should be able to be pulled apart once cooled.

2. Etch the pattern onto the material. Because the materials for circumferential orthoses are generally stretched to contour around the arm, the pattern does not need to be as precise as for a single-surface orthosis. It is important to know how much the material will be pulled and if it will be overlapped or finished edge to edge, so that a piece of sufficient size is cut (Fig. 30.37).

FIG 30.37 Circumferential orthosis trimmed to close edge to edge.

3. Wrap the material all the way around the part being addressed. Two techniques can be used to create closure for a circumferential orthosis. The first is to pull the material around the part and pinch the remaining material together to create a seam. Gently tug on the seam to conform the material. When the material is cool, open the seam and trim the orthosis. The second technique is to overlap the two ends to form a flap (Fig. 30.38). To prevent the flap from adhering (this may happen when the coating is thinned as the material is stretched), wait until it has cooled slightly before overlapping.

FIG 30.38 Circumferential orthosis made from flexible material with overlap for easy donning and doffing.

4. Smooth edges as necessary. The circumferential orthosis creates multiple three-point pressure systems by virtue of its design, and strapping is used only to hold the orthosis firmly closed.

Fabrication and Fitting of Semiflexible Orthoses and Prefabricated Orthoses

Materials used in the fabrication of semiflexible orthoses include neoprene, cotton duck, woven elastics, and thermoplastic-impregnated materials. Neoprene orthoses are generally fabricated with use of a special glue that adheres pieces together at the edges. The patterns for neoprene orthoses must be precise to achieve a conforming fit. Cotton duck and other woven materials require sewing and considerable skill in pattern creation and the addition of darts to ensure a good fit. Very thin thermoplastic materials can be used to create semiflexible orthoses, and certain patterns can be adapted to allow for partial range of motion within an orthosis.

Many commercially prefabricated orthoses are made from woven materials, because these materials present the broadest range of size adjustability and are less likely to require custom fabrication. It is highly recommended that even a prefabricated orthosis should be custom fit by a therapist to ensure proper fit and adherence to an appropriate wearing schedule. Remember that it is the therapist's responsibility to take the time to develop the skills needed to ensure that even prefabricated orthoses fit the client as if they were custom made.

Threaded Case Study

Alexei, Part 2

Using the Occupational Therapy Practice Framework, the evaluation of Alexei began with an occupational profile to establish his needs, priorities, and goals, which included the ability to administer his own medications and to be independent in his ADLs so he could return to his independent living apartment. Analysis of Alexei's occupational performance identified his inability to grasp small objects, such as insulin syringes and a glucose level tester, and to perform ADLs, such as grasping a normal eating utensil or toothbrush, zipping his pants, or taking money from his wallet. Alexei demonstrated problems within the performance skills category, including poor coordination of motion and difficulty manipulating objects. Under the category of client factors, problems with his right-dominant hand included lack of ROM and the mobility required to perform tasks successfully. The personal (or internal) contexts supporting Alexei that were identified during the evaluation revealed his flexibility and intelligence, his engaging and assertive communication style, his ability to learn an exercise regimen and how to use complex orthoses, his history of successfully managing health-related problems such as diabetes, his strong motivation to remain independent in his own apartment, and his psychological need to live in a place that would allow him to have a companion pet. His external contexts, including physical and social contexts, both supported and interfered with Alexei's achieving his goals. Positive aspects included his living in a full-service senior housing complex, a supportive nursing staff at his complex willing to help him regain independence, and an administrator at the complex who was willing to modify the rules slightly to support Alexei's goal of returning to his apartment in the independent living section of the complex. Negative aspects of these contexts included lack of adequate transportation to therapy and the living site's strict procedural rules that residents must stay in the least restrictive setting.

What would have happened to Alexei if OT intervention had consisted of just therapy sessions with no utilization of dynamic orthoses? ROM gains achieved during therapy probably would not have been maintained. The intervention plan of using dynamic orthoses was established on the basis of Alexei's limited ability to get to therapy appointments, coupled with his ability to carry out much of his rehabilitation on his own or with the assistance of nursing staff at the assisted living complex.

How critical was the team approach, and how important was ascertaining the client's main goal during the initial evaluation? The outcome was ultimately successful because (1) a collaborative relationship was formed between the very motivated client, the OT, and the nursing staff, with all participants focusing on and working toward the goal of retraining Alexei in independent medical management, and (2) the complex administrator agreed to bend the rules for a month until Alexei could achieve his goal of complete independence. Without a focused goal, much therapy time could have been lost working toward gains less important to the client, which may have ultimately robbed him of his independence.

Section 2 Arm Supports

Michal Atkins, Jane Baumgarten

Introduction and Clinical Reasoning

There is an increasing array of orthotic devices available in today's marketplace to support the weak upper extremity (UE). Like the orthoses described in the first part of this chapter, these devices are used to support, align, or prevent/decrease deformity of a specific body part; however, their primary function is to allow clients with significant UE weakness to move their arms and engage in meaningful occupation.

Commercially available products range from simple to complex and may be prescribed for temporary or permanent use. They may be home or clinic based in their application, and the indications for their use may be positional, therapeutic, occupation based, or any combination of these uses. Static positional devices provide support for weak UEs, prevent or reduce pain, and help to maintain range of motion (ROM). Dynamic orthoses may be utilized to decrease pain, increase strength or ROM, enable engagement in meaningful occupations, or any combination of these potential benefits. **Dynamic arm supports** maximize the potential for strengthening and UE function through a combination of supporting the weight of the arm and minimizing the effect of gravity.

The challenge to the occupational therapist is to combine a thorough occupational history with in-depth assessment and collaborative goal setting to establish the best choice of arm support for each client. Unfortunately, there is a paucity of evidence-based data that compares and contrasts different arm supports in order to assist the therapist in choosing the optimal device.[4] Garber and Gregorio[15] studied the prescription and use of upper limb devices in persons with tetraplegia. Although these authors did not provide specific information on mobile arm supports, they stated that "The devices retained in use most often were the more costly orthoses such as reciprocal orthoses and ball-bearing feeders."[15]

The following process is critical to the optimal selection of arm supports. The therapist must first give careful consideration to the nature of the trauma or the condition and its likely course. Will the client get stronger? Is the condition static? Or is it a degenerative condition where a decrease in function is expected? Are arm supports a short-term or long-term/permanent solution to decreased UE function and occupational engagement?

The first step is to clearly identify the goal of the intervention with respect to the use of an arm support. Is the goal of the treatment to provide comfortable positioning and pain reduction? Is it to provide a strengthening program in preparation for occupational engagement? Is it to achieve mastery of a specific task or tasks? Is it to combine both a meaningful occupation and exercise? Or is it a goal that is subject to repeated revision as the client's physical status changes?

Once the primary treatment goal for use of arm supports is defined, the acuity of the trauma or medical condition must be considered. Immediately following a traumatic injury, the first priority must be to manage pain and to prevent further complications. Static positioning devices provide support and stability but will limit mobility when the arms are very weak. Dynamic arm supports are necessary to increase function in the UEs and to increase strength and active movement of the arms, but their effect on pain must be carefully evaluated.

Expense and funding source can be significant factors in the prescription and use of arm supports, as is the setting in which the client is receiving treatment. Sample clinic equipment may be available for use in the inpatient rehabilitation setting, but not funded for long-term use. If the optimal arm supports are not available to a client, less expensive or homemade options will need to be considered.

It is crucial to evaluate where the arm device will be used and, if necessary, where it will be mounted. Will the client always be in a wheelchair when out of bed, or will he or she be independent in household or community ambulation and require an alternative mounting location?

A thorough assessment of client factors, including muscle strength, ROM, motor control, muscle tone, and sensation, will round out the evaluation process for determining the appropriate arm support. The therapist must ascertain if the client has adequate motor control and muscle strength to benefit from a particular dynamic arm support, as well as the space to use it, an adequate mounting surface, and the motivation to engage in the training necessary to maximize the benefits of an arm support.

Careful consideration of each of these factors will result in optimal prescription of static or dynamic arm supports, maximizing both therapeutic and functional benefits for the client.

Threaded Case Study

Matt, Part 1

Matt is 39 years old. He has been married for 8 years and has a 7-year-old daughter. He had been working for 10 years at a law firm with 20 attorneys when he sustained a C4 complete (American Spinal Injury Association [ASIA] Impairment Scale A) spinal cord injury in a motor vehicle accident. He was admitted to an acute hospital for 3 weeks and was just transferred to an inpatient rehabilitation facility near his family and friends. In an OT assessment in which the Canadian Occupational Performance Measure (COPM) was used, Matt was asked to identify the most important occupations in which he would like to participate upon his return home. The occupation of greatest importance to Matt was to resume his law practice, so that he could support his family financially and be active in the community. This meant that he would have to be able to write, use the computer and telephone, and manage some essential activities of daily living (ADLs) while at work (i.e., feeding, pressure relief, bladder management, and independent mobility). Matt also placed high importance on doing as much as possible with his daughter, including playing with her and being involved in her school activities. In addition, he wanted to be able to participate in social activities with his wife, such as going out to dinner. Upon admission to the acute rehabilitation unit, Matt was unable to participate in any of these activities.

Evaluation of client factors revealed that Matt's ROM was within normal limits (WNL) throughout his UEs except for 15- to 25-degree limitations in shoulder flexion, abduction, and external rotation bilaterally. Muscle tone was WNL. Bilateral UE strength was 2/5 (poor) in the anterior, middle, and posterior deltoids; 2/5 (poor) in the biceps and brachioradialis; 2−/5 (poor minus) in the supinators; 0/5 in the triceps; and 0/5 in all wrist and hand musculature. Matt's sensation with regard to light touch and superficial pain was intact through C4 bilaterally, impaired bilaterally at C5, and absent bilaterally at C6 and below. Proprioception was intact at the shoulders, impaired in the elbows, and absent in the wrists, fingers, and thumbs.

Critical Thinking Questions

1. Given Matt's status upon initial evaluation, are there any devices that would enable him to resume his most important occupation of practicing law? What are they?

2. What equipment and setup would allow Matt to play with his daughter at home and to continue to strengthen his arms?

3. What series of interventions would you provide to enable Matt to return to his law firm, where the partners are concerned about his ability to manage the many aspects of the job of an attorney?

Static Arm Supports

Optimal early static positioning is critical to maximizing later functional use of the UEs. **Static arm supports** are most commonly used to support the UEs in a comfortable, protected position in order minimize pain and subluxation.[7] At times, static supports are also used to stretch the shoulder(s) or elbow(s) to maintain or increase ROM.

Pillows are often the first and most readily available solution for providing static support to the upper limbs. While in bed, clients tend to rest their arms close to their body with the shoulder positioned in adduction and internal rotation. To prevent a functionally significant loss of ROM, the arms may need to be positioned in abduction and external rotation for part of the day (Fig. 30.39).

FIG 30.39 Static arm support with carefully placed pillows. (Courtesy of Department of Occupational and Recreational Therapy; Rancho Los Amigos National Rehabilitation Center, Downey, CA.)

Static arm supports must also be considered when the client is first seated either in a hospital bed, in a chair, or in a wheelchair, as the weight of the arm in an upright position may cause increased pain or shoulder subluxation.[7] The first priority must be to reduce pain and prevent further complications, as this may lead to decreased functional capabilities in the future. Static positioning while in a wheelchair may be achieved with lap trays or armrests (Fig. 30.40). Half lap trays are available for clients who need unilateral support such as survivors of stroke. Full lap trays are used when support for both arms is required, as with individuals with spinal cord injury (SCI) and resulting tetraplegia (also known as quadriplegia) or Guillain-Barré syndrome.[5] Static positioning devices provide support and stability, but they do not enhance mobility when the arms are very weak. Dynamic arm supports are necessary to allow clients to engage in functional and therapeutic activities.

FIG 30.40 Correct static arm support positioning in the wheelchair. (Courtesy of Department of Occupational and Recreational Therapy; Rancho Los Amigos National Rehabilitation Center, Downey, CA.)

Dynamic Arm Supports

Dynamic arm supports are devices that support the weight of the arm and minimize the negative effect of gravity on the functional use of weak UEs. They enable clients to move their arms despite significant weakness, exercise, and engage in ADL. Although these devices vary in design, complexity, and cost, they all assist the upper limb in moving as freely as possible. The use of robotic devices (computerized dynamic arm supports) has been introduced in an increasing number of therapy clinics to further enhance the benefits of therapy. Terminology associated with dynamic arm supports is inconsistent and confusing as the field continues to develop.[32] This is due in part to the different "languages" spoken by the engineers who develop the devices and the therapists and their clients who use them. It is the responsibility of the purchasing institution and the therapists to educate themselves regarding the capabilities of any device they are considering for use in treatment. Video demonstrations of various devices in use can be helpful in this process. In an attempt to identify and categorize the currently existing dynamic arm supports, Van der Heide, Gelderblom, and de Witte identified commercially available devices to support weak UEs.[32] The article classifies dynamic arm supports in three categories: (1) nonactuated devices, which provide no external power; (2) passively actuated devices, which assist the UE with rubber bands, springs, or weights; and (3) actively actuated devices that use electrical power, such as robotic arms.[32] This chapter discusses only the most commonly used devices and those that are available for purchase in the United States.

Suspension Arm Devices

Suspension arm devices are orthoses that hang from a bed frame or an overhead suspension rod attached to a wheelchair and support the arm. They are reasonably priced, easily adjustable, and offer a myriad of potential therapeutic and functional benefits for clients with significant UE weakness or motor control impairment. These devices support the shoulder, elbow, and forearm and may allow motion in weak proximal muscles, prevent disuse atrophy, maintain ROM, and relieve pain. They provide proximal support to allow for distal function, enabling occupational performance for individuals who otherwise would be unable to move their arms against gravity. With minimal training, suspension arm devices allow clients with very weak UEs to recognize early in rehabilitation that they can successfully engage in an occupation of choice, decreasing feelings of helplessness and hopelessness. Because of the mechanical principles on which they operate, suspension arm devices are generally more effective for positioning and exercise than for occupational performance. The upper limb swings as a pendulum from straps or springs attached to the suspension rod, which makes it difficult to make fine adjustments in movement.[24]

Suspension Arm Slings

The JAECO suspension sling (Fig. 30.41) has a single strap suspended from a suspension rod or over-the-bed frame. An adjustable balance bar supports the two leather suspension slings. These slings provide separate support for the wrist and elbow. The adjustable suspension mount is attached to the wheelchair and holds the suspension rod.

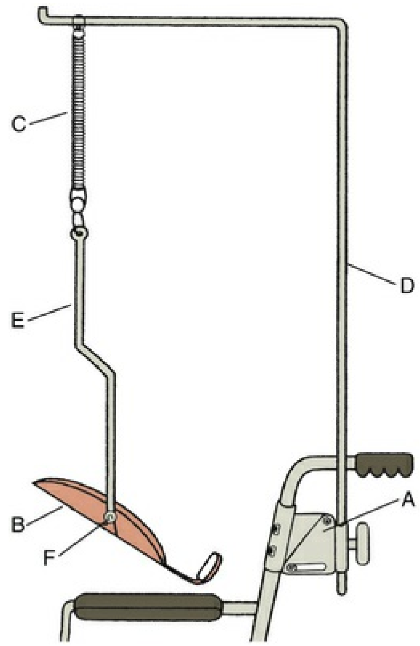


FIG 30.41 Suspension arm support. **A,** Adjustable suspension mount. **B,** Forearm support. **C,** Springs. **D,** Suspension rod. **E,** Suspension bar. **F,** Rocker arm (offset swivel). (Adapted with permission from Department of Occupational and Recreational Therapy; Rancho Los Amigos National Rehabilitation Center, Downey, CA.)

Suspension Arm Supports

The JAECO suspension arm support (Fig. 30.42) has a forearm support with an adjustable fulcrum instead of the two slings, which allows for greater customized adjustment in elbow flexion and extension. It is suspended from a single point on the suspension rod or over-the-bed frame, and allows the client to perform simple tabletop activities and occupations such as feeding or grooming.

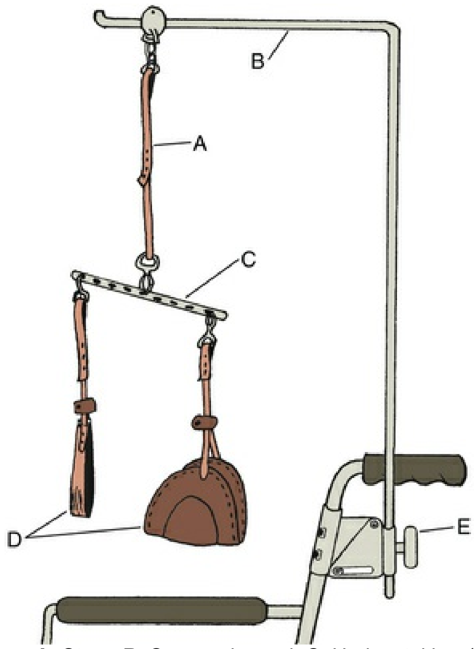


FIG 30.42 Suspension sling. **A,** Strap. **B,** Suspension rod. **C,** Horizontal bar (adjustable balance bar). **D,** Wrist and elbow suspension slings. **E,** Adjustable suspension mount. (Adapted with permission from Department of Occupational and Recreational Therapy; Rancho Los Amigos National Rehabilitation Center, Downey, CA.)

Adjustment of Suspension Arm Devices

Suspension arm devices are simple to adjust. The overall height of the device is adjusted at the interface between the suspension rod and the wheelchair mount. The higher the suspension rod, the flatter the arc of pendulum swing when the arm is in motion, enhancing the capability for occupational performance. The straps that connect the suspension rod to the limb can be adjusted to allow for use at various work surfaces and for specific activities. The placement of the straps along the horizontal balance bar will position the elbow in greater or lesser degrees of flexion, and if edema is present, the hand is held higher than the elbow. The forearm support used with the suspension arm support is the same as that used with a mobile arm support, which will be discussed in detail later in this chapter. The attached rocker arm can be adjusted lengthwise on the forearm support, which permits greater directional assistance for vertical motion.

Threaded Case Study

Matt, Part 2

When Matt was first cleared to sit in bed, he was frustrated that he could feel his muscles contracting, but he was unable to move his arms. When Matt's arms were placed in the suspension slings mounted to an over-the-bed frame, he was immediately able to move them. He was excited to be able to "exercise my arms." When asked what he would like to do with his arms in the slings, Matt decided that he would like to try to use his iPad. The iPad was positioned on an over-the-bed table, and with his arms in the suspension slings and a short training session, Matt was able to begin to use it. With practice he was able to listen to music and connect with friends on Facebook by moving his shoulders and activating the screen with the dorsum of his fingers or his thumb. This successful experience helped Matt realize that he could use his arms, despite the significant weakness and remaining paralysis.

Mobile Arm Supports

A **mobile arm support** (MAS) is a passively or actively actuated mechanical device that supports the weight of the arm and provides assistance to shoulder and elbow motions through a linkage of low-friction joints (Fig. 30.43). MASs are used for persons with weakness of the shoulder and elbow that limits their ability to position the hand in space. They were developed early in the 1950s and have been known by other names, including ball-bearing feeder, ball-bearing arm support, and balanced forearm orthosis (BFO).

FIG 30.43 The JAECO/Rancho MultiLink MAS mounted on a wheelchair. (1) MultiLink arm; (2) offset swivel with forearm support slide; (3) forearm support. (Courtesy North Coast Medical, Inc., Gilroy, CA.)

A MAS can increase UE function for persons with severe arm weakness caused by conditions such as cervical spinal cord injury, muscular dystrophy, Guillain-Barré syndrome, amyotrophic lateral sclerosis, poliomyelitis, and polymyositis.[16,17,34] The MAS has also been used for pain relief in the shoulder and elbow during occupational performance for clients with arthritis and other painful conditions. Motor control problems such as ataxia, the inability to generate coordinated motor activity during voluntary movement, can significantly interfere with successful occupational performance. There are also commercially available arm supports that provide dampening of extraneous motion, although results with these devices have been mixed.

How Mobile Arm Supports Work

MASs compensate for proximal weakness in the UEs in three ways: (1) they allow for a significant increase in active movement in the shoulder and elbow, (2) they enable hand placement in a variety of positions, and (3) they allow persons with significant weakness to engage in functional tasks. MASs can be used for occupational performance (allowing engagement in desktop tasks and ADLs such as feeding, hygiene, and grooming) or for therapeutic exercises (improving ROM, strength, and endurance). Their use may be temporary or permanent.[4,6,34] The mechanical principles on which the MAS functions are threefold. The devices (1) use gravity to assist weak muscles, (2) support the weight of the arm to reduce the load on weak muscles, and (3) use friction-reduced bushings in the arm support joints to increase the ease of movement.

Criteria for Use[33,34]

A person must meet several criteria to be considered for MAS use. Many of these criteria apply to use of other devices to assist weak arms, but they were initially developed for MAS use. These include the following conditions.

Goals, occupational performance, and client motivation.

The person must have a goal or need to perform specific occupations and motions of the arm that cannot otherwise be accomplished because of weak shoulder and elbow musculature. To optimize chances for successful use of a MAS, the client must *want* to use the device and must have sufficient motivation for training to use it proficiently.[4] Atkins and colleagues[4] surveyed therapists who specialize in treating clients with spinal cord injury, and the most frequently identified activities in which MAS users engaged were (in descending frequency) exercise, eating, page turning, power wheelchair propulsion, brushing teeth, and keyboarding.[4]

Adequate motor control.

The person must possess selective volitional control of the existing muscles that will power the MAS. People with conditions such as cerebral palsy, stroke, or traumatic brain injury who do not possess isolated selective motor control are typically not good candidates for use of an MAS.

Adequate source of power.

The potential MAS user must have adequate strength to move the MAS with the arm secured in it. Movement is typically generated by the shoulder and elbow muscles, although power can also come from a combination of functioning muscles in the neck, trunk, and shoulder girdle. Neck or trunk musculature alone is seldom adequate for performance of ADLs using a MAS but can enhance function in combination with other muscles. Muscle strength of 2−/5 (poor minus) in the available scapular, shoulder, and elbow muscles is typically the minimum for successful use of the MAS.

Sufficient passive range of motion.

To use an MAS, the potential user must have available passive range of motion (PROM) in shoulder flexion, abduction, internal and external rotation, elbow flexion and extension, and forearm pronation. The ideal available PROM for functional use of the MAS includes at least 0 to 90 degrees of shoulder flexion and abduction, external rotation of 0 to 30 degrees or more, normal shoulder internal rotation and elbow flexion, and 0 to 80 degrees of forearm pronation. PROM of 0 to 90 degrees in hip flexion allows for an upright sitting position and provides an optimal base of support for UE function.

Stable trunk positioning.

An upright sitting posture is ideal, but initially clients may have difficulty tolerating this position. Using the MAS in a semireclined (5–20 degrees) sitting position is possible, but more challenging. In addition to presenting with weakness in the UEs, clients may present with trunk weakness as well, as in the case of those with complete tetraplegia. Clients with significant trunk weakness will require lateral trunk supports for optimal use of the MAS.

Freedom from interfering pain.

A careful evaluation of pain level, pain triggers, and pain buffers assists the therapist in deciding whether a client is a candidate for MAS use. Using MASs may decrease chronic pain, as these devices support the weight of the arm and allow the person to move freely. However, freer movement may also have the opposite effect, increasing pain from overuse of weak muscles, as the MAS allows the person to engage in repetitive motion despite severe weakness. The occupational therapist should carefully monitor pain level when introducing and initially using the MAS.

Adequate cognition.

A basic understanding of the device, how it works, and its basic adjustments is crucial for clients who use the device at home. With young children or adults with cognitive impairment, a family member or a caregiver may receive training to assist with setting up and adjusting the MAS.

Threaded Case Study

Matt, Part 3

Matt meets all of the criteria listed here. He has occupations of interest that can be accomplished through the use of an MAS. Client factors, including motor control, strength, ROM, and stable trunk positioning, are sufficient to allow him to use an MAS. He has minimal pain in his arms, and his cognition is intact. He is highly motivated to return to his law practice and has a very supportive wife.

Mobile Arm Support Parts and Their Function: The JAECO/Rancho MultiLink Mobile Arm Support

The most commonly used MAS throughout the United States since the 1950s has been the JAECO MAS, manufactured by JAECO Orthopedics. In 1995, the Rehabilitation Engineering Program at Rancho Los Amigos National Medical Center received a series of National Institute on Disability and Rehabilitation Research (NIDRR) grants (NIDRR# H133E003001, #H133E020732) to design, develop, and test a new MAS.[22] The resultant JAECO/Rancho MultiLink MAS improved on the original MAS design and successfully addressed several concerns identified by long-term users and experienced therapists. It is the most commonly purchased MAS on the market, and few of the traditional JAECO MASs are being ordered.[12] Therefore our discussion of MAS parts, functions, and adjustment will focus on the JAECO/Rancho MultiLink MAS (Fig. 30.44; see also Fig. 30.43). The JAECO/Rancho MultiLink MAS is far easier to adjust than its predecessor and comes with a clear manual detailing its setup and basic adjustments. All parts of this MAS are interchangeable for application between the right and left side of the mounting surface (i.e., wheelchair or table). The MultiLink mount (see Fig. 30.44, B) is attached to the wheelchair or a standard chair and is the interface between the chair and the MAS arm. The MultiLink arm (see Fig. 30.44, A [3]) is then connected to the mount (see Fig. 30.44, A [1]) using the proximal shaft (see Fig. 30.44, A [2]) and allows for friction-reduced movement. The adjustable forearm support is connected to an adjustable offset swivel (see Fig. 30.44, C), which is inserted into the distal end of the MultiLink arm. The MAS user's arm is placed in the forearm support.

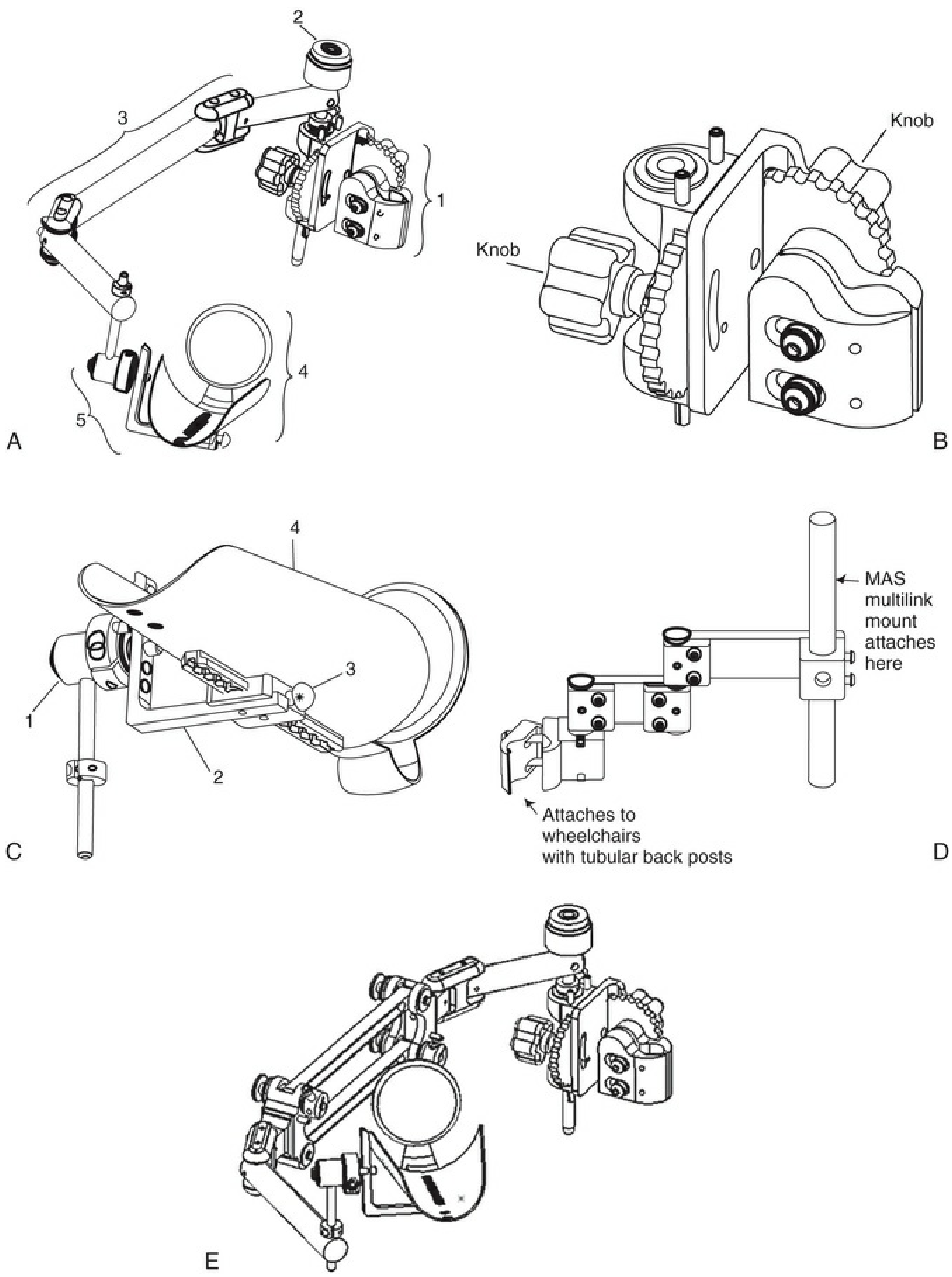


FIG 30.44 **A,** JAECO/Rancho Multilink Mobile Arm Support. (1) MAS mount. (2) Proximal shaft with bubble level. (3) MultiLink. (4) Forearm support with elbow dial. (5) Offset swivel with adjustable slide. **B,** JAECO/Rancho MultiLink Mobile Arm Support mount. Two knobs control adjustment without use of tools. **C,** JAECO/Rancho MultiLink Mobile Arm Support offset swivel with adjustable slide. (1) Offset swivel with (2) adjustable slide. (3) Spring-loaded pullout knob to adjust position on the forearm support (4). **D,** JAECO Mount Adapter MR-10 enables the JAECO/Rancho mount to attach to wheelchairs with tubular back posts. **E,** The JAECO/Rancho MultiLink Arm with Elevation Assist. (Courtesy JAECO Orthopedic, Inc., Hot Springs, Ark.)

It is of greatest importance that the therapist understands the adjustment capabilities of each component of the MAS, as it is these adjustments that customize the MAS to meet the needs and goals of each individual MAS user and augment his or her available internal source of power (muscle strength).

Adjustment capabilities of individual parts.[20]

MultiLink mount.

The mount comes with two adjustable scroll wheels, which tilt the MAS to assist the user to move in the direction in which he or she is weaker (see Fig. 30.44, B). The user must have adequate strength to move against the assisted motion. These adjustments allow for optimal (1) forward reach and return movements and (2) side-to-side movements. Once the overall functional range of the MAS is maximized, the scroll wheels are tightened (locked) in place.

Forearm support and offset swivel.

Optimal vertical (hand-to-mouth) movements are achieved by adjusting the offset swivel along the slide, which is affixed to the bottom of the forearm support (see Fig. 30.44, C [2]). Moving the rocker arm along the slide toward the wrist aids in upward motion, and moving it toward the elbow aids in downward motion. As with the above-mentioned adjustments, the MAS user must have sufficient strength to move against the assisted motion. Each of these basic adjustments is made with the person's arm secured in the MAS.

MultiLink arms.

The therapist will choose between two types of MultiLink arms. The standard MultiLink arm (see Fig. 30.4, A [3]) provides horizontal movement, however, vertical motion is limited to that which is generated by elbow flexion and extension. The MultiLink arm with elevation assist (see Fig. 30.44) attaches to the mount in the same manner as the standard MultiLink arm but allows for elevation of the arm at the shoulder. According to 2014 data, this is the most frequently ordered type of MultiLink arm (M. Conry, personal communication).[11] The MultiLink arm with elevation assist is useful for the person who has deltoid strength between 2/5 (poor) and 3/5 (fair). This type of MultiLink arm allows for significantly greater freedom of movement and thus expanded functional use (Fig. 30.45). The client initiates the elevating motion (shoulder flexion or abduction), and the rubber bands attached to the middle section of the MultiLink arm help the client to flex or abduct the humerus to a higher level. The MultiLink arm with elevation assist has stops that can be adjusted to limit the amount of upward and downward motion. However, the client must have sufficient muscle power combined with the weight of the arm to return to the resting position. For this reason, not all persons with 2/5 to 3/5 deltoid strength are good candidates for this MAS component.

FIG 30.45 Sewing using the JAECO/Rancho MultiLink Arm with Elevation Assist.

Mobile arm support mount relocators.

Mounting the MAS to a wheelchair is frequently a challenge, as wheelchair backs and back posts vary in design and because other equipment such as lateral trunk supports must also be attached in the same area. To ensure that the MAS mount is placed in a position that will maximize function, JAECO developed a variety of MAS mount relocators (Figure 30-44, D). There are mount relocators that are designed specifically for use with wheelchairs with tubular back posts, for those with molded backrests, and for those with keyed back posts. Prior to ordering the MAS, the therapist must be familiar with the backrest design of the client's wheelchair.

Arm height adjustor.

The arm height adjustor allows for rapid adjustment of the height of the MultiLink arm for different activities and work surfaces.

Other mobile arm supports.

There are other MASs on the market that vary in design and may offer alternative and sometimes better solutions for certain clients than the JAECO/Rancho MultiLink MAS. One such device is the Wilmington Robotic Exoskeleton (WREX) (Fig. 30.46, A), which because of its design allows the arm to float. The mount is attached above the shoulder, which allows the arm to move more freely in a nonlinear fashion.[30] The Mobility Arm (Fig. 30.46, B) is a simpler wheelchair mounted arm support. Like the freestanding Swedish HelpArm (Fig. 30.46, C) described later in this chapter, it utilizes a weight to counterbalance the weight of the arm, allowing greater vertical movement from weak shoulder musculature. However, it lacks the fine adjustment of the JAECO/Rancho MultiLink MAS.

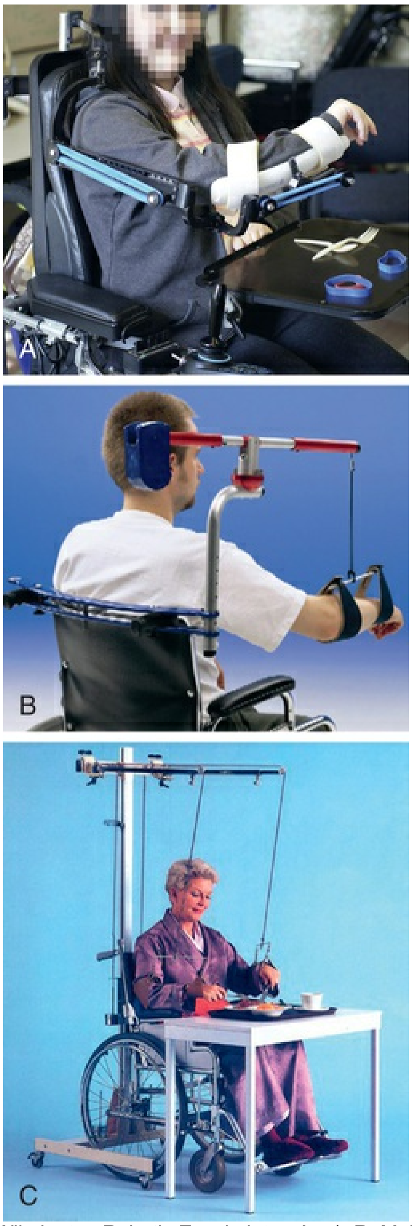


FIG 30.46 **A,** The WREX (Wilmington Robotic Exoskeleton Arm). **B,** Mobility arm sling mounted on a wheelchair. **C,** The Swedish HelpArm is similar in design to a traditional deltoid aid. (*A,* From Rahman T, Basante J, Alexander M: Robotics, assistive technology, and occupational therapy management to improve upper limb function in pediatric neuromuscular diseases, *Phys Med Rehabil Clin N Am* 23:701–717, 2012. *B* and *C,* Courtesy Performance Health, Warrenville, IL.)

Training

Training includes practice in all activities that interest the client and that need to be performed.[6,34] Any of these occupations may require fine adjustments to the MAS until the optimal settings are achieved. If strength or ROM increases during the training period, further adjustments will be needed. A wrist-hand orthosis or occupation-specific adaptive equipment may be necessary for use with the MAS.[6,34] When using a MAS to drive a power wheelchair, the client must practice in a variety of contexts to ensure that he or she can successfully negotiate hills and rough terrain. Because MASs rely on gravity to assist weak muscles, inclined terrain may pose significant challenges to the very weak client. Follow-up assessment and training with clients is indicated, especially for a growing child or for any client whose physical status may change.

Threaded Case Study

Matt Part 4

After 2 weeks in rehabilitation, Matt was able to sit upright in a wheelchair for 5 hours a day. He was given a power wheelchair, which he operated with a chin control for mobility and for reclining the wheelchair for pressure relief. He was still unable to participate in any of the most important occupations needed to return to work.

A JAECO/Rancho MultiLink MAS was mounted on his wheelchair, and he was given a lapboard for his wheelchair as well. With the MAS and his wrist-hand orthosis, he was able to use his iPad more easily and for an increasing variety of applications. His wife brought his laptop computer to the hospital, and he was able to send emails to his wife, coworkers, and friends. Activities that require hand-to-mouth skills are more complex than tabletop activities, so these occupations were introduced more gradually as Matt worked on reaching higher and higher. Once Matt could reach his mouth with his hand, eating activities were introduced. After training, Matt was able to feed himself using a wrist-hand orthosis and a universal cuff to hold a spoon or a fork. When Matt's daughter came to visit, the OT planned some treatment sessions to encourage Matt to use his MAS to play board games with her. Matt was encouraged by being able to play with his daughter, affirming the resumption of his role as a father.

Another of Matt's goals was to drive his power wheelchair using a hand control. He did not like the feeling of the chin switch in front of his face, and it made him self-conscious during social interactions. He practiced using the MAS to drive his wheelchair until he accomplished this task. With practice, Matt was able to use his iPad and his laptop computer, turn pages, manage a speakerphone, feed himself simple meals, and drive his power wheelchair.

Freestanding Dynamic Arm Supports

Freestanding dynamic arm supports that do not attach to the wheelchair allow the therapist to initiate treatment earlier in the rehabilitation process. These devices are more common in larger rehabilitation units and typically allow for quicker setup than a wheelchair-mounted MAS, maximizing inpatient therapy time. The rapid setup allows a client who is easily fatigued or in pain to begin engaging in self-care and tabletop activities and exercise as soon as minimal wheelchair sitting tolerance is established.

Because not all types of equipment are available in every facility, therapists must familiarize themselves with the devices available in their clinic to maximize their potential use. To achieve the optimal desired therapeutic outcome, the therapist must combine a clear understanding of the equipment at hand with the desired therapeutic goals.

Freestanding devices vary in complexity and ease of adjustment. All support the arm, allowing the client to engage in activities. These devices use rubber bands, springs, ball bearings, and other mechanical elements to negate the effects of gravity on weak proximal UE musculature.

The SaeboMAS has an adjustable parallelogram design offering various levels of assistance (Fig. 30.47). The mechanism is spring based, allowing for multidirectional activities. This device features a mechanical tension scale, which allows the therapist to grade the activity and to track and document progress. Height adjustment allows the client to practice skills in either a sitting or standing position.

FIG 30.47 The SaeboMAS floor model allows for a quick setup supporting the arm.

The JAECO/Rancho MultiLink MAS can be mounted to a lightweight, portable, and height-adjustable floor stand, which is placed next to the wheelchair (Fig. 30.48). This allows the seated client to engage in activities immediately and to evaluate whether a wheelchair or table-mounted MAS would be most beneficial.

FIG 30.48 The JAECO/Rancho MultiLink mounted to a stand allowing for a quick setup in the clinic.

The Swedish HelpArm (similar to what was once called a Deltoid Aid) utilizes weights to assist with upward movement of the arm. Increasing or decreasing the weights provides the optimal amount of assistance to the arm. This device can be used while the person is sitting in bed or in a chair. The therapist can limit the available motion, allowing clients with weak muscles to exercise and engage in self-care and tabletop activities.

Some devices, such as the ArmeoSpring, add interactive computerized elements to provide valuable feedback and monitoring of client performance (Fig. 30.49). Electrical sensors in the mechanical arm that are connected to a computer allow the client to focus on a clear goal and the therapist to monitor and record progress, optimizing the therapeutic session.

FIG 30.49 The ArmeoSpring mobile arm support by Hocoma.

Dynamic Arm Supports for the Ambulatory Client

Ambulatory clients with weak proximal UE musculature are unable to reach their upper torso and head, engage in tabletop activities, and reach for objects that are above waist height. When one arm is primarily affected, the person can easily use the less affected side. However, when both shoulders are weak, the hands may have functional strength, but the arms rest by the side of the body in a dependent position, making reaching for objects and lifting them impossible. Clients with bilateral proximal weakness may use table-mounted arm supports to allow them to position the hand in space for function. The JAECO/Rancho MultiLink MAS can be attached to a special table mount to allow the person to sit at a table and engage in activities. A similar mechanism is the SaeboMAS Mini, which is a lightweight, portable, table-mounted device (Fig. 30.50). Like the freestanding Saebo, it has an adjustable spring-based parallelogram design, offering graded levels of assistance in multiple planes of movement.

FIG 30.50 The SaeboMAS Mini mounted on a table. (Courtesy Saebo, Inc., Charlotte, NC.)

When using a table-mounted dynamic arm device, the ambulatory client must dedicate one location to engage in all desired activities. An activity center or desk with the dynamic arm support attached is a good solution for a person who spends hours in one area, such as at work. However, how do ambulatory clients with severe proximal weakness use their arms to brush their teeth at the sink, use an ATM, or reach for a cereal box at the supermarket?

Equipment solutions for those individuals who must use their arms while standing or walking exist but are seldom used. Dynamic arm supports can be attached to the trunk by a custom-made body orthosis, but they are cumbersome. These devices have been primarily studied and developed for children. A commercially available example is the Wilmington Robotic Exoskeleton (WREX). It is typically attached to a wheelchair but can be attached to a custom body jacket for ambulatory clients. The WREX has been fitted on children as young as 6 years old, allowing them to engage in activities while sitting, standing, or walking.[31] Since the 1990s, Tariq Rahman, PhD, and his team at the Alfred I. DuPont Hospital for Children have been improving the WREX to allow children with arthrogryposis to eat, play, and study using the device. This device is large and visible, and potential users have to weigh the benefits versus the negative social impact in deciding whether to use it.[31]

With the ongoing development of new materials and technologies, it is the hope of these authors that better equipment solutions for ambulatory, actively engaged adults with weak proximal UE musculature will be developed and marketed in the near future.

Robot-Assisted Therapy

Robot-assisted therapy for the upper limb includes a variety of complex and expensive devices (Fig. 30.51). These devices provide automated, goal-directed, repetitive movements with highly adjustable levels of assistance or resistance.[29] Robot-assisted therapy allows for the systematic adjustment of treatment parameters and provides the client with feedback and thus motivation to reach a goal.[26,29] In addition, it provides kinetic measurements that can assist the therapist in grading the therapy program and monitoring and recording progress. The interest in robot-assisted therapy began in the 1990s with the emergence of new evidence indicating that brain neuroplasticity can occur in adults, not only in children as was previously thought. Research showed that rote, repetitive exercise of an affected limb, shortly after trauma, leads to increased brain activity and improved function. Initial studies focused on gait training after neurologic injuries such as stroke and incomplete tetraplegia. The use of robot-assisted therapy for the upper limbs began with stroke survivors after initial evidence showed that (as with lower extremities) it reduced motor impairments in the upper limbs when administered shortly after onset of a cerebral vascular accident (CVA).

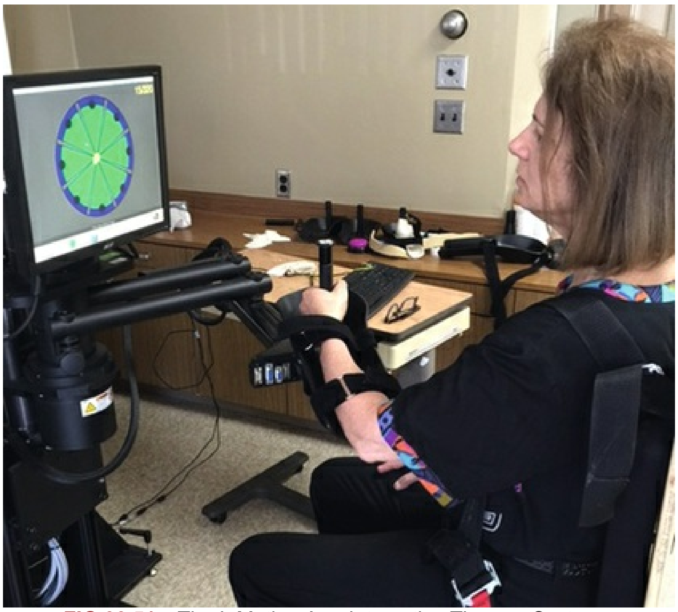


FIG 30.51 The InMotion Arm Interactive Therapy System.

It is important to note that robot-assisted therapies are not meant to replace the therapist but to augment traditional therapies and enable the therapist to provide more intensive therapy than was possible before. Robot-assisted therapy is frequently combined with neuromuscular electrical stimulation to facilitate and strengthen movement and to provide greater feedback to the client.

A robot-assisted therapy session may involve the therapist and client collaborating on a specific goal such as reaching a target on a screen by moving the arm in a prescribed direction. When the arm is weak, the robotic device can provide adequate assistance to allow the motion to be completed repeatedly. If the person is stronger, the device can provide resistance to the motion, with the goal of increasing strength. As stated previously, motor control problems such as ataxia pose a continual challenge to both therapist and client. Some robotic devices can be adjusted to dampen extraneous movements, allowing for greater function in certain clients. Suggested protocols for the frequency and duration of treatment have been developed for individuals recovering from CVAs[10,26]; however, at this time, there is no conclusive evidence to guide the therapist in determining what specific regimen is optimal for each client.[10,26] With the successful outcomes of robot-assisted therapy for stroke survivors, research being conducted on individuals with traumatic brain injury, spinal cord injury,[12] and cerebral palsy[21] is showing promise.

More and more companies are developing and marketing robot-assisted therapy devices. These devices are expensive (approximately $80,000 to $200,000) and are usually purchased by large rehabilitation hospitals and research institutions. Two of the advantages of robot-assisted therapy are the provision of ongoing feedback to the client and the ability to produce high-intensity, goal-directed repetition without boredom, due to the interactive component of the treatment.

Threaded Case Study

Matt, Part 5

Matt's OT utilized a robotic device several times a week for part of his treatment session. The goal of the sessions was to help Matt isolate shoulder and elbow movements and strengthen specific muscles. The settings of the robot were frequently adjusted in response to Matt's changing status, continually challenging him as his strength and endurance increased. He initially required active-assistive exercise, moving his arm through part of a predetermined pathway for reaching and returning his arm to his side with assistance provided by the robot at the end of his available active ROM. Next, Matt was able to complete the entire motion independently, and lastly the therapist changed the parameters by introducing light resistance to his movement. Matt was highly motivated to train on the robot, and he liked the visual and auditory feedback he received when he reached his daily goals. Interacting with the robot provided Matt with just the right challenge.

Cost

Recommending the optimal equipment for home use is critical for maximizing both UE strength and occupational performance. Cost and funding sources must always be considered. The therapist must establish whether equipment will be covered by insurance, and if the first attempt to procure equipment through insurance fails, the therapist may resubmit the request with a stronger justification. When insurance does not cover arm supports and additional adaptive equipment and the client has no means to pay for the orthosis, alternative funding sources such as community fundraising and nonprofit grant assistance should be explored. Another alternative to purchasing expensive devices is the use of cheaper, homemade equipment. Despite not meeting all of the capabilities of a well-designed orthosis, homemade solutions may provide an adequate substitute to an expensive device. For a home exercise program, the family may be instructed in the fabrication of a tabletop skateboard that allows the person to exercise his or her arm at home, in preparation for ADLs.

Threaded Case Study

Matt, Part 6

Matt was first able to benefit from using suspension arm supports in bed and using adapted equipment to access his iPad. Once he established adequate sitting tolerance in a power wheelchair, he was fitted for an MAS. Additional adaptive equipment and adequate training and practice allowed him to engage in many of his desired occupations, including feeding, hygiene/grooming activities, computer use, and controlling aspects of his home and office environments including operating light switches and using electronic devices. His daughter's visits always included special playtime using the MAS. Robot-assisted therapy sessions were used to strengthen weak muscles and to provide precise feedback that quantified gains in both strength and endurance. Following discharge, Matt was referred to the assistive technology service, where a plan was formulated for Matt and the occupational therapist to visit his home and law office to determine how he could manage his required work functions. In addition to the equipment he obtained as an inpatient, it was recommended that Matt would benefit from an adjustable desk, which would allow him to independently access his phone, computer, and files. He was also instructed in the procedure to obtain free specialized adaptive equipment from his telephone company, for both work and home. This visit and the implementation of equipment recommendations resulted in Matt's return to his law practice 2 months after discharge.

Summary

Clients with weak UEs benefit greatly from the use of carefully prescribed arm supports. Static arm positioning provides support for weak musculature, helps to prevent shoulder subluxation, and assists with the management of pain in the UEs. Dynamic arm supports allow the client with weak upper limbs to engage in meaningful occupations and may also be used for strengthening. Suspension arm supports are inexpensive and easy to adjust, but they do not allow for the discrete adjustments required for clients with severe weakness. Mobile arm supports are highly adjustable devices that support the weight of the arm and minimize the effects of gravity on weak proximal UE muscles. Depending on the client's diagnosis and prognosis, the use of MASs may be temporary or permanent. Clients must have a functional need and strong motivation to successfully use MASs. It is the role of the occupational therapist to select the arm support that best meets the needs of each client, and this is established through careful evaluation and the assurance that the client meets the minimum criteria for optimal use. Clients' concerns about MASs include increased overall wheelchair dimensions and a heightened appearance of disability.

With adequate training, however, clients who experience occupational benefits accept and use the device. Freestanding dynamic arm supports are used in therapy clinics and allow quick setup and early therapeutic intervention. Robot-assisted therapy is a rapidly growing field with mounting evidence to support its efficacy as an adjunct to traditional therapy. However, these devices are expensive and not readily available to all therapists and clients.

Acknowledgments for Section 2

We would like to thank Y. Lynn Yasuda, MA, OTR/L, FAOTA, and the staff and clients at Rancho Los Amigos National Rehabilitation Center, who have taught us so much. We would also like to thank Mark Conry and his family for their commitment to improving the JAECO MAS throughout the years and, by so doing, improving the lives of many individuals. Lastly, we would like to thank Lydia Cabico and Kim Hasday, MA, OTR/L, for their valuable assistance.

Review Questions

1. Describe the role of the OT in the orthoses-making process.
2. What is wrist tenodesis, and how can it be used functionally?
3. Describe the axis of motion of forearm rotation, and discuss how it affects the fit of an orthosis.
4. Name the three major nerves that supply the hand, and describe their sensory innervation patterns.
5. Why is tip prehension considered to be a dynamic rather than static prehension pattern?
6. What is the one grasp pattern that does not include the thumb?
7. Define the terms *friction*, *torque*, and *stress*.
8. How is shear stress created and how can it best be avoided?
9. Why do translational forces minimize the effectiveness of an orthosis?
10. Describe the difference between a dynamic and a static orthosis.
11. How may an orthotic pattern vary if it is to be fitted on the dorsum of the hand, as compared with the volar surface?
12. How does the amount of drape in a low-temperature thermoplastic material affect the making of an orthosis?
13. What is the recommended type of material for small finger orthoses? Why?
14. What is the recommended type of material for large elbow and lower extremity orthoses? Why?
15. What is the importance of straps on a single-surface orthosis?
16. Why is optimal early static positioning important?
17. What are the main purposes of dynamic arm supports?
18. Where can suspension arm devices be attached?
19. What are the benefits of an MAS?
20. How does a mobile arm support work?
21. What are the criteria for successful MAS use?
22. What occupations can be achieved with the use of an MAS?
23. What are the parts of the JAECO/Rancho MultiLink MAS?
24. What are the benefits and limitations of freestanding dynamic arm supports?
25. What dynamic arm supports are available for the ambulatory client? What are their benefits and limitations?
26. What are the benefits and limitations of robot-assisted therapy?
27. What strategies can the therapist employ to encourage a reluctant client to try using an MAS?

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31

Traditional Sensorimotor Approaches to Intervention*

Winifred Schultz-Krohn, Julie Mclaughlin-Gray

CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Describe the four general processes of information flow related to control of movement.
2. Define motivational urge, and name the locus of this function in the brain.
3. Trace the flow of information in the central and peripheral nervous systems that leads to purposeful movement.
4. Define the sensorimotor system, its locus in the brain, and its function during motor performance.
5. List the structures that constitute the higher, middle, and lower levels of the central nervous system components for movement.
6. Name the four traditional sensorimotor approaches to intervention and the theorist responsible for each.
7. Name the two models of motor control that form the basis for the sensorimotor approaches to treatment.
8. Briefly describe each of the four traditional sensorimotor approaches to intervention; compare and contrast their similarities and their differences.
9. Understand and apply proprioceptive neuromuscular facilitation (PNF) as a preparatory method to facilitate client participation in desired occupations.
10. Define PNF and how this approach facilitates adaptive responses that are performed in daily occupations.
11. Understand the principles of PNF and how to apply them to enhance client performance.
12. Describe the influence of sensory input on motor learning.
13. Use the PNF evaluation to determine factors limiting clients' participation in their occupation.
14. Recognize upper and lower extremity diagonal patterns in daily performance skills.
15. Name the theorists who developed the PNF approach.
16. Discuss the historical background and current use of neurodevelopmental treatment (NDT) within occupational therapy.

7. Identify theoretical foundations of NDT as well as current principles of evaluation and intervention.
8. Identify management strategies associated with NDT intervention and treatment techniques.
9. Integrate NDT within an occupation-centered and client-centered approach to evaluation and intervention.
10. Discuss the relationship between evidence-based practice and NDT, and discuss the types of evidence available to support the use of NDT in occupational therapy.

KEY TERMS

Approximation
Asymmetric patterns
Bilateral patterns
Co-contraction
Combined movements
Conation
Contract-relax
Diagonal patterns
Generalizability
Hold-relax
Inhibitory techniques
Lower motor neurons
Manual contacts
Mass movement patterns
Maximal resistance
Motivational urge
Motor program
Movement strategy
Part-task practice
Proprioceptive neuromuscular facilitation
Proprioceptive stimulation
Reciprocal inhibition
Reciprocal patterns
Reflex and hierarchical models
Repeated contractions
Rhythmic initiation
Rhythmic rotation
Rhythmic stabilization
Sensorimotor system
Sensory stimulation

Slow reversal
Slow reversal-hold-relax
Stabilizing reversals
Stepwise procedures
Stretch
Symmetric patterns
Traction
Unilateral patterns
Upper motor neurons
Verbal commands
Verbal mediation
Whole-task practice

Overview*

Case Study

Carlos

Carlos, a 59-year-old construction foreman, suffered a right cerebrovascular accident 3 days earlier and currently requires maximum assistance for most self-care tasks. He is able to speak and recognizes his wife and two adult children, but he appears easily confused when expected to participate in self-care activities. He has no functional motor control of his left arm or hand, and sensation is markedly impaired on his left extremities. He exhibits a decorticate posture in both left extremities, with flexion tone dominating his arm and extensor tone dominating his leg. He is able to partially roll to the right side of the hospital bed and push up on his right arm to a sitting position, but at home he sleeps on the opposite side of the bed. He is able to stand by using a quad cane in his right hand but is unable to safely walk from the bed to the bathroom in his hospital room.

As Carlos's occupational therapist, you are expected to design and implement an intervention plan based on the best evidence available. Occupational therapists working with clients who have sustained damage to the central nervous system are often concerned with enhancing functional movement as a means of promoting independence in occupational performance.[16] To achieve this objective, a variety of intervention approaches are available from which the therapist may choose. This chapter reviews the traditional sensorimotor approaches and presents a brief description of each.

Critical Thinking Questions

1. How can a traditional intervention approach improve Carlos's occupational performance?
2. What potential difficulties should be anticipated when using a traditional intervention approach?
3. What current knowledge of central nervous system function could be used to support the selection and implementation of traditional sensorimotor intervention methods?

Occupation performance frequently requires precise voluntary movement that is controlled and monitored by the nervous system. Various structures within the nervous system are coordinated to selectively activate specific muscles to initiate, perform, and complete a desired task or activity. If a movement is poorly performed and thereby compromises task performance, feedback occurs through knowledge of the results of the action, and the neurologic commands to the muscles are modified so that accuracy of movement is achieved. Knowledge of the intricate working of the nervous system is of special importance to the occupational therapist concerned with refinement and improvement of the motor performance of clients with neurologic conditions.[3] A brief overview of the flow of information associated with the control of movement is described in the following sections.

Central Nervous System Control of Movement

The firing of motor neurons located in the anterior horn of the spinal cord produces all movements.[84] These neurons directly innervate the skeletal muscles. The activity of the spinal or lower motor neurons can be modulated by segmental spinal circuitry and by the descending influence of the upper motor neurons located in the motor cortex and brainstem.[52,54] Two other structures, the basal ganglia and the cerebellum, and their associated pathways, are also intimately involved with motor control. Lesions in these structures are associated with characteristic movement disorders.

Movement production does not begin and end with the **upper motor neurons** or **lower motor neurons**. Many central nervous system (CNS) structures contribute to the development of the signals that activate muscles. Although much about the control of movement is still unknown, animal and human research suggests that four general processes are related to the flow of information needed to control movement. The four general processes of information flow are motivation, ideation, programming, and execution.[10,18] A schematic diagram that indicates the main direction of information flow and connecting the various motor centers appears in Fig. 31.1.

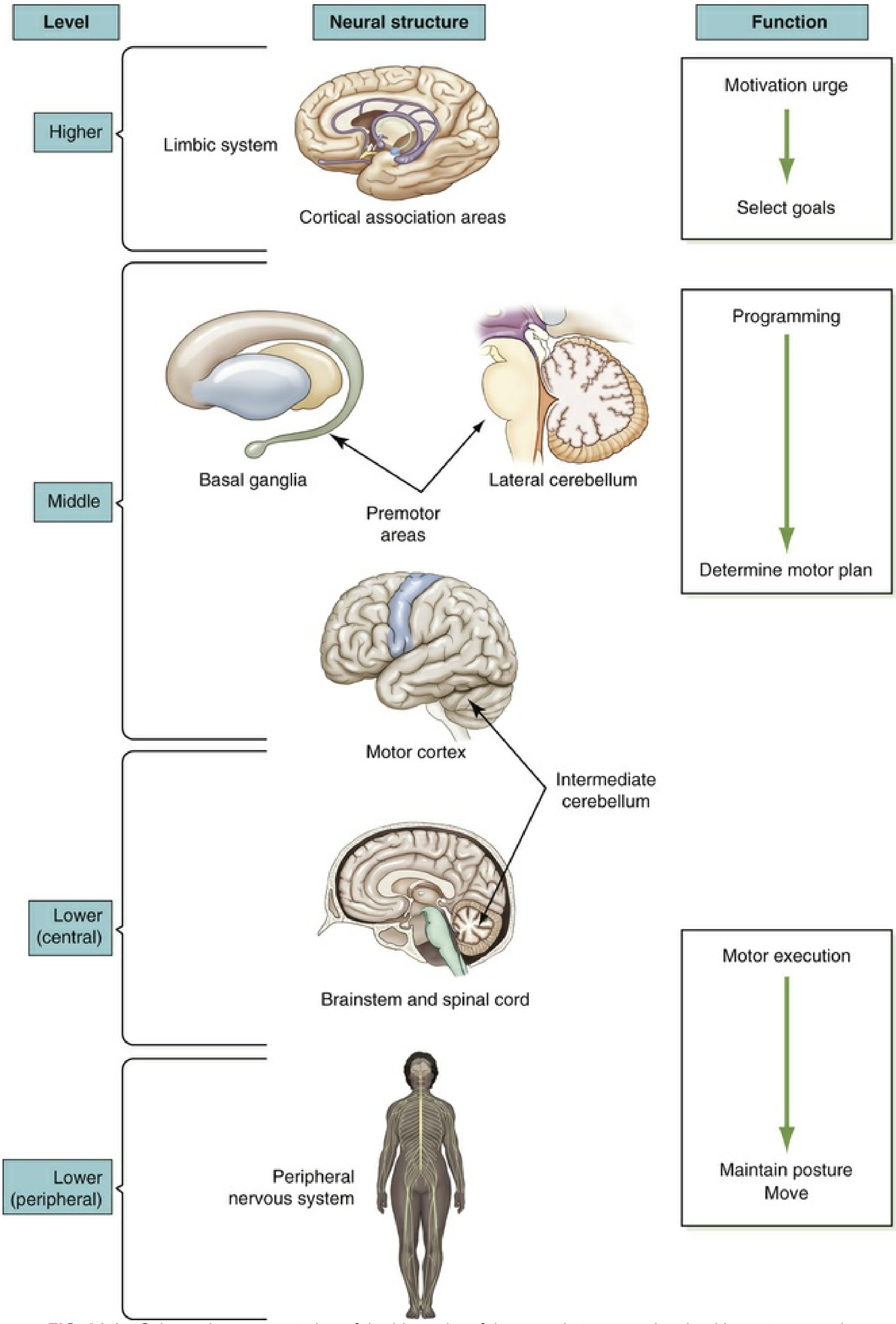


FIG. 31.1 Schematic representation of the hierarchy of the neural structures involved in motor control. The *left column* indicates the hierarchical level and the *right column* the major function of the neural structures shown in the center column during motor performance. (Adapted from Cheney PD: Role of cerebral cortex

in voluntary movements: a review, *Phys Ther* 65:624, 1985.)

The motivation or emotive component of the movement is a function of the limbic system.[10,77] The **motivational urge** or impulse to act associated with the limbic system is transformed to ideas by the cortical association areas. This connection of knowledge and affective behavior is also referred to as **conation**.[39] Conation represents the intentional, deliberate, and goal-directed aspect of behavior and is related to the individual's reason for the motor performance. The association areas of the frontal, parietal, temporal, and occipital lobes are concerned with ideation, or the goal of the movement, and the programming or **movement strategy** (plan) that best achieves the goal. Programming of a movement strategy also involves the premotor areas, the basal ganglia, and the cerebellum. The **motor program** is the procedure or the spatiotemporal order of muscle activation that is needed for smooth and accurate motor performance. The execution level, represented by the motor cortex, the cerebellum, and the spinal cord, is concerned with the activation of the spinal motor neurons and interneurons that generate the goal-directed movement and the necessary postural adjustments.

To appreciate the flow of information leading to purposeful movement, consider the actions of your client Carlos, who sustained a right cerebrovascular accident (RCVA) with resultant left hemiplegia, is thirsty, and is reaching out for a glass of water while seated at a table for support (Fig. 31.2). The limbic system, which connects with the areas of the midbrain and brainstem that control vital functions such as hunger and thirst, has registered the need for water.[37] This need for drinking water has been conveyed to the cortical association areas, which also received visual, auditory, somatosensory, and proprioceptive information about precisely where the body is in space and where the glass of water is relative to the body.[41] This sensory information is needed before the movement is initiated. Strategies or motor plans are formulated to move the arm and hand from their immediate location in space to one in which the glass of water is picked up and moved to the mouth. Motor programs are generated by the association cortex in conjunction with the basal ganglia, lateral cerebellum, and premotor cortex. Once a strategy is selected, the motor cortex is activated. The motor cortex, in turn, conveys the action plan to the brainstem and spinal cord. Activation of the cervical spinal neurons generates a coordinated and precise movement of the shoulder, elbow, wrist, and fingers. Input from the brainstem and cerebellum ensures that the axial musculature makes the necessary postural adjustments. Sensory information during the movement is necessary to ensure the smooth performance of the ongoing movement and to improve subsequent similar movements. Because the motor areas rely heavily on sensory feedback provided by exteroceptors and proprioceptors regarding the accuracy of movement, the structures of the brain that control movement are often referred to as the **sensorimotor system**. Carlos is able to use his right hand to pick up the glass of water but has compromised postural control. When he is supported, sitting at the table, he is able to complete this task, but when standing and holding his cane in his right hand he is unable to use his left arm and hand to reach and pick up the glass of water. The resultant motor problems from the RCVA further compromise his ability to perform a bimanual task such as pouring liquid into a glass even when he has the necessary motivational urge or intention for movement.

FIG. 31.2 A person reaching for a glass of water.

Given the motivation-ideation-programming-execution scheme of how information is organized through the nervous system, it is obvious that control of voluntary movement involves almost all of the neocortex. Voluntary movement depends on knowledge of where the body is in space, where the body intends to go with respect to this external space, the internal and external loads that must be overcome, and formulation of a strategy or plan to perform the movement. Once a strategy or plan has been formulated, it must be held in memory until execution, at which point appropriate instructions are sent to the spinal motor neurons. The primary functional aspects of the sensorimotor areas involved in motor control are examined next.[10,46,77]

Sensorimotor Cortex

The sensorimotor cortex is the major integrating center of sensory input and motor output. It is composed of cortical areas located immediately anterior and posterior to the central sulcus (Fig. 31.3). The three principal motor regions located in the frontal lobe are the primary motor area, the supplementary motor area, and the premotor area. The two principal sensory regions located in the parietal lobe are the primary somatosensory cortex and the posterior parietal cortex. Each area of the sensorimotor cortex (primary motor cortex, primary somatosensory cortex, posterior parietal cortex, supplementary motor area, and premotor cortex) is arranged in a manner that provides a topographical representation of the contralateral body segments.[46,70] Each of these areas is responsible for certain aspects of movement generation. In the previous example of reaching out for the glass of water, Carlos had a mental image of his body and its relation to the surrounding space by integrating the information supplied through somatosensory, proprioceptive, and visual inputs to the posterior parietal cortex. Clients with a lesion in this area demonstrate impairment of body image and its relation to extrapersonal space, and, in the extreme situation, neglect of the contralateral body segments.

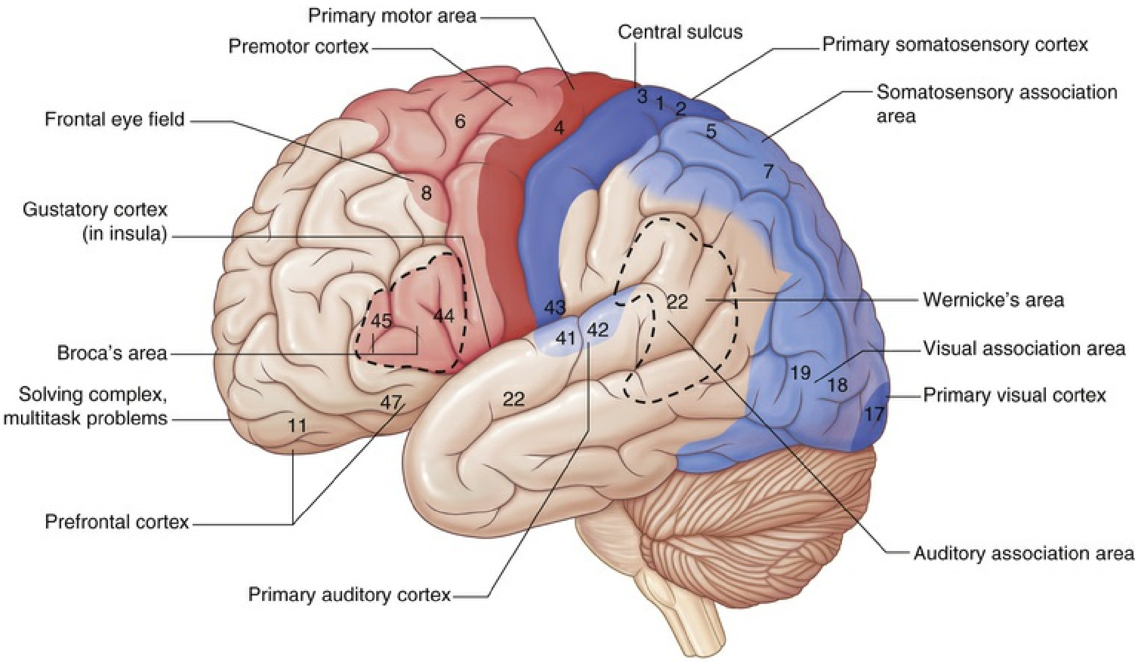


FIG. 31.3 Areas of the neocortex intimately involved in planning of and instruction for voluntary movement. Areas 4 and 6 constitute the motor cortex. (Red: motor cortex; blue: sensory cortex; pale blue and pale red: association cortex.) (From Naish J, Syndercombe D, editors: *Medical sciences*, ed 2, Edinburgh, 2015, Saunders.)

The posterior parietal cortex integrates and translates sensory information so that the ensuing movements are directed appropriately in extrapersonal space. It is extensively interconnected with the association areas of the frontal lobe that are considered to be involved in determining the consequences of movement strategies such as moving the arm forward, curling the fingers around the glass, and lifting the glass to the mouth. The fingers begin to curl appropriately before any contact occurs with the glass; therefore the size and shape of the glass must be recognized before grasping. The prefrontal association areas and the posterior parietal cortex project to the premotor area, which is thought to be concerned with the orientation of body segments before the initiation of movement. The input of the posterior parietal cortex to the premotor area may be important in the somatosensory guidance of movement.[18] Lesions of the premotor area or posterior parietal cortex have been demonstrated to generate an inappropriate movement strategy.[43]

Planning of movement is considered to be the function of the supplementary motor area. In animal studies, the electrophysiologic recordings of cells in this area indicate that the cells typically increase discharge rates about a second before the observable execution of movement of either hand.[89] The same findings have been corroborated in humans with the use of imaging techniques to study patterns of cortical activation. Imaging studies using positron emission tomography (PET) monitor changes in local blood flow, because an increase in the local cerebral blood flow is associated with increased neuronal activity. Under these conditions, when subjects were asked to imagine a movement without actually moving the finger, the blood flow to the supplementary motor cortex increased and no comparable increase in blood flow was seen in the primary motor area.[73] When subjects were asked to perform a series of finger movements from memory, blood flow to the supplementary motor cortex increased in advance of the movement but not during the performance of the movement. Unilateral lesions of the supplementary motor area result in apraxia (the loss of the ability to perform movement in the absence of motor or sensory impairments). Another effect of such lesions is the inability to produce the correct sequence of muscle activation for complex motor activities such as speaking, writing, buttoning, typing, sewing, and playing the piano.

The primary somatosensory cortex projection to the primary motor cortex and association areas provides the sensory input needed for motor planning, movement initiation, and regulation of ongoing movement.[29] The primary motor cortex integrates the information it receives from other areas of the brain and generates the descending command for the execution of movement. Not only is this descending command sent to the brainstem and spinal cord, but a copy of it is also sent to the basal ganglia and cerebellum. The descending command specifies the muscles to be activated and the direction, speed, and required force.[18] Lesions of the primary somatosensory cortex typically result in contralateral sensory loss. Movements are uncoordinated because the ability to register sensory feedback during and after the movement is compromised. Damage to the primary motor area results in motor execution deficits. The client presents the classic picture of contralateral muscle weakness, spasticity, and poor isolation of movement with corresponding loss of function.

Relation to Sensorimotor Intervention Approaches

The CNS structures involved with movement can be grouped functionally into higher, middle, and lower levels. The higher level consists of the limbic system and association areas, where the motivation for action is generated. The sensorimotor areas, along with the basal ganglia and cerebellum, form the middle level, and the lower level consists of the nuclei in the brainstem and spinal cord. Under normal circumstances, an individual's repertoire of motor activity is varied and complex, meeting the unique task and environmental demands. After damage to the CNS regions involved with movement, the coordinated efforts between the various levels of motor control are disrupted, and the motor response may be limited or stereotyped. Traditional sensorimotor approaches to intervention can be viewed as targeting the middle sensorimotor level, the motor planning–strategy formulation process, and the lower level–execution process, with the aim of reintegrating, as far as possible, a complete motor control hierarchy. A motor relearning program (discussed in Chapter 32) should also be cognitively oriented and targeted toward achieving a goal or "occupational" task and include all three levels of CNS function related to motor control. This represents the inherent limitation of the traditional sensorimotor approaches. These approaches do not actively engage the client's volitional intent or motivation to perform a motor act. The limitations of traditional sensorimotor approaches must be carefully considered prior to selecting this form of intervention for the client. The OT practitioner must include activities to foster the **generalizability** of movement patterns to functional and meaningful tasks for clients.

The foundational premise of these traditional sensorimotor approaches posits that clients need to be taught motor strategies or compensatory mechanisms to adapt to the deficits produced by a lesion. Compensatory mechanisms and the shaping of motor programs are brought about by the use of sensory inputs. The sensorimotor approaches use **sensory stimulation** to elicit specific movement patterns. Early in the intervention phase, the emphasis is on the use of external sensory stimuli. Once a movement response is obtained, to reinforce and strengthen the response, the focus shifts to the use of intrinsic sensory information, which thereby encourages voluntary motor control.

The four traditional sensorimotor intervention approaches historically used by occupational therapists (OTs) are the Rood approach, the Brunnstrom (movement therapy) approach, the **proprioceptive neuromuscular facilitation** (PNF) approach, and the Bobath or neurodevelopmental treatment approach. These approaches, developed in the 1950s and 1960s, have their theoretical basis in the reflex and hierarchical models of motor control. Although more contemporary models are currently being used to guide intervention with clients who demonstrate CNS dysfunction, an understanding of these traditional approaches is warranted to appreciate their contributions to clinical practice and to recognize the appropriate application of these approaches in selected populations.

Reflex and Hierarchical Models of Motor Control

Reflex and hierarchical models of motor control view movement strategies along a developmental continuum. Two major fundamental assumptions underlie the reflex and hierarchical models.

The basic units of motor control are reflexes. Reflexes are motor responses that occur in response to specific sensory stimuli. Reflexes are automatic, predictable, and stereotypical; they are normal responses seen from early infancy. As the CNS matures, reflexes become integrated and are believed to form the foundation for volitional motor control. Volitional (purposeful) movement is the summation and integration of reflexive movement. When damage to the CNS occurs, a resurgence of reflexive motor activity occurs in addition to an inability to modulate these reflexive movements.

Motor control is hierarchically arranged. In a hierarchical model of motor control, the CNS is believed to have a specific organizational structure, and motor development and function depend on that structure. This hierarchical organization refers to a system in which the higher centers of the brain regulate and exert control over lower centers of the CNS. The higher centers, specifically the cortical and subcortical areas, are responsible for regulation and control of volitional, conscious movement. The lower levels regulate and control reflexive, automatic, and responsive movement. Based on this conceptualization, when damage occurs to the CNS, it is believed that the damaged area can no longer regulate and exert control over the underlying areas. Motor control, according to this belief, becomes a function of the next lower functioning level of the CNS. Typically this means a return to more reflexive and primitive movement patterns.

The four traditional sensorimotor intervention strategies rely heavily on these basic assumptions about motor development and motor control. Consequently, intervention strategies used in these approaches frequently involve the application of sensory stimulation to muscles and joints to evoke specific motor responses, handling and positioning techniques to effect changes in muscle tone, and the use of developmental postures to enhance the ability to initiate and carry out movements. Table 31.1 presents a comparison and summary of key treatment strategies used in each of the four traditional sensorimotor approaches.

TABLE 31.1

Comparison of Key Treatment Strategies Used in the Traditional Sensorimotor Approaches

Key Treatment Strategies	Rood Approach	Brunnstrom Approach (Movement Therapy)	Proprioceptive Neuromuscular Approach	Neurodevelopmental Treatment
Sensory stimulation used to evoke a motor response	YES (uses direct application of sensory stimuli to muscles and joints)	YES (movement occurs in response to sensory stimuli)	YES (tactile, auditory, and visual sensory stimuli promote motor responses)	YES (abnormal muscle tone occurs, in part because of abnormal sensory experiences)
Reflexive movement used as a precursor for volitional movement	YES (reflexive movement achieved initially through the application of sensory stimuli)	YES (move the patient along a continuum of reflexive to volitional movement patterns)	YES (volitional movements can be assisted by reflexive supported postures)	NO
Treatment directed toward influencing muscle tone	YES (sensory stimuli used to inhibit or facilitate tone)	YES (postures, sensory stimuli used to inhibit or facilitate tone)	YES (movement patterns used to normalize tone)	YES (handling techniques and postures can inhibit or facilitate muscle tone)
Developmental patterns/sequences used for the development of motor skills	YES (ontogenic motor patterns used to develop motor skills)	YES (flexion and extension synergies; proximal to distal return)	YES (patterns used to facilitate proximal to distal motor control)	YES
Conscious attention is directed toward movement	NO	YES	YES	YES
Treatment directly emphasizes the development of skilled movements for task performance	NO	NO	NO	YES

Section 1 Traditional Sensorimotor Intervention Approaches*

Rood Approach

Margaret Rood drew heavily from both the reflex and the hierarchical models in designing her intervention approach.[74-76] Key components of the Rood approach are the use of sensory stimulation to evoke a motor response and the use of developmental postures to promote changes in muscle tone. Sensory stimulation is applied to muscles and joints to elicit a specific motor response. Stimulation has the potential to have either an inhibitory or a facilitatory effect on muscle tone. Rood described various types of sensory stimulation including the use of slow rolling, neutral warmth, deep pressure, tapping, and prolonged **stretch**. Examples of how this stimulation may be applied include tapping over a muscle belly to facilitate (increase) muscle tone and applying deep pressure to a muscle's tendinous insertion to elicit an inhibitory (decreased) effect. Rood also described the use of specific developmental sequences believed to promote motor responses.[75] These sequences were proximal to distal and cephalocaudal. Treatment strategies move clients through these developmental sequences.

In current clinical practice, practitioners may use selected principles from Rood's work as adjunctive or preliminary interventions to prepare an individual to engage in a purposeful activity—for example, the application of quick stretch over the triceps before instructing a client to reach for a cup or glass to improve elbow extension.[86] A client may be instructed in ways to apply his or her own sensory stimulation to enhance activities of daily living (ADLs) performance. For example, during upper extremity dressing, the occupational therapist may ask Carlos to perform a prolonged stretch to the left biceps, which reduces muscle tone, which may, in turn, increase the ease with which the arm is moved through the sleeve of his shirt.

Limitations in the use of Rood's approach are numerous and include the passive nature of the sensory stimulation (it is applied *to* an individual) and the short-lasting and unpredictable effect of some of the sensory stimulation. Please refer to the discussion later in this chapter for additional details regarding the Rood approach to intervention.

Brunnstrom (Movement Therapy) Approach

Signe Brunnstrom, a physical therapist (PT), developed an intervention approach specifically for individuals who had sustained a cerebrovascular accident (CVA).[12,13] The approach she designed draws strongly from both the reflex and hierarchical models of motor control. Brunnstrom conceptualized clients who had sustained a CVA as going through an "evolution in reverse." Spastic or flaccid muscle tone and the presence of reflexive movements that may be evident after a client sustains a CVA are considered part of the normal process of recovery and are viewed as necessary intermediate steps in regaining volitional movement.[80] Brunnstrom clearly detailed stages of motor recovery after a CVA (Table 31.2). These stages include the description of flexor synergy patterns and extensor synergy patterns for the upper and lower limbs and are used as descriptors of change following a CVA.[33] Carlos currently displays flexor tone dominating his left arm and extensor tone dominating his left leg. This dominating tone interferes with isolated control of his left extremities.

TABLE 31.2

Brunnstrom Recovery Stage of Hand Function

Stage	Arm Function (Naghdi et al, 2010, 1373)[68a]	Hand Function (Pandian et al, 2012, 331-332)[69a]
1	Flaccidity is present and no movements of the limbs can be initiated.	Flaccidity.
2	The basic limb synergies or some of their components may appear as associated reactions or minimal voluntary movement responses may be present. Spasticity begins to develop.	Little or no active finger flexion.
3	The patient gains voluntary control of the movement synergies, although full range of all synergy components does not necessarily develop. Spasticity is severe.	Mass grasp; use of hook grasp but no release; no voluntary finger extension; possible reflex extension of digits.
4	Some movement combinations that do not follow the synergies are mastered, and spasticity begins to decline.	Lateral prehension, release by thumb movement; semi-voluntary finger extension of digits, variable range.
5	More difficult movement combinations are possible as the basic limb synergies lose their dominance over motor acts."	Palmar prehension; possibly cylindrical and spherical grasp, awkwardly performed and with a limited functional use; voluntary mass extension of the digits, variable range.
6	"Spasticity disappears and individual joint movements become possible."	All prehensile types under control; skills improving; full range voluntary extension of the digits; individual finger movements present, less accurate than on the opposite side.

Naghdi S, Ansari NN, Mansouri K, et al: A neurophysiological and clinical study of Brunnstrom recovery stages in the upper limb following stroke, *Brain Injury* 24:1372–1378, 2010.

Pandian S, Arya KN, Davidson EW: Comparison of Brunnstrom movement therapy and motor relearning program in rehabilitation of post-stroke hemiparetic hand: A randomized trial, *J Bodywork Movement Ther* 16:330–337, 2012.

In the Brunnstrom approach emphasis is placed on facilitating the progress of the individual by promotion of movement, from reflexive to volitional. In the early stages of recovery this may include the incorporation of reflexes and associated reactions to change tone and achieve movement. For example, to generate reflexive movement in the arm, resistance may be applied to one side of the body to increase muscle tone on the opposite side. This technique is applied until the client demonstrates volitional control over the movement pattern.

Proprioceptive Neuromuscular Facilitation Approach

The PNF approach is grounded in the reflex and hierarchical models of motor control. Developed through the collaborative efforts of a physician, Dr. Herman Kabat, and two PTs, Margaret Knott and Dorothy Voss, in the 1950s, this intervention approach continues to be used but has not been revised since its origins. Major emphasis in this approach is on the developmental sequencing of movement and the balanced interplay between agonist and antagonist in producing volitional movement.[97] PNF describes **mass movement patterns**, which are diagonal in nature, for the limbs and trunk. Intervention strategies use these patterns to promote movement. The use of sensory stimulation, including tactile, auditory, and visual inputs, is also actively incorporated into treatment to promote a motor response.

In OT clinical practice the inclusion of PNF patterns often can be seen in the way functional activities are designed, especially in the placement of objects during purposeful activities. For example, a client is asked to reach into a shopping bag placed on his left side to retrieve objects that will then be placed into a cabinet on the right side. Specific information regarding the application of PNF is discussed later in Section 2. This approach has been successfully used to increase range of motion and to stretch tightened muscles.[82] The application of PNF has also been demonstrated to reduce falls in older adults.[85]

Neurodevelopmental Treatment Approach

Neurodevelopmental treatment (NDT), also known as the Bobath treatment approach, is based on normal development and movement. Berta Bobath, a gymnast who later became a PT, and her husband, Karel Bobath, a physician, provided the initial theoretical foundations of NDT in the 1950s.[38] At that time they drew from the hierarchical model of motor control. The primary objectives of neurodevelopmental treatment are to normalize muscle tone, inhibit primitive reflexes, and facilitate normal postural reactions.[8] Improving the quality of movement and helping clients relearn normal movement patterns are key objectives of this approach. To achieve these objectives, therapists employ numerous techniques, including handling techniques, use of **inhibitory techniques** to diminish the negative impact of spasticity on normal movement, weight bearing over the affected limb, the use of positions that encourage the use of both sides of the body, and the avoidance of any sensory input that may adversely affect muscle tone.[25] In clinical practice today, many of these techniques and strategies are used within the context of purposeful activities.

NDT continues to revise its theoretical framework in response to new evidence on the function of the CNS.[38] Discussions on the rationale for NDT include the current understanding of motor systems and motor learning. See Section 3 for further descriptions.

Section 1 Summary

Movement takes place within an occupational context. Emotional needs influence motor strategies. The spinal cord or brainstem can mediate reflexive responses, but interpretation and transformation of sensory signals by all areas of the sensorimotor system are essential for voluntary movement to occur with precision. The primary somatosensory cortex and posterior parietal cortex are primarily responsible for processing sensory information. The premotor area uses sensory information for the planning of movements, the supplementary motor area is important for bimanual coordination, and the motor cortex is important for execution.

The traditional sensorimotor intervention approaches have their theoretical basis in reflex and hierarchical models of motor control. These approaches offer a valuable link between neurophysiologic principles and the rehabilitation treatment of clients with CNS dysfunction. In contemporary practice many of the techniques described in these approaches are used as adjunctive or preliminary techniques or are incorporated into more task-directed treatment activities.

Section 2 Proprioceptive Neuromuscular Facilitation Approach

Winifred Schultz-Krohn

Threaded Case Study

Leticia, Part 1

Leticia, a 34-year-old married mother of two, was involved in an automobile accident in which she sustained a brain injury and fractures of her left wrist and several ribs. Leticia's injuries left her with diplopia, a rigid posture, and lack of motor control as a result of the ataxia. As a mother, Leticia had always been involved with her children and was a teacher's aide at their grade school. It is important to Leticia that she resume her parenting role, including caring for their home, driving a car, and resuming her work in the classroom. Unfortunately, she fatigues quickly and struggles to engage in the routine daily activities that she used to enjoy with her family. She specifically references her desire to be able to play games with her children, prepare family meals, and tutor children in the third grade class in which she assisted before her accident.

Critical Thinking Questions

1. How do you know which movement patterns to select to help Leticia regain the ability to perform these family- and work-related occupations or tasks?

2. Which PNF techniques will most effectively address Leticia's impairments, and how do you select a PNF technique to facilitate the desired performance of a task?

3. How do you determine the progression of intervention from a PNF perspective?

Based on normal movement and motor development, proprioceptive neuromuscular facilitation is more than a technique; it is a philosophy of intervention. Through the case study of Leticia we will discuss the application of PNF to the evaluation and intervention of occupational therapy. Basic principles, diagonal patterns, and more commonly used techniques will be introduced, and their application and presence in routine daily life skills will be demonstrated. PNF addresses the client factors of posture, mobility, strength, effort, and coordination. To use PNF effectively, it is necessary to understand normal development, learn the motor skills to use the techniques, and apply the concepts and techniques to OT activities.[4] This section should form the basis for further reading and training under the supervision of a therapist experienced in PNF.

PNF is based on normal movement and motor development. In normal motor activity the brain registers total movement and not individual muscle action.[42] Encompassed in the PNF approach are mass movement patterns that are spiral and diagonal in nature and that resemble movement seen in functional activities. In this multisensory approach, facilitation techniques are superimposed on movement patterns and postures through the therapist's **manual contacts**, **verbal commands**, and visual cues. These facilitation techniques and movement patterns can be preparatory methods that prepare clients to participate more effectively in their daily occupations or they can be applied within the performance of a task.

PNF is used as an intervention technique for numerous conditions, including Parkinson's disease, spinal cord injuries, arthritis, stroke, head injuries, and hand injuries. It has been effectively combined with neuromobilization techniques to reduce sensory deficits in individuals who sustained a CVA.[103]

History

PNF originated in the 1940s with Dr. Herman Kabat, a physician and neurophysiologist. He applied neurophysiologic principles, based on the work of Sherrington, to the intervention of paralysis secondary to poliomyelitis and multiple sclerosis. In 1948 Kabat and Henry Kaiser founded the

Kabat-Kaiser Institute in Vallejo, California. Here Kabat worked with PT Margaret Knott to develop the PNF method of intervention. By 1951 the diagonal patterns and core techniques were established. PNF is now used to treat numerous neurologic, musculoskeletal, and general medical conditions.

In 1952 Dorothy Voss, a PT, joined the staff at the Kaiser-Kabat Institute. She and Knott undertook the teaching and supervision of staff therapists. In 1954 Knott and Voss presented the first 2-week course in Vallejo. Two years later, the first edition of *Proprioceptive Neuromuscular Facilitation* by Margaret Knott and Dorothy Voss was published.

During this same period several reports in the *American Journal of Occupational Therapy* described PNF and its application to OT intervention.[4,17,20,45,94,101] It was not until 1974 that the first PNF course for OT practitioners, taught by Dorothy Voss, was offered. Since then, Beverly Myers, an occupational therapist, and others have offered courses for OT practitioners throughout the United States. In 1984 PNF was first taught concurrently to both PTs and OT practitioners at the Rehabilitation Institute in Chicago.[68,97] Today courses are offered throughout the United States as well as Europe, Asia, and South America. Currently, four main theoretical models are used to explain the beneficial effects of PNF to improve motor performance: autogenic inhibition, **reciprocal inhibition**, stress relaxation, and the gate control theory.[36]

Principles of Intervention

Voss presented 11 principles of intervention at the Northwestern University Special Therapeutic Exercise Project in 1966. These principles were developed from concepts in the fields of neurophysiology, motor learning, and motor behavior and are still essential to the practice of PNF today.[95]

All human beings have potentials that have not been fully developed. This philosophy is the underlying basis of PNF. Therefore in evaluation and intervention planning, the client's abilities and potentials are emphasized. For example, the client who has weakness on one side of the body can use the intact side to assist the weaker part. Likewise, the client who has hemiplegia with a flaccid arm can use the intact head, neck, and trunk musculature to begin reinforcement of the weak arm in weight-bearing activities.

Normal motor development proceeds in a cervicocaudal and proximodistal direction. The cervicocaudal and proximodistal direction is followed in evaluation and intervention. When severe disability is present, attention is first given to the head and neck region, with its visual, auditory, and vestibular receptors, and then to the upper trunk and extremities. If the superior region is intact, an effective source of reinforcement for the inferior region is available.[97] The proximodistal direction is followed by developing adequate function in the head, neck, and trunk before developing function in the extremities. This approach is of particular importance in intervention that facilitates fine motor coordination in the upper extremities. Unless adequate control exists in the head, neck, and trunk region, fine motor skills cannot be developed effectively. For example, Leticia needs to strengthen her head, neck, and trunk muscles to regain adequate postural control before she can adequately perform fine motor tasks required in her job such as cutting with scissors. This illustrates how addressing a specific client factor of postural control can influence occupational performance.

Early motor behavior is dominated by reflex activity. Mature motor behavior is supported or reinforced by postural reflexes. As the human being matures, primitive reflexes are integrated and available for reinforcement to allow for progressive development such as that of rolling, crawling, and sitting. Reflexes also have been noted to have an effect on tone changes in the extremities. Hellebrandt, Schade, and Carns[35] studied the effect of the tonic neck reflex (TNR) and the asymmetric tonic neck reflex (ATNR) on changes in tone and movement in the extremities of normal adults. They found that head and neck movement significantly affected arm and leg movement. In applying this finding to intervention, for example, weak elbow extensors can be reinforced with the ATNR by having the client look toward the side of weakness. Likewise, the client can be assisted in assuming postures with the influence of reflex support. For example, Leticia can use the body-on-body righting reflex to support her ability to assume sitting upright on the edge of the bed from a side-lying position when she gets up in the morning.

Early motor behavior is characterized by spontaneous movement, which oscillates between extremes of flexion and extension. These movements are rhythmic and reversing in character. In intervention it is important to attend to both directions of movement. When the OT practitioner is working with the client on getting up from a chair, attention also must be given to sitting back down. Often with an injury, the eccentric contraction (eg, sitting down) is lost and becomes very difficult for the client to regain. If not properly treated, the client may be left with inadequate motor control to sit down smoothly and thus may "drop" into a chair. This eccentric control would be particularly important for Leticia because she is required to sit in low chairs at her children's school. Similarly, in training for ADLs the client must learn how to get undressed and dressed.

Developing motor behavior is expressed in an orderly sequence of total patterns of movement and posture. In the normal infant the sequence of total patterns is demonstrated through the progression of locomotion. The infant learns to roll, to crawl, to creep, and finally to stand and walk. Throughout these stages of locomotion the infant also learns to use the extremities in different patterns and within different postures. Initially the hands are used for reaching and grasping within the most supported postures, such as supine and prone. As postural control develops, the infant begins to use the hands in side-lying, sitting, and standing positions. In intervention, to maximize motor performance, clients should be given opportunities to work in a variety of developmental postures. The use of extremities in total patterns requires interaction with component patterns of the head, neck, and trunk. For example, in swinging a tennis racquet in a forehand stroke, the arm and the head, neck, and trunk move in the direction of the swing. Without the interaction of the distal and proximal components, movement becomes less powerful and less coordinated.

The growth of motor behavior has cyclic trends, as evidenced by shifts between flexor and extensor dominance. The shifts between antagonists help to develop muscle balance and control. One of the main goals of the PNF intervention approach is to establish a balance between antagonists. Developmentally the infant establishes this balance before creeping (ie, when rocking forward [extensor dominant] and backward [flexor dominant] on hands and knees). Postural control and balance must be achieved before movement can begin in this position. In intervention it is important to establish a balance between antagonistic muscles by first observing where imbalance exists and then facilitating the weaker component. For example, if the client who has a stroke demonstrates a flexor synergy (flexor dominant), extension should be facilitated.

Normal motor development has an orderly sequence but lacks a step-by-step quality. Overlapping of skills occurs. The child does not perfect performance of one activity before beginning another, more advanced activity. In trying to ascertain in which total pattern to position the client, normal motor development should be heeded. If one technique or developmental posture is not effective in obtaining the desired result, it may be necessary to try the activity in another developmental posture. For example, if a client who has ataxia, such as Leticia, is unable to perform a fine motor task while sitting, it may be necessary to practice skills in a more supported posture, such as prone on the elbows or with her elbows supported on a surface such as a table. Just as the infant reverts to a more secure posture when attempting a complex fine motor task, the client also needs a secure posture when attempting more challenging tasks. On the other hand, if the client has not perfected a motor activity such as walking on level surfaces, he or she may benefit from attempting a higher-level activity such as walking up or down stairs, which in turn can improve ambulation on level surfaces. It is natural for the client to move up and down the developmental sequence, and this allows multiple and varied opportunities for practicing motor activities. The cognitive demands of the task in relation to the developmental posture also must be considered. When the client's position is varied, either by changing the base of support or by shifting weight on different extremities, the quality of visual and cognitive processing is influenced.[1]

Locomotion depends on reciprocal contraction of flexors and extensors, and the maintenance of posture requires continual adjustment for nuances of imbalance. Antagonistic pairs of movements, reflexes, and muscles and joint motion interact as necessary with the movement or posture. This principle restates one of the main objectives of PNF—to achieve a balance between antagonists. An example of imbalance is the client with a head injury who is unable to maintain adequate sitting balance for a tabletop cognitive activity because of a dominance of trunk extensor tone. Another example is the client who has hemiplegia with tight finger flexors secondary to flexor-dominant tone in the hand. In intervention, emphasis is placed on correcting the imbalances. In the presence of spasticity, first the spasticity is inhibited and then the antagonistic muscles, reflexes, and postures are facilitated.

Improvement in motor ability is dependent on motor learning. Multisensory input from the therapist facilitates the client's motor learning and is an integral part of the PNF approach. For example, the therapist may work with a client on a shoulder flexion activity such as reaching into the cabinet for a cup. The therapist may say, "Reach for the cup," to add verbal input. This approach also encourages the client to look in the direction of the movement to allow vision to enhance the motor response. Thus tactile, auditory, and visual inputs are used. Motor learning has occurred when these external cues are no longer needed for adequate performance.

Frequency of stimulation and repetitive activity are used to promote and retain motor learning and to develop strength and endurance. Just as the therapist who is learning PNF needs the opportunity to practice the techniques, the client needs the opportunity to practice new motor skills. With practice, habits will be formed that support motor performance in occupation. In the process of development, the infant constantly repeats a motor skill in many settings and developmental postures until it is mastered, as becomes apparent to anyone who watches a child learning to walk. Numerous attempts fail, but the child repeats the efforts until the skill is mastered. After the activity is learned, it becomes part of the child. He or she is able to use the activity automatically and deliberately as the occasion demands.[97] The same is true for the person learning to play the piano or to play tennis. Without the opportunity to practice, motor learning cannot successfully occur. Just as Leticia's students may be given homework to help them practice the material they learn in school, Leticia will also need to be given a home program that encourages her to practice the postures and movements facilitated in therapy.

Goal-directed activities coupled with techniques of facilitation are used to hasten learning of total patterns of walking and self-care activities. When facilitation techniques are applied to self-care, the objective is improved functional ability, but improvement is obtained by more than instruction and practice. Deficiencies are corrected by the direct application of manual contacts and techniques to facilitate a desired response.[40] During an intervention session, this approach may mean applying stretch to finger extensors to facilitate the release of an object or providing joint approximation through the shoulders and pelvis of a client who has ataxia to provide stability while the client is standing to wash dishes. With repetition of appropriate facilitation techniques, Leticia will have the opportunity to feel more normal movement and need to rely less on the therapist's external input.

Motor Learning

Motor learning requires a multisensory approach. Auditory, visual, and tactile systems are all used to achieve the desired response. The correct combination of sensory input with each client should be ascertained, implemented, and altered as the client progresses. The developmental level of the client and the ability to cooperate also should be taken into consideration.[97] The approach used with a client who has aphasia differs from the approach used with a client who has a hand injury. For example, the client with a hand injury would better understand verbal instructions than would the client with aphasia. Fewer verbal and more tactile and gestural cues would be appropriate with the client who has aphasia. Similarly, the approach used with a child varies greatly from that used with an adult. Interventions with Leticia must take into consideration her visual deficits in addition to any cognitive impairment that remains as a result of her head injury.

Auditory System

Verbal commands should be brief and clear. It is important to time the command so that it does not come too early or too late in relation to the motor act. Tone of voice may influence the quality of the client's response. Buchwald[14] stated that tones of moderate intensity evoke gamma motor neuron activity and that louder tones can alter alpha motor neuron activity. Strong, sharp commands simulate a stress situation and are used when maximal stimulation of motor response is desired. A soft tone of voice is used to offer reassurance and to encourage a smooth movement, as in the presence of pain (eg, when techniques are used to increase the mobility in Leticia's left wrist). When a client is giving the best effort, a moderate tone can be used.[97]

Another effect of auditory feedback on motor performance was studied by Loomis and Boersma.[54] They used a **verbal mediation** strategy to teach wheelchair safety before transferring out of the chair to clients with right CVA. Loomis and Boersma taught clients to say aloud the steps required to leave the wheelchair safely and independently. They found that only clients who used verbal mediation learned the wheelchair drill sufficiently to perform safe and independent transfers. These clients also had better retention of the sequence of steps, which suggests that verbal mediation is beneficial in reaching independence with better sequencing and fewer errors.

When Leticia first arrived in therapy, she suffered considerable pain at the site of her wrist fracture. Early PNF intervention should use soft verbal commands when activities that involve wrist mobility are performed. In contrast, when facilitating Leticia's ability to assume postures (ie, moving from side-lying to tall kneeling), more forceful, sharp commands may be needed.

Visual System

Visual stimuli assist in initiation and coordination of movement. Visual input should be monitored to ensure that the client is tracking in the direction of movement. For example, the therapist's position is important because the client often uses the therapist's movement or position as a visual cue. If the therapist desires Leticia to move in a forward direction, he or she should be positioned diagonally in front of the client. In addition to the therapist's position, placement of the OT activity also should be considered. Using one of her children's favorite board games, the therapist could place it in front and to the left of Leticia to increase head, neck, and trunk rotation. Because OT is activity oriented, an abundance of visual stimuli is offered to the client.

Special consideration will need to be given to the use of vision when working with Leticia. Her stronger head and neck musculature can be used to reinforce oculomotor control. Total body and extremity diagonal patterns can be used to reinforce eye teaming.

Tactile System

Developmentally the tactile system matures before the auditory and visual systems.[26] Furthermore, the tactile system is more efficient. This is because it has temporal and spatial discrimination abilities, as opposed to the visual system, which can make only spatial discriminations, and the auditory system, which can make only temporal discriminations.[32] Affolter[2] stated that during development, processing of tactile-kinesthetic information can be considered fundamental for building cognitive and emotional experience. Looking at and listening to the world do not result in change; however, the world cannot be touched without some change taking place. A Chinese proverb often cited at PNF courses reinforces this viewpoint: “I listen and I forget, I see and I remember, I do and I understand.”

It is important for the client to feel movement patterns that are coordinated and balanced. This is particularly important for clients with ataxia, such as Leticia. With the PNF approach, tactile input is supplied through the therapist's manual contacts to guide and reinforce the desired response. This approach may involve gently touching the client to guide movement, using stretch to initiate movement, and providing resistance to strengthen movement. The type and extent of manual contacts depend on the client's clinical status, which is determined through evaluation and reevaluation. For example, the use of stretch or resistance in the presence of musculoskeletal instability may be contraindicated, as in the early healing phases of Leticia's fractures. Likewise, stretch or resistance should not be used if they cause increased pain or tone imbalance.

To increase speed and accuracy in motor performance, the client needs the opportunity to practice. Through repetition, habit patterns that occur automatically without voluntary effort are established. The PNF approach uses the concepts of **part-task practice** and **whole-task practice**. In other words, to learn the whole task, emphasis is placed on the parts of the task that the client is unable to perform independently. The term **stepwise procedures** describes the emphasis on a part of the task during performance of the whole.[97] Performance of each part of the task is improved by combining practice with appropriate sensory cues and techniques of facilitation. For example, the client learning to transfer from a wheelchair to a tub bench may have difficulty lifting the leg over the tub rim. This part of the task should be practiced, with repetition and facilitation techniques to the hip flexors, during performance of the transfer. When the transfer becomes smooth and coordinated, it is no longer necessary to practice each part individually. It is also unnecessary for the therapist to facilitate.

Leticia has difficulty getting down on the floor to play games with her children. In intervention, she should be provided with facilitation and practice of moving from sitting on a chair to tall kneeling to side-sitting on the floor. She will initially require considerable manual facilitation by the therapist to move through and achieve these various movement patterns. As she develops more skill, the therapist will reduce and adjust the intensity of the tactile input.

In summation, several components are necessary for motor learning to occur. In the PNF intervention approach, these components include multisensory input from the therapist's verbal commands, visual cues, and manual contacts. Touch is the most efficient form of stimulation and provides the opportunity for the client to feel normal movement. Current motor-learning theory argues that for motor learning to occur, the client cannot be a passive recipient of intervention.

Therefore the client needs opportunities to practice motor skills in the context of functional life situations. Initially the therapist's manual contacts and sensory input are needed. These should be decreased, however, as the client demonstrates and learns skilled movement. The amount of feedback from the therapist should also be decreased as the client learns to rely on his or her own internal feedback system for error detection and correction.

Assessment

Assessment requires astute observational skills and knowledge of normal movement. An initial assessment is completed to determine the client's abilities, deficiencies, and potential. After the intervention plan is established, ongoing assessment is necessary to ascertain the effectiveness of intervention and to make modifications as the client changes.

The PNF assessment follows a sequence from proximal to distal. First, vital and related functions are considered, such as breathing, swallowing, voice production, facial and oral musculature, and visual-ocular control. Any impairment or weakness in these functions is noted. Because Leticia fatigues quickly, breathing patterns and efficiency need to be closely evaluated as she engages in her daily activities.

The head and neck region is observed after vital functions. Deficiencies in this area directly affect the upper trunk and extremities. Head and neck positions are observed in varying postures and total patterns during functional activities. It is important to note (1) dominance of tone (flexor or extensor), (2) alignment (midline or shift to one side), and (3) stability and mobility (more or less needed).[68]

After observation of the head and neck region, the assessment proceeds to the following parts of the body: upper trunk, upper extremities, lower trunk, and lower extremities. Each segment is assessed individually in specific movement patterns, in addition to in developmental activities in which the body segments interact. For example, shoulder flexion can be observed in an individual upper-extremity movement pattern, in addition to during a total developmental pattern such as rolling.

During assessment of developmental activities and postures, the following issues should be addressed:

- Is there a need for more stability or mobility?
- Is there a balance between flexors and extensors, or is one more dominant?
- Is the client able to move in all directions?
- What are the major limitations (eg, weakness, incoordination, spasticity, and contractures)?
- Is the client able to assume a posture and to maintain it? If not, which total pattern or postures are inadequate?
- Are the inadequacies more proximal or distal?
- Which sensory input does the client respond to most effectively: auditory, visual, or tactile?
- Which techniques of facilitation does the client respond to best?

When applying these questions to Leticia's evaluation, the following observations can be made. First, Leticia will need to develop stability to diminish the effects of her ataxia. She is not dominated by either flexor or extensor tone, but when fatigued she has more difficulty maintaining upright posture. She will therefore need to have facilitation of head, neck, and trunk extensors when fatigued. She can move in all directions but has less stability when walking backward. Her major limitations are poor motor control and rigidity, but prevention of a wrist contracture is also a concern. Leticia is having difficulty assuming kneeling, sitting, and standing postures because of her instability. Once in an upright posture, she can maintain it for a few minutes, but then fatigue sets in. She will therefore need to build endurance in more supported lower developmental postures. When moving into more upright postures, she will need PNF techniques to build strength and endurance. Her inadequate proximal control and trunk rigidity impact her ability to effectively use her extremities, especially in higher developmental positions. Visual sensory input may not be the best to start with because of her diplopia; however, facilitation of oculomotor control using PNF techniques will be of benefit as she progresses. Facilitation techniques that Leticia responds to best are rhythmic stabilization, stabilizing reversals, and approximation.

Finally the client is observed during self-care and other ADLs to determine whether performance of individual and total patterns is adequate within the context of a functional activity. The client's performance may vary from one setting to another. After the client leaves the structured setting of the OT or PT clinic for the less structured home or community environment, deterioration of motor performance is not unusual. Thus the intervention plan must accommodate the practice of motor performance in a variety of settings in locations appropriate to the specific activity.

Intervention Implementation

After assessment, an intervention plan is developed that includes goals the client hopes to accomplish. The techniques and procedures that have the most favorable influence on movement and posture are used. Similarly, appropriate total patterns (developmental postures) and patterns of facilitation are selected to enhance performance.

Diagonal Patterns

The **diagonal patterns** used in the PNF approach are mass movement patterns observed in most functional activities. Part of the challenge in OT assessment and intervention is recognizing the diagonal patterns in ADLs. Knowledge of the diagonals is necessary for identifying areas of deficiency. Two diagonal motions are present for each major part of the body: head and neck, upper and lower trunk, and extremities. Each diagonal pattern has a flexion and extension component, together with rotation and movement away from or toward the midline.

The head, neck, and trunk patterns are referred to as (1) flexion with rotation to the right or left and (2) extension with rotation to the right or left. These proximal patterns combine with the extremity diagonals. The upper and lower extremity diagonals are described according to the three movement components at the shoulder and hip: (1) flexion and extension, (2) abduction and adduction, and (3) external and internal rotation. Voss[95] introduced shorter descriptions for the extremity patterns in 1967 and referred to them as diagonal 1 (D_1) flexion/extension and diagonal 2 (D_2) flexion/extension. The reference points for flexion and extension are the shoulder and hip joints of the upper and lower extremities, respectively.

The movements associated with each diagonal and examples of these patterns seen in self-care and other ADLs are presented in the following sections. Note that in functional activities, not all components of the pattern or full range of motion (ROM) are necessarily seen. Furthermore, the diagonals interact during functional movement, changing from one pattern or combination to another, when they cross the transverse and sagittal planes of the body.[67]

Unilateral Patterns

Various **unilateral patterns** can be applied:

1. Upper extremity (UE) D_1 flexion (shoulder flexion-adduction-external rotation): scapula elevation, abduction, and rotation; shoulder flexion, adduction, and external rotation; elbow in flexion or extension; forearm supination; wrist flexion to the radial side; finger flexion and adduction; thumb adduction (Fig. 31.4, A). Examples in functional activity: hand-to-mouth motion in feeding, tennis forehand, combing hair on the left side of the head with right hand (Fig. 31.5, A), rolling from supine to prone.

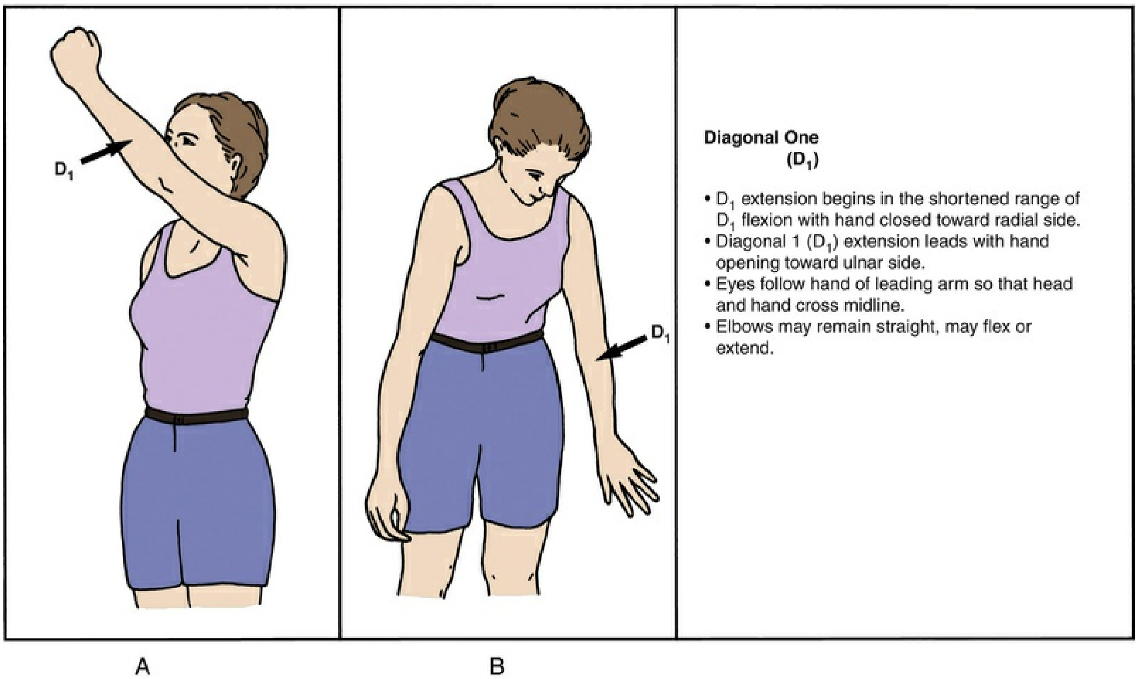


FIG. 31.4 **A,** Upper extremity D_1 flexion pattern. **B,** Upper extremity D_1 extension pattern. (From Myers BJ: Unit I: *PNF diagonal patterns and their application to functional activities, videotape study guide,* Chicago, 1982, Rehabilitation Institute of Chicago.)

FIG. 31.5 **A,** Upper extremity D_1 flexion pattern used to comb the hair, opposite side. **B,** Upper extremity D_1 extension pattern used to push a car door open. (*A,* From iStock.com.)

2. UE D_1 extension (shoulder extension-abduction-internal rotation): scapula depression, adduction, and rotation; shoulder extension, abduction, and internal rotation; elbow in flexion or extension; forearm pronation; wrist extension to the ulnar side; finger extension and abduction; thumb in palmar abduction (Fig. 31.4, B). Examples in functional activity: pushing a car door open from the inside (Fig. 31.5, B), tennis backhand stroke, rolling from prone to supine.

3. UE D_2 flexion (shoulder flexion-abduction-external rotation): scapula elevation, adduction, and rotation; shoulder flexion, abduction, and external rotation; elbow in flexion or extension; forearm supination; wrist extension to the radial side; finger extension and abduction; thumb extension (Fig. 31.6, A). Examples in functional activity: combing hair on the right side of the head with the right hand (Fig. 31.7, A), lifting a racquet in tennis serve, backstroke in swimming. The D_2 flexion pattern would be emphasized with Leticia in her left upper extremity to facilitate supination and wrist extension, which are weak secondary to her wrist fracture.

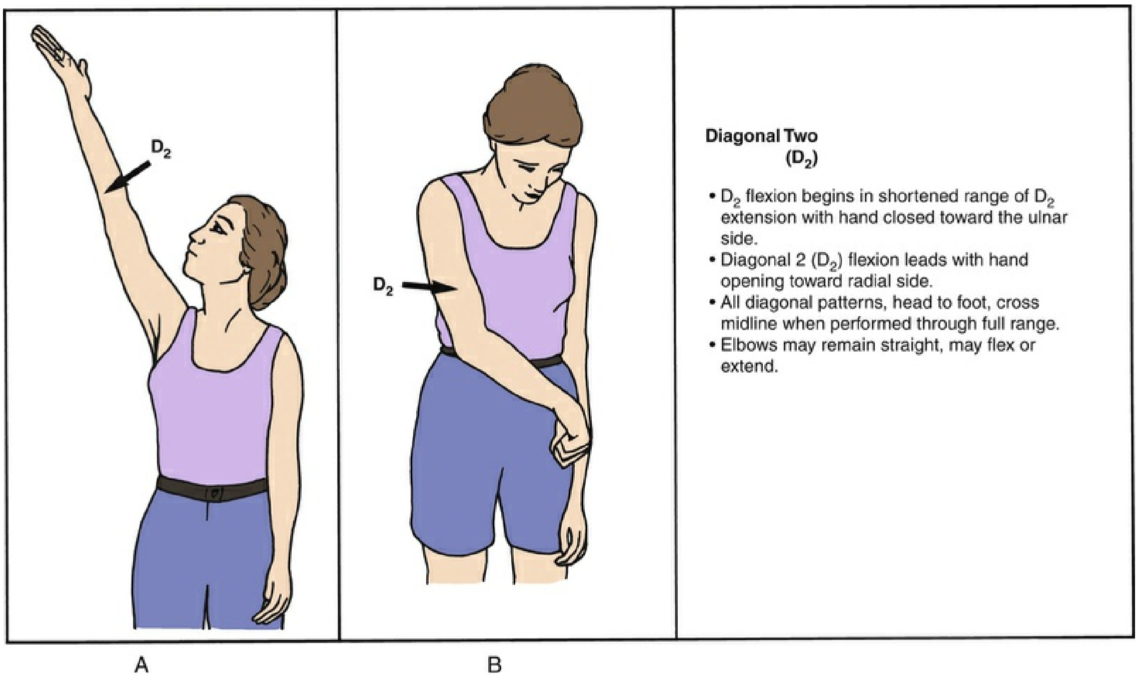


FIG. 31.6 **A,** Upper extremity D_2 flexion pattern. **B,** Upper extremity D_2 extension pattern. (From Myers BJ: Unit I: *PNF diagonal patterns and their application to functional activities, videotape study guide,* Chicago, 1982, Rehabilitation Institute of Chicago.)

FIG. 31.7 **A** and **B,** Upper extremity D_2 flexion pattern used to comb the hair, same side. **C,** Upper extremity D_2 extension pattern used to button trousers, opposite side. (*A*, From iStock.com. *B*, From Shutterstock.com.)

4. UE D_2 extension (shoulder extension-adduction-internal rotation): scapula depression, abduction, and rotation; shoulder extension, adduction, and internal rotation; elbow in flexion or extension; forearm pronation; wrist flexion to the ulnar side; finger flexion and adduction; thumb opposition (Fig. 31.6, B). Examples in functional activity: pitching a baseball, hitting a ball in tennis serve, buttoning pants on the left side with the right hand (Fig. 31.7, C). The rotational component in lower extremity (LE) D_1 flexion and extension parallels the UE patterns.

5. LE D_1 flexion (hip flexion-adduction-external rotation): hip flexion, adduction, and external rotation; knee in flexion or extension; ankle and foot dorsiflexion with inversion and toe extension. Examples in functional activity: kicking a soccer ball, rolling from supine to prone, putting on a sock with legs crossed (Fig. 31.8, A).

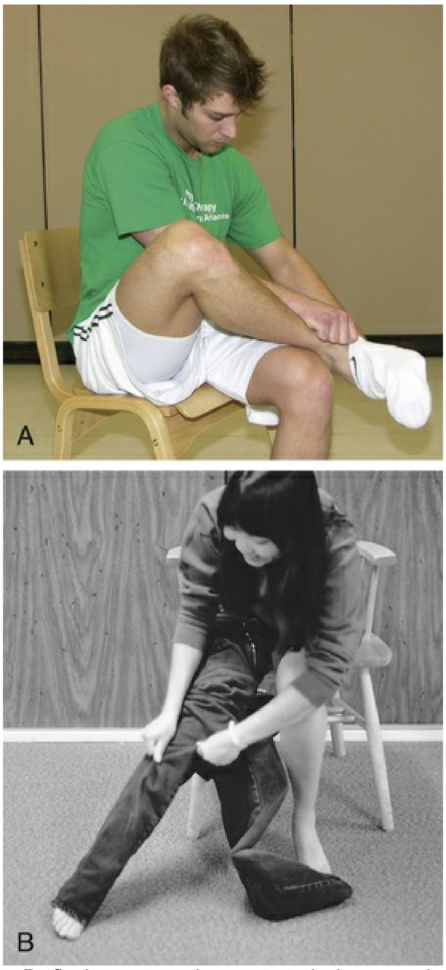


FIG. 31.8 **A,** Lower extremity D_1 flexion pattern demonstrated when crossing the leg to put on a sock. **B,** Lower extremity D_1 extension pattern used when pulling on trousers. (*A,* From Reese NB, Bandy WD: *Joint range of motion and muscle length testing,* ed 3, St. Louis, 2017, Elsevier.)

6. LE D_1 extension (hip extension-abduction-internal rotation): hip extension, abduction, and internal rotation; knee in flexion or extension; ankle and foot plantar flexion with eversion and toe flexion. Examples in functional activity: putting leg into pants (Fig. 31.8, B), rolling from prone to supine. The rotational component of LE D_2 flexion and extension is opposite to the UE patterns.

7. LE D_2 flexion (hip flexion-abduction-internal rotation): hip flexion, abduction, and internal rotation; knee in flexion or extension; ankle and foot dorsiflexion with eversion and toe extension. Examples in functional activity: karate kick (Fig. 31.9, A), drawing the heels up during the breaststroke in swimming.

FIG. 31.9 **A,** Lower extremity D_2 flexion pattern shown in a karate kick. **B,** Lower extremity D_2 extension pattern used in long sitting with the legs crossed. (*A,* From Shutterstock.com. *B,* From DAJ [via Thinkstock.com].)

8. LE D_2 extension (hip extension-adduction-external rotation): hip extension, adduction and external rotation: knee in flexion or extension; ankle and foot in plantar flexion with inversion and toe flexion. Examples of functional activity: push-off in gait, the kick during the breaststroke in swimming, long sitting with legs crossed (Fig. 31.9, B).

Bilateral Patterns

Movements in the extremities may be reinforced by combining diagonals in **bilateral patterns** as follows:

1. **Symmetric patterns**: Paired extremities perform similar movements at the same time (Fig. 31.10, A). Examples: bilateral symmetric D_1 extension, such as pushing off a chair to stand (Fig. 31.11, A); bilateral symmetric D_2 extension, such as starting to take off a pullover sweater (Fig. 31.11, B); bilateral symmetric D_2 flexion, such as reaching to lift a large item off a high shelf (Fig. 31.11, C). Bilateral symmetric UE patterns facilitate trunk flexion and extension.

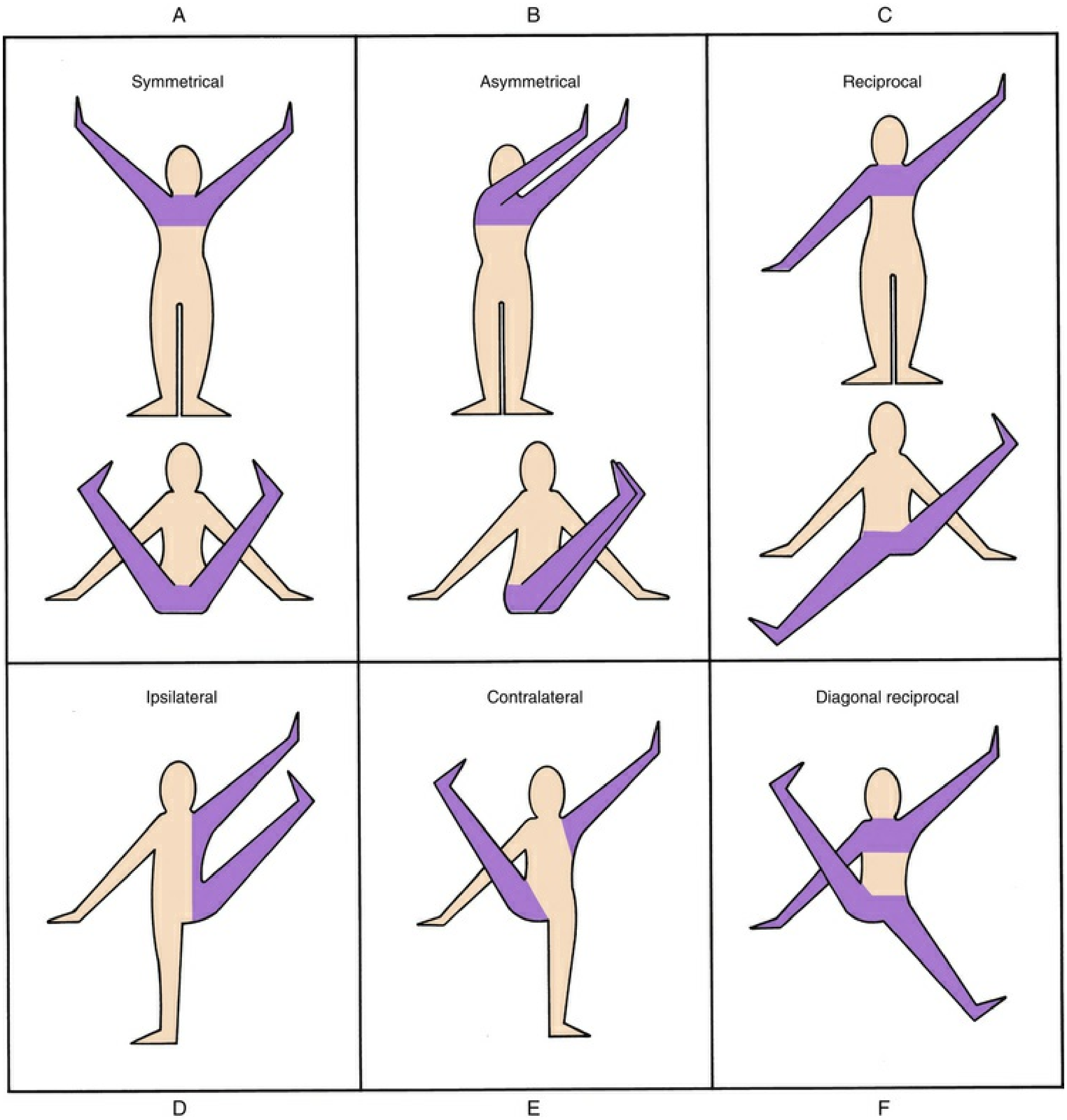


FIG. 31.10 **A,** Symmetric patterns. **B,** Asymmetric patterns. **C,** Reciprocal patterns. **D,** Ipsilateral pattern. **E,** Contralateral pattern. **F,** Diagonal reciprocal pattern. (From Myers BJ: Unit I: *PNF diagonal patterns and their application to functional activities, videotape study guide,* Chicago, 1982, Rehabilitation Institute of Chicago.)

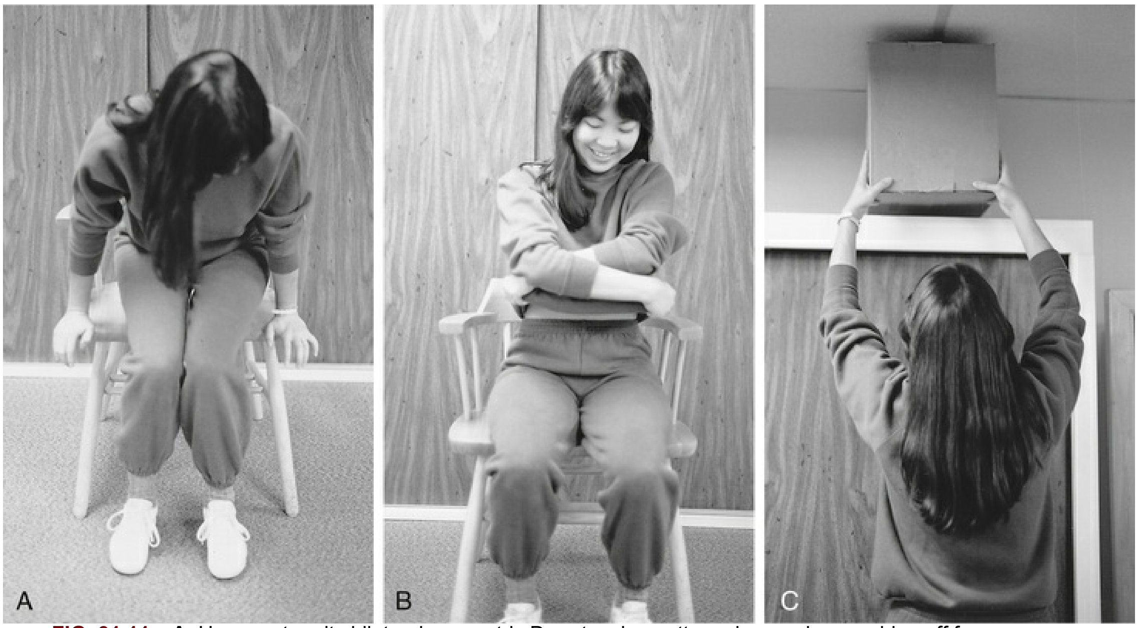
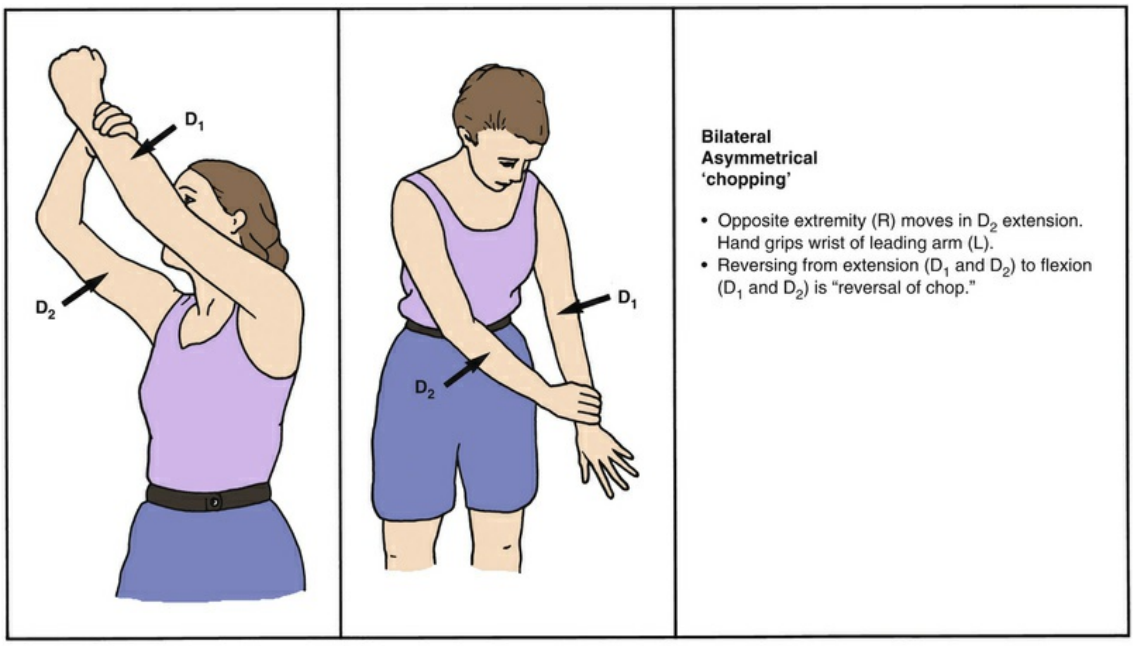


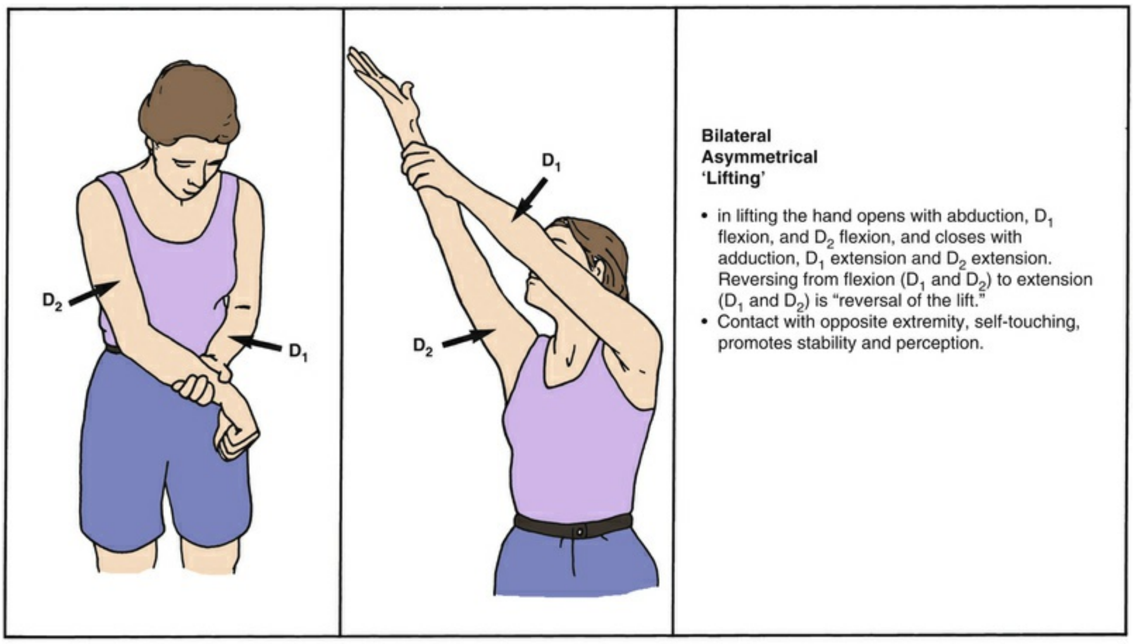
FIG. 31.11 **A,** Upper extremity bilateral symmetric D_1 extension pattern shown when pushing off from a chair. **B,** Upper extremity bilateral symmetric D_2 extension pattern used when starting to take off a pullover shirt. **C,** Upper extremity bilateral symmetric D_2 flexion pattern used when reaching to lift a box off a high shelf.

2. **Asymmetric patterns**: Paired extremities perform movements toward one side of the body at the same time, which facilitates trunk rotation (Fig. 31.10, B). The asymmetric patterns can be performed with the arms in contact, such as in the chopping and lifting patterns in which greater trunk rotation is seen (Figs. 31.12 and 31.13). Furthermore, with the arms in contact, self-touching occurs. This is frequently observed in the presence of pain or in reinforcement of a motion when greater control or power is needed.[97] This phenomenon is observed in the baseball player at bat and in the tennis player who uses a two-handed backhand to increase control and power. Asymmetric patterns with arms in contact would be beneficial for Leticia to control ataxia. Examples of asymmetric patterns are bilateral asymmetric flexion to the left, with the left arm in D_2 flexion and the right arm in D_1 flexion, such as when putting on a left earring (Fig. 31.14), and bilateral asymmetric extension to the left, with the right arm in D_2 extension and the left arm in D_1 extension, such as when zipping a left-side zipper.



A B

FIG. 31.12 Bilateral asymmetric chopping. (From Myers BJ: Unit I: *PNF diagonal patterns and their application to functional activities, videotape study guide,* Chicago, 1982, Rehabilitation Institute of Chicago.)



A B

FIG. 31.13 Bilateral asymmetric lifting. (From Myers BJ: Unit I: *PNF diagonal patterns and their application to functional activities, videotape study guide,* Chicago, 1982, Rehabilitation Institute of Chicago.)

FIG. 31.14 Putting on an earring requires use of the upper extremity bilateral asymmetric flexion pattern. (*Left*, From iStock.com. *Right*, From Jupiterimages [via Thinkstock.com].)

3. **Reciprocal patterns**: Paired extremities move in opposite directions simultaneously, either in the same diagonal or in combined diagonals. If paired extremities perform movements in combined diagonals (Fig. 31.10, C), a stabilizing effect occurs on the head, neck, and trunk because movement of the extremities is in the opposite direction while head and neck remain in midline. During activities requiring high-level balance, the reciprocal patterns with combined diagonals come into play with one extremity in D_1 extension and the other extremity in D_2 flexion. Examples of this are pitching in baseball, sidestroke in swimming, and walking on a narrow walkway with one extremity in a diagonal flexion pattern with the other in a diagonal extension pattern (see Fig. 31.15). In contrast, reciprocal patterns in the same diagonal, such as D_1 in arm swing during walking, facilitate trunk rotation. Leticia needs to work with reciprocals of D_1 to improve rhythm of arm swing and trunk rotation during walking.

FIG. 31.15 A bilateral reciprocal pattern of the upper extremities is used to maintain balance when walking on a narrow walkway. (From Jupiterimages [via Thinkstock.com].)

Combined Movements of Upper and Lower Extremities

Interaction of the upper and lower extremities results in (1) ipsilateral patterns, with extremities of the same side moving in the same direction at the same time; (2) contralateral patterns, with extremities of opposite sides moving in the same direction at the same time; and (3) diagonal reciprocal patterns, with contralateral extremities moving in the same direction at the same time while opposite contralateral extremities move in the opposite direction (Fig. 31.10, D, E, and F).

The **combined movements** of the upper and lower extremities are observed in activities such as crawling and walking. Awareness of these patterns is important in the assessment of the client's motor skills. The ipsilateral patterns are more primitive developmentally and indicate a lack of bilateral integration. Less rotation also is observed in ipsilateral patterns. Therefore the goal in intervention is to progress from ipsilateral to contralateral to diagonal reciprocal patterns.

Several advantages exist to the use of the diagonal patterns in intervention. First, crossing of midline occurs. This movement is of particular importance in the remediation of perceptual motor deficits such as unilateral neglect, in which integration of both sides of the body and awareness of the neglected side are intervention goals. Second, each muscle has an optimal pattern in which it functions. For example, the client who has weak thumb opposition benefits from active movement in D_2 extension. Similarly, D_1 extension is the optimal pattern for ulnar wrist extension. Leticia should work in D_2 flexion after her Colles wrist fracture is stable. This pattern will increase range of motion and strengthen supination and radial wrist extension. Third, the diagonal patterns use groups of muscles, which is typical of movement seen in functional activities. For example, in eating, the hand-to-mouth action is accomplished in one mass movement pattern (D_1 flexion) that uses several muscles simultaneously. Therefore movement in the diagonals is more efficient than movement performed at each joint separately. Finally, rotation is always a component in the diagonals (eg, trunk rotation to the left or right and forearm pronation and supination). With an injury or with the aging process, rotation frequently is impaired and can be facilitated with movement in the diagonals. In intervention, attention should be given to the placement of activities so that movement occurs in the diagonal. For example, if the client is working on a wood-sanding project, trunk rotation with extension can be facilitated by placing the project on an inclined plane in a diagonal. Leticia can incorporate rotational movements into homemaking activities such as unloading the dishwasher.

Total Patterns

In PNF, developmental postures also are called total patterns of movement and posture.[66] Total patterns require interaction between proximal (head, neck, and trunk) and distal (extremity) components. The assumption of postures is important, as is the maintenance of postures. When posture cannot be sustained, emphasis should be placed on the assumption of posture.[96] For example, before the client can be expected to sustain a sitting posture, he or she must be able to perform lower developmental total patterns of movement, such as rolling and moving from side-lying to side-sitting.

The active assumption of postures can be included in OT activities. For example, a reaching and placing activity could be set up so that the client must reach for the object in the supine posture and place it in the side-lying posture. The use of total patterns also can reinforce individual extremity movements. For example, in an activity such as wiping a tabletop, wrist extension is reinforced when the client leans forward over the supporting arm. This would be a way to make homemaking activities part of Leticia's home exercise program for her wrist in the later stages of recovery.

Several facts support the use of total patterns in the PNF intervention approach.[66] First, total patterns of movement and posture are experienced as part of the normal developmental process in all human beings. Therefore recapitulation of these postures is meaningful to the client and acquired with less difficulty. Second, movement in and out of total patterns and the ability to sustain postures enhance components of normal development, such as reflex integration and support, balance between antagonists, and development of motor control in a cephalocaudal, proximodistal direction. Third, the use of total patterns improves the ability to assume and maintain postures, which is important in all areas of occupation.

Voss developed the sequence and procedures for assisting clients with developmental postures. In 1981 Myers developed a videotape that shows the use of the sequence and procedures in OT.[66] This video demonstrates more information on the application of the total patterns and postures to OT.

Procedures

PNF techniques are superimposed on movement and posture. Among these techniques are basic procedures considered essential to the PNF approach. Two procedures, verbal commands and visual cues, were discussed previously. Other procedures are described in the following sections.

Manual contacts refer to the placement of the therapist's hands on the client. These contacts are most effective when applied directly to the skin. Pressure from the therapist's touch is used as a facilitating mechanism and serves as a sensory cue to help the client understand the direction of the anticipated movement.[97] The amount of pressure applied depends on the specific technique being used and on the desired response. The location of manual contacts is chosen according to the groups of muscles, tendons, and joints responsible for the desired movement patterns. If the client is having difficulty reaching to comb the back of the hair because of scapular weakness, the desired movement pattern is D_2 flexion. Manual contacts should be on the posterior surface of the scapula to reinforce the muscles that elevate, adduct, and rotate the scapula.

Stretch is used to initiate voluntary movement and enhance speed of response and strength in weak muscles. This procedure is based on Sherrington's neurophysiologic principle of reciprocal innervation.[84] When a muscle is stretched, the Ia and II fibers in the muscle spindle send excitatory messages to the alpha motor neurons, which innervate the stretched muscle. Inhibitory messages are sent to the antagonistic muscle simultaneously.[26]

When stretch is used in the PNF approach, the part to be facilitated is placed in the extreme lengthened range of the desired pattern (or where tension is felt on all muscle components of a given pattern). This range is the completely shortened range of the antagonistic pattern. Special attention is given to the rotatory component of the pattern because it is responsible for elongation of the fibers of the muscles in a given pattern. After the correct position for the stretch stimulus has been achieved, stretch is superimposed on the pattern. The client should attempt the movement at the exact time that the stretch reflex is elicited. The use of verbal commands also should coincide with the application of stretch, to reinforce the movement. Discrimination should be exercised with the use of stretch to prevent an increase in pain or muscle imbalances.

Traction facilitates the joint receptors by creating a separation of the joint surfaces. It is thought that traction promotes movement and is used for pulling motion.[97] In activities such as carrying a heavy suitcase or pulling open a jammed door, traction can be felt on joint surfaces. Although traction may be contraindicated for clients with acute symptoms, such as after surgery or a fracture, it can sometimes relieve pain and promote greater ROM in painful joints.

Approximation facilitates joint receptors by compressing joint surfaces. It promotes stability and postural control and is used for pushing motion.[97] Approximation is usually superimposed on a weight-bearing posture. For example, to enhance postural control in the prone-on-elbows posture, approximation may be given through the shoulders in a downward direction. As part of a home program to enhance proximal stability, Leticia could play board games on the floor with her children in weight-bearing positions such as prone on elbows or side-sitting. A weighted vest could be used in place of the therapist's manual contacts to provide approximation.

Maximal resistance involves Sherrington's principle of irradiation—namely, that stronger muscles and patterns reinforce weaker components.[84] This procedure is frequently misunderstood and applied incorrectly. It is defined as the greatest amount of resistance that can be applied to an active contraction while allowing full ROM to occur, or to an isometric contraction without defeating or breaking the client's hold.[97] Maximal resistance is not the greatest amount of resistance that the therapist can apply. The objective is to obtain maximal effort on the part of the client because strength is increased by movement against resistance that requires maximal effort.[34]

If the resistance applied by the therapist results in uncoordinated or jerky movement or if it breaks the client's hold, too much resistance has been given. Movement against maximal resistance should be slow and smooth. To use this technique effectively, the therapist must sense the appropriate amount of resistance. For clients with neurologic impairment or pain, the resistance may be very light, and light resistance is probably maximal for the client's needs. The therapist's manual contacts may offer light resistance that actually assists by providing the client with a way to track the desired movement. In the presence of spasticity, resistance may increase existing muscle imbalance and thus needs to be monitored. For example, if an increase in finger flexor spasticity is noted with resisted rocking in the hands-knees position, resistance should be decreased or eliminated or an alternate position should be used.

Techniques

Specific techniques are used in conjunction with these basic procedures. A few have been selected for discussion. These techniques are divided into three categories: those directed to the agonists, those that are a reversal of the antagonists, and those that promote relaxation.[97]

Techniques Directed to the Agonist

Repeated contractions is a technique based on the assumption that repetition of an activity is necessary for motor learning and helps develop strength, ROM, and endurance. The client's voluntary movement is facilitated with stretch and resistance, using isometric and isotonic contractions. This is also referred to as the **contract-relax** (CR) method where the targeted muscles for lengthening are contracted by the client against resistance for a short period of time.[36] Following the contraction against a stable resistance (isometric contractions), stretch is gently applied to lengthen the targeted muscle. The process of repeatedly contracting against a force and then relaxing and stretching has been effective in increasing muscle length. Repeated contractions could be used to increase trunk flexion with rotation in the client who has difficulty reaching to put on a pair of shoes from the sitting position. The client bends forward as far as possible. At the point where active motion weakens, the client is asked to hold with an isometric contraction. This action is followed by isotonic contractions, facilitated by stretch, as the client is asked to “reach toward your feet.” This sequence is repeated either until fatigue is evident or until the client is able to reach the feet. The pattern can be reinforced further by asking the client to hold with another isometric contraction at the end of the sequence.

The use of PNF with older adults residing in assisted-living settings has been investigated.[48] Residents were provided with a 10-week training period using PNF to improve sit-to-stand, shoulder, and ankle range of motion and strength. Using repeated measures analysis of variance (ANOVA), statistically significant improvements were noted in all mentioned areas. The skills allowed individuals to engage in instrumental activities of daily living (IADLs) with improved postural control.

Elderly clients who had sustained falls were provided with training using PNF.[85] When compared to older adults who were provided only with general exercise, the older adults who had PNF training had statistically significant improvements in various measures related to fall prevention. Authors concluded that PNF training was beneficial in enhancing physical conditioning of older adults who had experienced falls.

Rhythmic initiation is used to improve the ability to initiate movement, which may be a problem with clients who have Parkinson's disease or apraxia. This technique involves voluntary relaxation, passive movement of the extremity by the therapist, and repeated isotonic contractions of the agonistic pattern. The verbal command is, "Relax and let me move you." As relaxation is felt, the command is, "Now you do it with me." After several repetitions of active movement, resistance may be given to reinforce the movement. Rhythmic initiation allows the client to feel the pattern before beginning active movement. Thus the proprioceptive and kinesthetic senses are enhanced. This rhythmic initiation was used with clients who had chronic strokes to enhance controlled movements.[98] When compared to healthy adults, the use of PNF effectively reduced the muscle stiffness noted in individuals who have chronic stroke. The muscle stiffness contributes to increased effort when attempting to move and compromises functional skills.

Reversal of Antagonist Techniques

Reversal of antagonist techniques employ a characteristic of normal development—namely, that movement is reversing and changes direction. These techniques are based on Sherrington's principle of successive induction, according to which the stronger antagonist facilitates the weaker agonist.[84] The agonist is facilitated through resistance to the antagonist. The contraction of the antagonist can be isotonic, isometric, or a combination of the two. The most common approach is the contract-relax-antagonist-contract (CRAC) method.[36] The contract-relax is the same as previously described, but then the method includes contracting the antagonist against a stable resistance. These techniques may be contraindicated for clients in whom resistance of antagonists increases symptoms such as pain and spasticity. For example, the facilitation of finger extension (agonist) would not be achieved effectively through resistance applied to spastic finger flexors (antagonist). In this situation, finger extension may be better facilitated through the use of repeated contractions, in which the emphasis is only on the extensor surface.

Slow reversal is an isotonic contraction (against resistance) of the antagonist followed by an isotonic contraction (against resistance) of the agonist. Slow reversal-hold is the same sequence, with an isometric contraction at the end of the range. For the client who has difficulty reaching his or her mouth for oral hygiene because of weakness in the D_1 flexion pattern, the slow reversal procedure is as follows: an isotonic contraction against resistance in D_1 extension with the verbal command "Push down and out," followed by an isotonic contraction of D_1 flexion against resistance with the verbal command "Pull up and across." An increase or buildup of power in the agonist should be felt with each successive isotonic contraction. Slow reversal used in conjunction with repeated contractions could be applied to trunk movement patterns to help Leticia overcome her rigidity and improve the balance of antagonists. This sequence of techniques could also be used to increase Leticia's wrist range of motion and strength once her fracture is stable.

Stabilizing reversals are characterized by alternating isotonic contractions opposed by enough resistance to prevent motion. In practice, the therapist gives resistance to the client in one direction while asking the client to oppose the force, allowing no motion. Once the client is fully resisting the force, the therapist gradually moves the resistance in another direction. Each time the client is able to respond to the new resistance, the therapist moves the hand to resist a new direction, reversing directions as often as needed to achieve the client's stability. This technique is used to increase stability, balance, and muscle strength.

Rhythmic stabilization is used to increase stability by eliciting simultaneous isometric contractions of antagonistic muscle groups. **Co-contraction** results if the client is not allowed to relax. This technique requires repeated isometric contractions, leading to increased circulation or the tendency for the client to hold his or her breath, or both. Therefore rhythmic stabilization may be contraindicated for clients with cardiac involvement, and no more than three or four repetitions should be done at a time on any clients.

In rhythmic stabilization, manual contacts are applied on both agonist and antagonist muscles, with resistance given simultaneously. The client is asked to hold the contraction against graded resistance. Without allowing the client to relax, manual contacts are switched to opposite surfaces.

Rhythmic stabilization is useful with clients lacking postural control because of ataxia or proximal weakness. Used intermittently during an activity requiring postural stability, such as meal preparation in standing posture, this technique enhances muscle balance, endurance, and control of movement. Rhythmic stabilization techniques were found to be effective in improving postural control and reducing pain for individuals who had chronic low back pain.[49]

Because these two stabilizing techniques can be superimposed on activity-based movements, they could be used to facilitate Leticia's ability to perform numerous daily activities. For example, rhythmic stabilization could be used to improve trunk endurance and stability when Leticia experiences fatigue while standing at the sink to do the dishes.

Relaxation Techniques

Relaxation techniques are an effective means of increasing ROM, particularly in the presence of pain or spasticity, which may be increased by passive stretch.

Contract-relax involves passive motion to the point of limitation in movement patterns. This is followed by an isotonic contraction of the antagonist pattern against maximal resistance, with only the rotational component of the diagonal movement allowed. This action is followed by relaxation, then by further passive movement into the agonistic pattern (eg, contract-relax could involve passive motion to the point of limitation in D_2 flexion, which would be followed by an isotonic contraction of D_2 extension, then by further passive movement into D_2 flexion). This procedure is repeated at each point in the ROM in which limitation is felt to occur.[97] Contract-relax is used when no active range in the agonistic pattern is present. However, the ultimate goal is active movement through the full range. Therefore once relaxation and increased ROM occur, active movement should be facilitated. The contract-relax (CR) technique has been demonstrated as an effective means to gain ROM when compared to passive stretch but the mechanism underlying this technique is not clear.[65]

Hold-relax is performed in the same sequence as contract-relax but involves an isometric contraction (no movement allowed) of the antagonist, followed by relaxation and then active movement into the agonistic pattern. It has been recommended that the static contraction be held for 3 seconds to achieve the greatest improvement in ROM.[82] Because this technique involves an isometric contraction against resistance, it is particularly beneficial in the presence of pain or acute orthopedic conditions. For the client with reflex sympathetic dystrophy (RSD) who has pain with shoulder flexion, abduction, and external rotation, the therapist asks the client to hold against resistance in the D_2 extension pattern, then to initiate active movement into the D_2 flexion pattern. This technique is beneficial for the client with RSD during self-care activities such as shampooing hair and zipping a shirt in back.

Slow reversal-hold-relax begins with an isotonic contraction, followed by an isometric contraction, relaxation of the antagonistic pattern, and then by active movement of the agonistic pattern. When the client has the ability to move the agonist actively, this technique is preferred. For example, to increase active elbow extension in the presence of tight elbow flexors, the therapist asks the client to perform D_1 flexion with elbow flexion as resistance is applied. When the ROM is complete, the client is asked to hold with an isometric contraction, followed immediately by relaxation. When the client relaxes, he or she moves actively into D_1 extension with elbow extension. This technique helps increase elbow extension for such activities as reaching to lock the wheelchair brakes or picking up an object off the floor.

Rhythmic rotation is effective in decreasing spasticity and increasing ROM. The therapist passively moves the body part in the desired pattern. When the client feels tightness or restriction of movement, the therapist rotates the body part slowly and rhythmically in both directions. After the client relaxes, the therapist continues to move the body part into the newly available range. This technique prepares the paraplegic client with LE spasticity or clonus to put on a pair of pants. The technique is also effective in preparing for splint fabrication on a spastic extremity.

Threaded Case Study

Leticia, Part 2

To respond to the initial three questions at the beginning of this section, we need to review our assessment of Leticia. To determine the most effective movement patterns, we need to observe Leticia in her daily tasks, in addition to her performance of specific diagonal patterns and total patterns of movement. Techniques and procedures that best address Leticia's key deficits in motor control and rigidity should be selected. In addition to a focus on these key areas, special attention should be given to whether more mobility or stability is needed. Trunk ataxia would respond best to stabilizing techniques such as rhythmic stabilization, stabilizing reversals, and approximation. Rigidity would need mobilizing techniques such as slow reversal, slow reversal–hold, and repeated contractions. These techniques can be applied to clients during occupation-based activity.

The progression of intervention begins at the time of evaluation and considers the client's abilities as well as deficiencies. In Leticia's case, intervention will need to follow PNF principles. Intervention should initially address proximal control and start in lower developmental positions where she has the ability to perform coordinated movement. Once she has achieved more proximal stability, intervention can progress to work in higher developmental postures such as standing. Integrated into this progression of movement patterns and techniques are selected procedures that facilitate the desired motor response or activity performance.

Section 2 Summary

The PNF approach emphasizes the client's abilities and potential so that strengths assist weaker components. Strengths and deficiencies are assessed and addressed in intervention within total patterns of movement and posture. Carefully selected techniques are superimposed on these total patterns to enhance motor response and facilitate motor learning.

PNF uses multisensory input. The coordination and timing of sensory input are important in eliciting the desired response from the client. The client's performance should be monitored, and sensory input should be adjusted accordingly.

To use PNF effectively, the therapist must understand the developmental sequence and the components of normal movement. The therapist must learn the diagonal patterns and how they are used in ADL, must know when and how to use the techniques of facilitation and relaxation, and must be able to apply patterns and techniques of facilitation to OT evaluation and intervention. Attaining these skills requires observation and practice under the supervision of a therapist experienced in the PNF approach.

Case Study

Sophia

Sophia, a 50-year-old woman, was referred for occupational therapy services after a right CVA resulting in left hemiplegia. Before the CVA she had a history of hypertension but otherwise good health. Referral to occupational therapy was made 10 days after onset of the CVA for evaluation and intervention in ADLs, visual perceptual skills, and left UE function.

Assessment

Initial assessment revealed intact vital and related functions, such as the oral and facial musculature and swallowing. Voice production was good. Sophia had a tendency to hold her breath during activities, and subsequent decreased endurance was noted. Visual tracking was impaired, with an inability to scan past midline and apparent left-sided neglect.

Her head and neck were observed to be frequently rotated to the right and slightly flexed because of weak extensors. Her trunk was noted to be asymmetric in a sitting posture, with most of the weight supported on her right side. Sophia's posture was flexed because of weak extensors. Static sitting balance was fair and dynamic sitting balance was poor, with Sophia listing forward and to the left.

Sophia's right arm was normal in sensation and strength, although motor planning was impaired. Her left arm was essentially flaccid, with impaired light touch, pain, and proprioceptive sensation. Sophia complained of mild glenohumeral pain during passive movement at the end ranges of shoulder abduction and flexion. Scapular instability was noted. No active movement could be elicited in her left arm.

Perceptual testing showed apraxia (especially during activities requiring crossing of the midline) and left-sided neglect. Sophia was alert and oriented, with good attention span and memory. Carryover in tasks was adequate.

Sophia needed moderate assistance in ADLs and moderate to maximum assistance in transfers. Impaired balance and apraxia were the most limiting factors in performance of ADLs. She stated her immediate goal as being able to get herself ready in the morning with less time and effort.

Intervention Implementation

Following the cervicocaudal direction of development, alignment of her head and neck was the appropriate starting point for intervention. Left-sided awareness, sitting posture, and trunk balance were directly influenced by the position of her head and neck. Before the start of self-care activities, Sophia performed head and neck patterns of flexion and extension with rotation. To reinforce rotation to left, the therapist was positioned to the left of Sophia. Clothing and hygiene articles were also placed to her left.

Lack of trunk control was another problem. During bending activities while seated, Sophia reported a fear of falling and was unsure of her ability to return to the upright position. Consequently, she had difficulty leaning forward to transfer from the wheelchair. The slow reversal–hold technique was used to reinforce trunk patterns during ADLs. For example, as a preparatory method to facilitate the trunk control needed for donning pants over legs, the therapist was positioned in front and to the left of Sophia. Manual contact was on the anterior aspect of either scapula. The therapist moved with Sophia and applied resistance as she leaned forward. At the end of the range, Sophia was instructed to hold with isometric contraction. Manual contact was then switched to the posterior surface of either scapula. Resistance was applied as Sophia returned to the upright position. The verbal command was, “Look up and over your right shoulder.” When she was upright, she was again instructed to hold with isometric contraction. In addition to reinforcing trunk control, this technique alleviated Sophia's fear of leaning forward because the therapist was in continual contact with her.

An indirect benefit of the flexion and extension patterns of the head, neck, and trunk was the reinforcement of respiration. Sophia was encouraged to inhale during extension and exhale during flexion. This approach eliminated Sophia's tendency to hold her breath.

Intervention consisted of total patterns and techniques to facilitate proximal stability in the left UE and to provide proprioceptive input. Weight-bearing activities were selected because no active movement was available in her left arm. Sophia used her right UE in diagonal patterns to perform repetitive perceptual tasks, such as a mosaic tile design, paper-and-pencil activities, and board games. These activities were performed to include the side-lying posture on the left elbow, the prone posture on elbows, the side-sitting posture with weight on the left arm, and posture on all fours. To reinforce stability at the shoulder girdle, approximation and rhythmic stabilization were used with manual contact at both shoulders and then at the shoulder and pelvis. The performance of perceptual tasks in diagonals improved Sophia's motor planning, left-sided awareness, and trunk rotation.

Sophia was instructed in bilateral asymmetric chopping and lifting patterns to support her scapula and left UE in rolling and other activities. These patterns also enhanced left-sided awareness and trunk rotation. To facilitate scapular movement during chop and lift patterns, the therapist applied stretch to initiate movement, followed by the slow-reversal technique. In preparation for the lift pattern, manual contact was placed on the posterior surface of the scapula. Stretch was applied in a lengthened range. As Sophia initiated the lifting pattern, resistance was provided and maintained throughout the ROM. This procedure was repeated for the antagonistic or reverse-of-lift pattern, with manual contact switching to the anterior surface of the scapula.

About 3 to 4 weeks after the injury Sophia was able to initiate left UE movement in synergy with a predominance of flexor tone. Weight-bearing activities and rhythmic rotation were helpful in normalizing tone, and both techniques were used with ADLs such as dressing and bathing. Wrist and finger extensions were facilitated in the D_1 extension and D_2 flexion patterns by using repeated contractions.

Outcomes

Reevaluation after 5 weeks of occupational therapy revealed increased endurance and ability to coordinate breathing with activity and consistency in crossing the midline during visual scanning activities. Sophia was able to turn her head and neck to the left without cues from the therapist. The fear of falling forward with bending had diminished, and she automatically turned her head to look up and over her shoulder to reinforce assumption of the upright position. As trunk strength continued to improve, reinforcement with head and neck rotation was no longer necessary. Visual tracking alone, in the direction of movement, was sufficient to reinforce assumption of the upright position. Eventually, Sophia was able to achieve an upright position without apparent visual or head and neck reinforcement. Sitting balance improved with bilateral weight bearing through both hips. Shoulder pain decreased and scapular stability improved during weight-bearing activities. Sophia initiated left UE movement out of a flexor synergy pattern. Right UE motor planning was within functional limits for ADLs. Transfers and self-care required only minimal assistance, and cues were no longer needed for left UE awareness.

Section 3 Neurodevelopmental Treatment Approach*

Case Study

Charlotte

Charlotte is a 69-year-old woman who sustained a left CVA with resultant right hemiplegia 4 months ago. She is able to move her right arm in a synergistic manner but does not have smooth coordinated movements. When she attempts to use her right arm as an assist for functional tasks, the movement of her arm is dominated by hypertonicity in flexor muscles and it is difficult for her to extend her elbow or open her hand to grasp objects. She is able to stand and walk but tends to maintain more weight on her left lower extremity and take small steps with her right. She is right hand dominant and is having difficulties completing both ADL and IADL tasks that require the use of both hands. In particular she reports that it is difficult for her to cook meals and dress herself. Although she was instructed in one-hand dressing techniques, she reports that it is very time consuming and tiring to use these strategies. Charlotte reports that she misses not being able to paint, play the piano, or garden. She would like to improve the control of her right arm and hand.

Critical Thinking Questions

1. What additional information would be useful in designing an intervention plan to foster improved right hand function?
2. Which assessments would be useful to evaluate Charlotte's upper extremity function in relation to her occupational goals? How would the occupational therapist best evaluate Charlotte's upper extremity function in relation to her occupational goals?
3. What intervention would support the best outcomes to meet the client's goals?
4. Through skilled analysis of client factors and performance skills, what client abilities can be fostered during intervention and used to support the client's engagement in occupations?

Historical Context of the Neurodevelopmental Treatment Approach

Neurodevelopmental treatment (NDT), as it is currently referred to in the United States, originally began as the "Bobath concept," a treatment approach developed by Berta and Karel Bobath in the 1940s. Berta Bobath received her early training as a remedial gymnast at the Anna Herrmann School of gymnastics in Germany, where she stayed on as an instructor of gymnastics upon graduation.[81] She described the focus of her educational program at Anna Herrmann:

We were taught about the analysis of normal movements and various ways of relaxation. We learned to feel and evaluate degrees of relaxation not only on tight muscles but its effect on the strength and activity of their antagonists. This was done by a special way of handling a person, inducing movements in response to being moved.

In the 1930s, when the Nazis came to power in Germany, Berta Bobath lost her job as a gymnastics instructor; the school would not retain a Jewish teacher. She subsequently moved to London, eventually working at the Princess Louise Hospital.

Based on her background and skills in analyzing normal movement, Berta Bobath was repeatedly asked to see special cases of both children with cerebral palsy and adults with hemiplegia. At the time, it was assumed that individuals with upper motor neuron (UMN) lesions could not recover from their motor deficits. Because of her background in dance, her training in posture and the analysis of movement, and likely also her "heretical or eccentric"[88] views, Berta Bobath did not ascribe to this belief. She began by using her hands and body to reposition these clients into neutral and symmetric alignment. She examined the impact of her positioning and handling on their muscle tone and ability to move. Berta described the basis of her approach as "the inhibition of released and exaggerated abnormal reflex action, the counteraction of abnormal patterns, and the facilitation of more normal automatic voluntary movements."[81]

After much experience and success with her techniques, Berta ultimately studied to become a physiotherapist and passed the examination in 1950. Dr. Karel Bobath, Berta's husband and a psychiatrist, became interested in the approach and spent much of his career studying and explaining the neurophysiology behind Berta's observations. Together, Berta and Karel Bobath are credited with the development of the Bobath concept and the neurodevelopmental treatment approach. They established the first Bobath Centre in London in 1951 and soon began training other physiotherapists on her approach to the treatment of children with cerebral palsy and adults with hemiplegia. Today, courses on this approach are taught both nationally and internationally to occupational and physical therapists, speech-language pathologists, and, in some countries, nurses, physicians, and teachers.[38] Information regarding continuing education courses in the United States (for occupational therapists) can be found at the Neuro-Developmental Treatment Association (NDTA) website: www.ndta.org.

Based on the time period in which it was established, several contemporary authors described NDT as a treatment approach that is based on a hierarchical view of the nervous system. Although the accepted view of the nervous system at the start of the NDT approach reflected a hierarchical model, it does not appear true, or consistent with the writings of the Bobaths and other historians. The NDT approach was *not originally based on* a hierarchical perspective. The approach was based on Berta Bobath's experiences—her skilled observations of alignment, posture, and movement—and she achieved remarkable results in helping clients to improve functional movement. The results were then interpreted using the reflex-hierarchical model, which, at that time, was the proposed explanation of how the CNS was organized.[72,81] This inductive sequence, from observations to theory development, is discussed in many historical accounts of the approach. Although dynamic models of central nervous system function and specifically motor control did not exist at the time, contemporary dynamic perspectives support Berta Bobath's original observations and experiences more accurately than reflex-hierarchical models. Her handling resulted in changes in tone and movement capacity that were unlikely (or could not have resulted) if the client's tone and movement patterns were exclusively reflexive in nature. Her handling tapped into the dynamic system influencing motor output that is reflected in contemporary models of motor control.[84]

Whether the original NDT approach was founded upon a reflex-hierarchical perspective or simply explained in terms of that model, it was clearly suggested as a "living concept" from its inception[38]; theoretical and intervention concepts were intended as "working hypotheses." Dr. Bobath used this terminology to stress the need for the approach to change over time with new information. Because the approach was grounded in an understanding of and appreciation for normal movement rather than pathology, he emphasized that NDT would continue to evolve as the understanding of normal movement advances through new discoveries and theory development.

Berta Bobath's Developing Theory: Original Concepts and Changes Over Time

Philosophy of Neurodevelopmental Treatment

Deeply engrained in an NDT-trained therapist's methods are the philosophical underpinnings of the approach stemming from its opposition to prevailing perspectives in the 1950s. When Berta Bobath began working with people with UMN lesions, most people believed that these individuals would not recover, and practices reflected this perspective. Individuals were either not provided rehabilitation services or were provided a compensatory approach exclusively. Any remedial intervention was from an orthopedic frame of reference—primarily stretching and strengthening—and therefore did not address the neurologic basis underlying the movement problems.[38,72] Contrary to these views and practices, and related to her clinical observations and experiences, Berta Bobath believed these individuals could regain control of movement, given the right opportunities.

Part of the NDT philosophy is *a belief in recovery*, in the client's potential. This belief was coupled with a belief in the influence that normal movement could have on a person's quality of life. In the foreword to Bobath's first book[6], Dr. P.W. Nathan (1970) eloquently exposed some of the philosophical underpinnings of the approach, the essence of which remain today:

Whether the doctor knows he is doing so or not, he chooses either a policy of persuading the client to use the hemiplegic limbs and re-train his affected side, or else a policy of encouraging the client to neglect the hemiplegic side and to use the unaffected side for all tasks previously done by the limbs of both sides. The choice affects only the upper limb and the general posture of the client. There is no choice about the lower limb; the client has to learn to use it. That being so, it is best for him to learn to use it properly. If the client gives in to this neurological disorder, he will become an invalid. If he learns to retrain his hemiplegic side, he returns to life.

Key Principles of Neurodevelopmental Treatment

The NDT approach is now widely described as a problem-solving method for restoring movement and participation for individuals with UMN lesions, specifically cerebral palsy and hemiplegia.[38] The approach is aimed at restoration of function through identifying and correcting underlying impairments that interfere with movement and participation in everyday activities. The emphasis is on regaining normal movement and postural control, and quality of movement in general. Compensations are discouraged.[30] Clinicians studying the approach are instructed in Berta Bobath's belief in the potential of the hemiplegic side to recover movement and her emphasis on addressing the whole body and the whole person. According to Tallis,[88] the "fundamental ethos of Bobath [remains today as]…the client as partner, rehabilitation tailored to the client's current situation, and rehabilitation as a 24/7 activity."

Although the basic principles of intervention remain the same, ideas regarding the nature of the client's movement deficits and how movement is controlled and learned have evolved over time in response to scientific advances. Primary changes to the approach can be tied to discoveries in neuroscience and motor learning research, specifically a dynamic and interactive understanding of the way in which movement is controlled and executed, and feedback is utilized. In the most recent edition of her book on adult hemiplegia, Bobath[8] outlined the major problems of the client as abnormal coordination of movement and abnormal postural tone and control. Current findings suggest that motor performance deficits result from the combined "neurological dysfunction due to damage of the CNS, musculoskeletal changes, and learned movement strategies."[30] Intervention is no longer directed at reducing spasticity; merely reducing spasticity will not foster improvements in the client's motor control. However, there appear to be other aspects of hypertonicity that are non-neural in nature, such as changes in muscle length (shortening), joint alignment, and recruitment patterns, that tend to be amenable to handling strategies. Motor output is organized around task goals, and therefore motor skills are practiced in function as much as possible. Errors are required for motor learning, as is active participation on the part of the client; therefore passive movement of the client is minimized and handling is graded to assure increasing autonomy on the part of the client (Fig. 31.16).


A

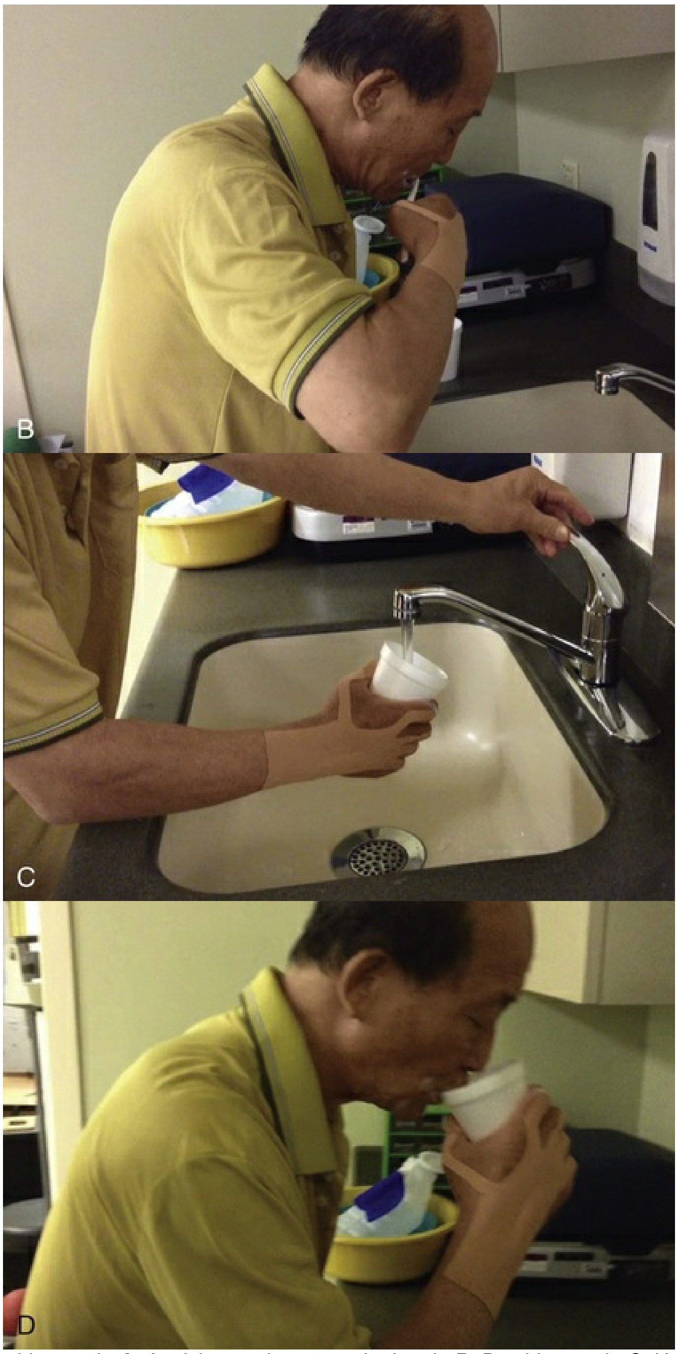


FIG. 31.16 Brushing teeth. **A,** Applying toothpaste to the brush. **B,** Brushing teeth. **C,** Holding the cup to fill with water. **D,** Drinking from the cup. (Photographs courtesy Michael Ang, OTD, OTR/L, CSRS.)

Using Neurodevelopmental Treatment to Restore Participation in Occupation

There has been a fair amount of controversy in the literature not only about the efficacy of NDT, which is addressed in the next section, but also about the approach itself.[22,60,61] Given the changes in the NDT approach over time, questions arise as to which aspects of the approach have remained constant. What are the current NDT strategies used to promote recovery of functional movement and therefore participation in occupation? What makes something NDT versus an entirely new approach to intervention? Because NDT has changed over time, other approaches have evolved from NDT, and NDT is used in combination with other approaches, it can be challenging to specify exactly which specific strategies are NDT. Physiotherapists who use the Bobath concept were surveyed and agreed that the following interventions are definitely or probably part of the approach: facilitation, mobilization, practicing motor skills of certain activities, practicing activities themselves, and teaching caregivers how to position the client.[93] Based on a review of the literature and the content of NDTA-approved courses (ndta.org), the next section represents a distillation of contemporary evaluation and intervention using the NDT approach.

It should also be mentioned that the NDT approach is incorporated into occupational therapy evaluation and intervention to address problems of motor control and functional movement. The approach alone does not provide a thorough lens with which to view the dynamics of occupational problems in context. NDT should be used in concert with other theoretical models in order to provide a comprehensive occupational therapy program. It should also be combined, as appropriate, with other interventions supported by the best available contemporary research, to effectively manage the client's needs and responses.

Evaluation

Based on a top-down approach to intervention, an occupational therapist using the NDT approach begins with an occupational history interview. Grounded in the occupational profile and the client's goals, the therapist would then observe the client's performance in various occupations. Based on NDT, this observation would include assessment not only of the client's level of assistance and the amount of movement present, but also of the *quality* of his or her movement and postural control.

Specifically, the clinician would assess the following:

1. The client's ability to maintain postural alignment required for the occupation. Consider Charlotte and her alignment when standing where the majority of her weight is shifted to her left leg and her right arm is predominantly flexed.

2. The “normal” or typical motor performance skills required for the tasks or activities that will be addressed. NDT-trained therapists analyze movement in terms of the whole body and the stability-mobility relationships between body segments in a task.

3. The client's alignment and movement while performing basic motor skills necessary in everyday activity such as reaching, sit-to-stand, and transferring, as well as while performing occupational goals.

4. Underlying impairments that are contributing to movement dysfunction. Ryerson and Levit[78] outlined the four primary impairments resulting from CNS lesions as “changes in muscle strength, muscle tone, and muscle activation, and changes in sensory processing.” It is these impairments that result in compensatory movements observed following CNS lesion and also, without intervention, often result in secondary impairments such as “changes in orthopedic alignment and mobility, changes in muscle and tissue length, edema, and pain.” Impairments are typically assessed in upright postures and during functional activity, through observation, handling, and the patient's subjective report. A common method for assessing tone is *placing,* in which the therapist guides the limb and asks the client to hold against gravity. If tone is too low, the client cannot hold the limb against gravity; if it is too high, the therapist will feel resistance during placing.[7]

Intervention

Because Bobath[7] believed that you cannot “superimpose normal patterns on abnormal ones” and because there is a desire to minimize abnormal patterns of movement from the beginning, therapists are encouraged to overlap evaluation and intervention.[44] Although “normal” movement has been emphasized since the inception of the approach, more recent descriptions emphasize efficient and functional movement, minimizing compensations.[63] Intervention typically includes facilitation of the normal motor performance skills involved in a task as well as practice of tasks themselves—or occupations—with manual guidance or handling.[51] An occupational therapist will also use the NDT framework when providing compensatory strategies to promote modified independence in necessary and valued occupations while remediating motor skills. Compensations based on an NDT approach stress incorporating the hemiplegic side as much as possible; avoiding repetition of abnormal movement patterns with the hemiplegic side, many of which lead to orthopedic impairments over time; and neutral/symmetric alignment during activities, which reinforces the other two.[78] After analyzing the client's movement problems and tendencies, both outside of and within the occupational goal, intervention is structured according to the following sequence: preparation → movement → function. These steps overlap within an intervention session as well as structure the series of sessions overall. Preparation encompasses all of the activities that are necessary for the client to actively work on motor skills required for the task and the task itself. Preparation might include the following:

1. The therapist's careful analysis of the movement components required for the task or occupational goal. A helpful way to organize this analysis is using segments of the body and analyzing the flow of movement that occurs within body segments and between body segments.

2. Set-up of the environment to promote active participation on the part of the client as well as attention to the client's starting alignment for activity. Consider the task of preparing vegetables for a meal. Although compensatory strategies may be used, incorporating the use of both hands while preparing vegetables provides a more functional approach (Fig. 31.17).

FIG. 31.17 Preparing for a meal using both hands to chop (**A**) and peel (**B**) vegetables.

3. Mobilization to give the client access to the range of motion required for the task.

Following preparation, the therapist will structure the session to work on specific motor skills required for the task. Often these are partially addressed outside of the occupation itself, in preparation for practice of the whole task, which is congruent with motor learning guidelines regarding part and whole-task practice.[28] Along with verbal cues, demonstration, and structure of the environment, facilitation of motor skills is done with *handling*. In handling, the therapist uses his or her body in contact with the client's to promote more efficient movement and avoid unwanted motor responses or alignments. Specifically, therapists use handling to add to the sensorimotor information that the client experiences during the performance of task, to make the client more aware of his or her body and incorporate the hemiplegic side, and to assist with the coordination and timing of movement patterns.[63] Continuing education courses and textbooks based on the NDT approach instruct clinicians on precise choices for hand placement that result in desired movement outcomes. These choices are referred to as *key points of control* (Fig. 31.18). Although the therapist uses manual handling and guiding, the client should be active in the process. Handling and guiding should be graded to provide just enough assistance and input to give the client a feel for a more efficient movement pattern, and gradually withdrawn as the client progresses and is able to do more of the movement pattern and task independently.[30]

FIG. 31.18 Key points of control. Trunk extension.

Intervention for limb movements is also graded from closed-chain patterns of movement to open-chain patterns. A closed-chain movement is one in which the distal part of a joint, or "chain" of joints, is fixed, and the proximal part is moving.[71] An example of a closed-chain pattern for the upper extremity (UE) would be incorporating the arm in a weight-bearing alignment for postural support and to assist with balance during an activity such as standing at a counter weight bearing on one hand for support while reaching overhead into a cupboard for an item (Fig. 31.19). Muscles in the weight-bearing arm must be active. Clinicians using an NDT approach include the UE in weight bearing as part of the base of support to assist with postural control and also to promote sensory input and isometric and eccentric control in the limb. Use of the weight-bearing or closed-chain strategy requires muscle activity in the arm; it is not passive positioning. Closed-chain weight-bearing positions are often combined with movement over the base of support to encourage activation of the UE to maintain balance.

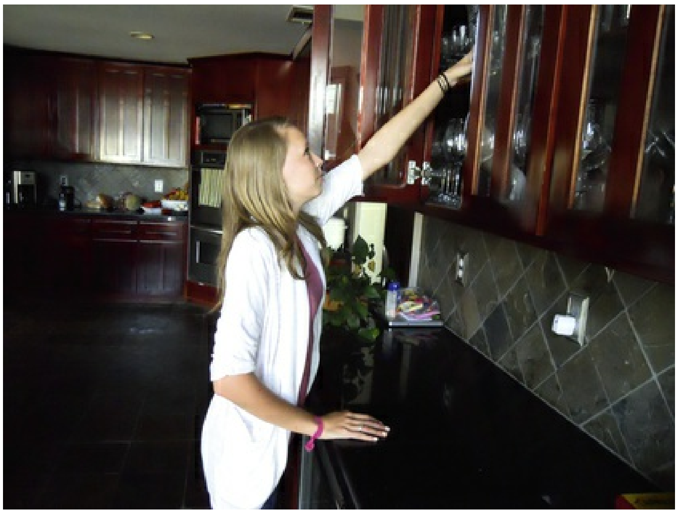


FIG. 31.19 Closed chain with weight bearing on upper extremity to support postural control.

Positioning the UE with the hand in contact with a stable surface can also be a useful position for mobilization and stretching the distal UE and to grade facilitation of isolated movement patterns in the arm. During mobilization and stretching, particularly of the wrist and hand, moving the arm on a fixed hand allows the therapist to stretch the extrinsic finger, thumb, and wrist flexors (Fig. 31.20). Muscle lengthening may lead to decreases in hypertonicity. In addition, when promoting isolated movement of the UE—for example, in reaching patterns of shoulder flexion with elbow extension—the distal contact offers the limb support and decreases the resistance or demand on proximal musculature required for the task. Similar to handling and other forms of sensory input and feedback, this support must be gradually withdrawn in order for muscle strengthening and motor learning to occur. The sequence of facilitation should proceed to incorporation of the learned movement patterns into an occupation or functional task. Handling is gradually decreased as the patient is able to complete efficient movement patterns.

FIG. 31.20 Weight bearing on the hand to mobilize and stretch wrist and finger flexors while supporting postural control.

Neurodevelopmental Treatment and Evidence-Based Practice

Evidence-based practice is a clinical reasoning process that combines the best available research, a clinician's expertise, and the client's preferences and values in order to make decisions about intervention with individual cases to provide the most effective and efficient care.[79] The best available research for clinical decision making regarding the effectiveness of specific interventions is a systematic review of randomized clinical trials or a randomized clinical trial.[27,82] Few studies exist that have addressed the effect of NDT on client outcomes. At the present time, a great majority of the evidence for the effectiveness of NDT is at a lower level on the evidence scale—expert opinion. The experts include many practitioners as well as clients and caregivers—who could be considered experts on their own lived experiences with the condition—who report positive outcomes as a result of incorporating NDT principles and management strategies into intervention.

The limited number of systematic reviews and clinical trials addressing the effectiveness of the NDT approach has yielded mixed results. One systematic review of the literature by Kollen et al.[50] examined 16 studies encompassing 813 clients and concluded that "there was no evidence of superiority of Bobath on sensorimotor control of upper and lower limb, dexterity, mobility, activities of daily living, health-related quality of life, and cost-effectiveness." Intervention studies have reported positive effects of NDT on gross motor skills in children and gait patterns in adults with CP.[47,92] Findings by Luke, Dodd, and Brock[56] indicated that although the Bobath concept was found to have slightly better results than other approaches or no intervention at all in reducing shoulder pain and tone, the Bobath concept was one approach among several that did not demonstrate "superiority of one approach over the other at improving upper limb impairment, activity or participation." Similarly, Paci,[69] in his review of 15 trials, found no evidence to support NDT as an optimal type of treatment, but also no conclusive support for the idea that the approach is not effective. Researchers agree that additional higher-level research, with more rigorous methodologies that define and detail NDT methods, is needed to provide evidence-based guidelines for practice. To systematize such research, Tyson, Connell, Busse, and Lennon[93] outlined a "typical treatment package" for future clinical trials based on their study of physiotherapists using the Bobath concept. The focus of the intervention package would be "facilitation, mobilization, practicing the components of movement, practicing a few whole activities, and teaching clients and caregivers on how to position the client." It has also been suggested that researchers study specific intervention techniques, rather than the NDT concept or approach as a whole.[93]

Neurodevelopmental treatment is not alone in lacking evidence. As Mayston stated,[62] "the reality is that there is only partial evidence to support current modalities such as task-specific training, constraint-induced movement therapy, treadmill training and muscle strengthening." The present evidence for use of the NDT approach consists of widespread clinical observations and expertise along with limited clinical trials and systematic reviews. In spite of a lack of high-level evidence supporting its efficacy, according to authors of one systematic literature review, “in the Western world, the Bobath Concept or neuro-developmental treatment is the most popular treatment approach used in stroke rehabilitation.”[50] This evidence, although useful and substantial, is not enough to warrant continued and isolated use of this approach as research demonstrating more effective or efficient methods at higher levels of evidence becomes available. Based on dynamic models integrating multiple systems within and outside the person that contribute to the control of movement, as well as occupational performance, contemporary clinical reasoning and intervention planning for individuals with UMN lesions must consider the complex web of factors contributing to function and integrate all available resources and intervention methods, supported by evidence, that contribute to effectively restoring participation in desired occupations (Fig. 31.21).

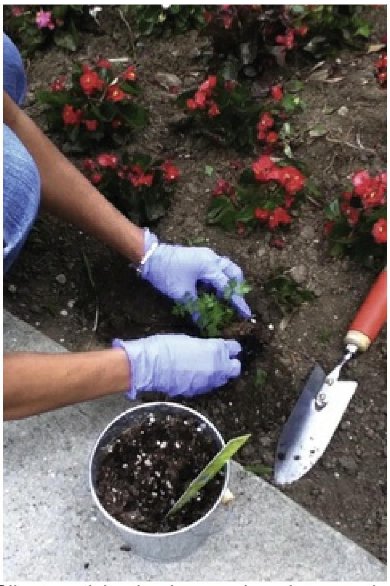


FIG. 31.21 Client participating in an enjoyed occupation, gardening.

Review Questions

1. What are the four general processes of information flow related to control of movement?
2. Define motivational urge and name the locus of this function in the brain.
3. Trace the flow of information in the central and peripheral nervous systems that leads to purposeful movement.
4. What is the sensorimotor system?
5. List the areas of the sensorimotor cortex.
6. List the structures that constitute the higher, middle, and lower levels of the CNS components for movement.
7. Name the four traditional sensorimotor approaches to treatment and the theorist responsible for each.
8. Which two models of motor control form the basis for the sensorimotor approaches to treatment?
9. Briefly describe each of the four traditional sensorimotor approaches to treatment. Compare and contrast their similarities and differences.
10. List some techniques used by therapists to influence or modify motor responses in each of the traditional sensorimotor approaches.
11. How are the sensorimotor approaches used in current clinical practice?
12. In clients with pain, what tone of voice should be used when giving verbal commands?
13. Discuss the significance of auditory, visual, and tactile input in motor learning.
14. Which UE diagonal pattern is used for the hand-to-mouth phase of eating? For zipping front-opening pants?
15. Discuss the advantages of using the chop and lift patterns.
16. Which trunk pattern is used when donning a left sock?
17. List three advantages of using the diagonal patterns.
18. What is the developmental sequence of total patterns?
19. If a client needs more stability, which of the following total patterns should be chosen: side lying or prone posture on elbows?
20. Which PNF technique facilitates postural control and cocontraction?
21. Discuss the neurophysiologic principles of Sherrington on which the PNF techniques of facilitation are based.
22. What is an effective technique to prepare a client with UE flexor spasticity to don a shirt?
23. Define maximal resistance.
24. Name two PNF techniques that facilitate initiation of movement.
25. What are the key principles of the NDT approach?
26. What is the difference between a closed and open kinetic chain?
27. Identify a task in which you would use a closed kinetic chain and a task in which you would use an open kinetic chain.

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Motor Learning

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CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Describe how motor control affects occupational performance.
2. Describe the dynamic systems theory and how it explains motor control.
3. Describe the task-oriented approach to motor learning.
4. Describe constraint-induced movement therapy as an intervention targeting functional use of a hemiparetic upper extremity following a neurological insult to the brain.
5. Describe the use of robotics in the use of upper extremity motor control.
6. Describe the use of virtual reality technology in the use of upper extremity motor control.
7. Describe the use of bilateral training techniques for improving upper extremity motor control.
8. Develop client-centered and occupation-based treatment programs to facilitate motor learning.

KEY TERMS

Bilateral training techniques
Brain plasticity
Constraint-induced movement therapy (CIMT)
Dynamic systems theory
Feedback
Heterarchical model
Hierarchical model
Knowledge of results
Learned nonuse
Motor control
Motor learning

Robotics
Shaping
Task-oriented approach
Virtual reality technology

Threaded Case Study

Richard, Part 1

Richard, a 66-year-old African American man, was admitted to a rehabilitation hospital on January 21, 2011, because of the onset of a left cerebrovascular accident (CVA) with resulting right-sided hemiparesis.

Before admission, the client lived with his wife in an apartment with four steps at the entrance. They have four grown children who do not live in the area. They also have three grandchildren. Richard is a retired electrician. He was independent in all activities of daily living (ADLs) before admission. He was responsible for meal preparation, household maintenance, and finances. He enjoys gardening, playing cards, and cooking. His social participation consisted of doing the weekly grocery shopping, attending church every Sunday, and going to the theater with his wife and family.

Richard's symptoms include right-sided hemiparesis. He has selective motion at the shoulder, elbow, wrist, and hand. He is able to lift his affected arm above his head and to grasp and release objects of all sizes; however, he has difficulty manipulating smaller objects.

Richard's daily routine consisted of getting up each morning at 6:00 am and walking the dog for about a mile. He then cooked breakfast for himself and his wife. After breakfast he was responsible for cleaning the kitchen and doing basic household maintenance.

Using the Canadian Occupational Performance Measure (COPM),[31] Richard identified the following occupational performance problems:

- Inability to perform cooking tasks with bilateral upper extremities
- Difficulty with fasteners and with the manipulation of objects of different textures and sizes smaller than 1 inch
- Inability to turn the pages of a prayer book while in church
- Difficulty performing the transitional movements of sitting to standing to kneeling and kneeling to standing to sitting while in church
- Inability to perform transitional movements during gardening activities
- Inability to manipulate cards with the affected upper extremity

Critical Thinking Questions

1. How has Richard's motor control affected his ability to engage in meaningful occupation?
2. What motor control intervention strategies would enable Richard to more effectively engage in his daily occupations?

Theoretical Foundations of Motor Learning

Motor learning is the acquisition and modification of learned movement patterns over time.[65] It involves cognitive and perceptual processes to code various motor programs. Motor learning requires practice and experience, which leads to permanent changes in the person's ability to produce movement sufficient to meet the demands of occupational performance. **Motor control** is the outcome of motor learning and involves the ability to produce purposeful movements of the extremities and postural adjustments in response to activity and environmental demands.[9]

The process of motor learning after a CVA, traumatic brain injury, cerebral palsy, and other neurological insults to the brain has received an enormous amount of attention in research and occupational therapy (OT) practice. Researchers have found that 5 years after the onset of a stroke, approximately 56% of clients continue to have severe hemiparesis.[17] The initial degree of motor impairment is a predictor of motor recovery, especially during the first few weeks after a stroke.[4,8] Dominkus et al.[15] assessed motor recovery in the upper extremity with the Motricity Index[14] and found that a client with initial paresis was 4.58 times more likely to achieve motor recovery than a client with initial paralysis. Furthermore, nearly 400,000 people survive with some level of neurological impairment and disability.[26] The explosion of new research on **brain plasticity**, or the ability of the brain to reorganize and develop new pathways, has paved the way for evolving approaches that target the ability of the individual to regain movement that enhances occupational performance, participation, and quality of life.[65] Recent studies support the theory that a form of brain plasticity known as cortical map reorganization plays a major role in regaining functional use of a hemiparetic upper extremity after a CVA.[12,33,63]

Dynamic Systems Theory

Modern motor control approaches are based on the **dynamic systems theory**, which views motor behavior as a dynamic interaction between client factors (eg, sensorimotor, cognitive, perceptual, and psychosocial), the context (eg, physical, cultural, spiritual, social, temporal, personal, and virtual), and the occupations that must be performed to enact the client's roles.[39,40] The dynamic systems theory is based on a **heterarchical model** in which each component (eg, client, environment, and occupational performance) is viewed as being critical in a dynamic interaction to support the client's ability to engage in occupation.[9,65] Thus, movement and motor control are the result of a dynamic interaction between each of the subsystems. In addition, any change in the system has an effect on all the subsystems. For example, a CVA can lead to changes in the client's sensorimotor, cognitive, and perceptual skills, which affects motor control, engagement in occupation, and the person's ability to master the environment.[88]

The heterarchical model is contrasted to the **hierarchical model**, which views higher centers in the central nervous system as having control over the subordinate lower centers.[40] The traditional sensorimotor approaches, such as neurodevelopmental treatment, proprioceptive neuromuscular facilitation, and the theories developed by Rood and Brunnstrom, are based on a hierarchical model. Recent research supports a dynamic systems theory approach in which motor learning plus the development of motor control is a dynamic process that involves interaction of the person, environment, and occupations that the client needs to perform or wants to perform.[2]

Task-Oriented Approach

The **task-oriented approach** to motor recovery is based on dynamic systems principles in which occupational performance and motor recovery are achieved by a dynamic interaction of the person, the environment, and the occupations that the person is performing.[39,40] In OT, this approach is occupation based and client centered and focuses on enabling the client to achieve motor recovery through occupational performance using real objects, environments, and meaningful occupations.[57,60] Research shows that the use of real objects from the environment versus simulated objects produces better functional movement.[86] The client must also have the opportunity to attempt to solve motor problems in the context of multiple environments by using a variety of strategies.[6,23] For example, Richard (refer to case study) would need to be able to turn the pages in the prayer book in the spiritual context of his place of worship, in addition to using motor strategies that allow him to move from sitting to standing to kneeling. Research has shown that the environmental context plays a key role in the transfer of motor skill acquisition.[19,38]

Occupations that the client has identified as being important through the COPM[31] can be used to motivate the client to problem-solve various motor strategies. An intervention plan that is developed collaboratively between the client and the therapist can aid the client in taking a more proactive role in making progress toward his or her outcomes and can facilitate more effective follow-through. Research has shown that a client-centered and occupation-based approach can assist clients in attaining their personal goals.[76,77] Emerging research is also demonstrating that an occupation-based approach is more effective than rote exercise in remediating motor control impairments.[a] In addition, engaging in an occupation or activity from start to finish has been shown to elicit a more efficient, forceful, and coordinated motor response than has performing only small portions of an activity.[37]

Activity analysis must be used to analyze the necessary movements that the client must perform to complete the task successfully.[51] Effective upgrading and downgrading of the activity must be incorporated for clients to feel that they are successfully moving toward their goals based on their cognitive ability.[58] Motor learning can take place only if the client has multiple practice opportunities across several real environmental contexts.[19,32] Further, the use of a self-administered graded repetitive arm supplementary program (GRASP) has been shown to improve arm function and provides an effective delivery model for improving upper limb recovery.[22]

Qualitative (eg, verbal encouragement) and quantitative (eg, concrete measures of success or failure during a motor task) analyses have been shown to produce knowledge of results, which enables the client to cognitively reflect on the strengths and weaknesses of a particular motor strategy and implement a more effective strategy for completing an activity.[27,80,82] Through this dialog, the client can learn to transfer various motor skills across multiple contexts.[68]

OT Practice Notes

Feedback and analysis of factors that promote success or failure in a particular motor strategy must be a central problem-solving dialog between the OT practitioner and the client.[24,25,41]

Constraint-Induced Movement Therapy

Constraint-induced movement therapy (CIMT), or forced use, is a therapeutic strategy designed to promote functional use of a hemiparetic upper extremity and has been credited with speeding up the cortical map reorganization process in nonhuman primates[72] and in humans.[30] CIMT is also based on the principles of dynamic systems theory and a task-oriented approach to the acquisition of motor control. In other methods of stroke rehabilitation, clients learn to use the more functional or less involved upper extremity for daily activities. This treatment approach may foster learned nonuse of the more involved upper extremity. **Learned nonuse** is a phenomenon in which the individual neglects to use the affected or more involved extremity because of the extreme difficulty coordinating movement after the onset of a stroke, brain injury, or other neurological condition.[30]

As a person or an animal moves through its environment and manipulates objects, it receives sensory feedback from various sources simultaneously. Vision, audition, proprioception, and kinesthesia provide important sensory information for skilled movement. The importance of sensory information to motor action was demonstrated in the classic experiment carried out by Mott and Sherrington.[48] The afferent (sensory) input enters the spinal cord through the dorsal roots of the spinal nerves. By selectively severing the dorsal roots, sensory input was effectively eliminated while leaving motor innervation basically intact. Experiments conducted before 1955 demonstrated that deafferentation of a single forelimb in rhesus monkeys resulted in an unused extremity when the animal was unrestricted.

Animal research has led to the discovery that cortical reorganization occurs after injury to the nervous system.[33] Research on somatosensory deafferentation in monkeys has shown that if a single monkey forelimb is deafferented, the monkey will not use that extremity.[28] In other words, the procedure left the monkeys with intact motor nerves but no sensation in the affected upper extremity. The initial shock to the nervous system prevented movement. Even after the nervous system recovered, the monkeys failed to use their affected limb. Taub[69] theorized that use of the deafferented extremity could be retrained if the intact extremity is restrained and the monkey is forced to use the affected extremity. If the restraint was used for a specific time, between 1 and 2 weeks, the functional improvement could be permanent. These studies have shown that certain training procedures can be used to enable monkeys to regain use of their deafferented extremity.[28,29,70,71] Experimental evidence indicates that the persistent loss of motor function caused by deafferentation was due to learned behavioral suppression, a phenomenon called learned nonuse.[69] Conditioned response techniques did not show promise in restoring use of the extremity for daily activities.

Another therapeutic strategy, **shaping**, did result in significant improvements in motor function during ADLs. Shaping procedures are behavioral techniques that approach a desired motor outcome in small, successive increments.[45,54,73] Shaping strategies allow subjects to experience successful gains in performance with relatively small amounts of motor improvement. Explanations from several studies have led to the development of a hypothesis that explains why the constraint and training procedures improve motor recovery after deafferentation.

The theory of learned nonuse was first described by Taub and is thought to extend to humans after central nervous system damage (Fig. 32.1).[69-71,83] Animal research has demonstrated that when the forelimb is not functional, the animal no longer uses the affected upper extremity for everyday tasks. This tendency has led to reinforcement and persistence of nonuse of the affected limb. Constraining the unaffected limb of the monkeys provided the early evidence for reversing learned nonuse.

FIG 32.1 Client with a left cerebrovascular accident and right hemiparesis before initiation of the constraint-induced movement therapy (CIMT) program. The client demonstrates learned nonuse by using her stronger, uninvolved left upper extremity during self-feeding. (Courtesy Remy Chu, OTR/L.)

To date, rehabilitation methods for those who have sustained a CVA or other neurological insult to the brain have included, but are not limited to, biofeedback, neuromuscular facilitation, and operant conditioning. These various forms of rehabilitation are often used in conjunction with methods that teach clients to compensate by using their intact upper extremity to perform their day-to-day functional activities. Compensatory rehabilitation strategies may improve the efficiency of the intact upper extremity, but at the same time they encourage learned nonuse of the affected upper extremity. At present there is minimal experimental evidence demonstrating the positive benefits of these forms of therapy.

An alternative therapeutic approach, CIMT, has been used extensively for rehabilitation. Unlike more traditional rehabilitation therapies, CIMT forces the client to use the more involved upper extremity by immobilizing the less involved or unaffected upper extremity in a sling, mitt, or a combination of both (Fig. 32.2). Clients then practice using their affected upper extremity on an intensive basis for several consecutive weeks by using shaping movements with the affected upper extremity. The improvements noted in the more involved extremity after this program were attributed to the learned nonuse phenomenon described by Taub[69]; thus, part of the theoretic framework of CIMT is taken from the neurophysiological and behavioral studies of the learned nonuse of the more affected limb seen in animal experiments. Constraining the intact forelimb of these monkeys provided the first evidence of the ability to overcome the learned nonuse phenomenon. This success led to further studies involving humans with hemiparesis that developed after a stroke, brain injury, and other neurological conditions.

FIG 32.2 Constraint-induced movement therapy (CIMT) forces the individual to use the affected upper extremity by immobilizing the unaffected upper extremity in a mitt. (Courtesy Posey Company, Arcadia, CA.)

Wolf[83,84] and Miltner et al.[44] demonstrated the positive effects of using CIMT in individuals with stroke. Liepert et al.[33] demonstrated cortical reorganization in humans undergoing CIMT. In 1993 Taub et al.[74] found significant results when using CIMT in a randomized clinical trial of nine individuals after stroke. These subjects had experienced strokes from 1 to 18 years before participation in CIMT and were required to meet inclusion criteria similar to those used by Wolf et al.[84] (eg, possessing some wrist and finger extension while still demonstrating significant disability). Additionally, the subjects had to demonstrate good balance because they would be wearing a sling and would therefore be unable to use their less affected or unaffected upper extremity to protect themselves in the event of a fall. The subjects were randomly assigned to either an experimental group or a control group. The subjects assigned to the experimental group wore a sling on the less involved upper extremity for a period of 12 days. During the 12 days the sling was worn throughout all waking hours except when specific activities were being carried out, such as when it was unsafe or extremely difficult to use the more affected arm exclusively. The study also used a behavioral contract that included an agreement from the subjects to wear the restraint device for at least 90% of their waking hours during the 12-day intervention period. The behavioral contract specifically identified activities during which the subject was to use the more involved arm exclusively, to use both arms, and/or to use the less involved arm (for safety reasons). Participants in the control group were instructed to focus attention on the more involved upper extremity and were encouraged to attempt to use the more involved upper extremity for as many new functional activities as possible at home. Activities were recorded throughout the 2-week period. Those in the control group also received two sessions involving activities requiring active movement of the more involved extremity and were provided an individualized range-of-motion exercise program. The effectiveness of treatment was measured with the Wolf Motor Function Test (WMFT) and the Motor Activity Log (MAL), a structured interview exploring functional use in the life setting. Speed, quality of movement, and functional use of the affected upper extremity were significantly improved in the research group in comparison to the control group, and functional movement was maintained over a 2-year period.

In 1999 Kunkel et al.[30] also demonstrated a greater than 100% increase in the amount of use of the affected upper extremity in real-world environments. The effective factor in all forms of CIMT appears to be intensive practice and functional use of the affected upper extremity repeatedly across multiple contexts for many hours a day for a period of consecutive days.[85]

Over the past 30 years, numerous studies have further confirmed the effectiveness of CIMT versus traditional rehabilitation therapy in improving the client's functional motor control after stroke.[64] More recently, however, research involving CIMT has used various populations, altered the inclusion criteria, and modified the intensity of treatment and the length of the therapy program from the original research protocol. For example, Pierce et al.[56] found that the forced-use component of CIMT in conjunction with a home program may be effectively incorporated into the traditional outpatient setting. Furthermore, Page et al.[53] found that repeated task-specific practice is more critical than intensity in improving upper extremity function.

In the Very Early Constraint-Induced Movement during Stroke Rehabilitation (VECTORS) study,[16] 52 subjects were randomized to one of three groups an average of 9.7 days after stroke. The three groups included the following: (1) standard CIMT, in which subjects received 2 hours of shaping therapy and wore a mitt for 6 hours per day; (2) high-intensity CIMT, in which clients underwent 3 hours of shaping exercise per day and wore a mitt for 90% of waking hours; and (3) the control treatment, consisting of 1 hour of ADL training and 1 hour of upper extremity bilateral training exercises. All treatment was provided for 2 weeks. The primary end-point measure was the total Action Research Arm Test (ARAT) score on the more affected side at 90 days after stroke onset. In all groups the total ARAT score improved with time. Subjects in the standard CIMT and control treatment groups achieved similar gains in total ARAT score (24.2 and 25.7, respectively), whereas subjects in the high-intensity CIMT group exhibited an average gain of just 12.6 points.

Overall, there is conflicting evidence of the benefit of CIMT over traditional therapies in the acute stage of stroke; however, there is strong evidence of the benefit of CIMT and modified CIMT over traditional therapies in the chronic stage of stroke. The benefits appear to be confined to stroke patients with some active wrist and hand movements, particularly those with sensory loss and neglect. These findings have broadened the scope and applicability of CIMT to various populations.

Although recent CIMT research has expanded the scope to include different diagnostic criteria, different treatment regimens, and different inclusion criteria, little of the current CIMT research has addressed the participant's self-reported satisfaction in life roles after completing a CIMT program. After individuals have a stroke or other neurological condition, they experience a disruption in their life roles. This disruption can lead to feelings of ineffectiveness, incompetence, and helplessness. To restore health and quality of life, one must identify and alter one's lifestyle to improve the fit between oneself and the environment. CIMT has been proved to be effective in improving motor control in individuals who have experienced a stroke or other neurological condition. Functional carryover of CIMT from the clinic to the natural environment has been demonstrated. Research has shown significant improvement in daily use of the affected upper extremity and an increase in the speed at which the individual carries out activities after participating in a CIMT program. Increased life satisfaction resulting from an increased ability to use the affected upper extremity has been noted in individuals who reported satisfaction in performance of meaningful daily activities and life roles.[52,59]

To determine whether a subject meets the inclusion criteria for CIMT, a telephone screening protocol is often administered.[46] Many research studies use a CIMT protocol that contains typical inclusion criteria for use of this therapeutic strategy. These criteria can include (1) a first-time CVA that occurred more than 1 year earlier; (2) not currently receiving any therapeutic intervention; (3) a score of higher than 44 on the Berg Balance Test[3] or limited balance problems requiring an assistive device for mobility in clients who had a full-time caregiver to assist in any balance issues; (4) ability to move the affected arm in 45 degrees of shoulder flexion and abduction, 90 degrees of elbow flexion and extension, 20 degrees of wrist extension, and 10 degrees of extension at the metacarpal phalanges and interphalanges as determined by the client's available active range of motion (Fig. 32.3); (5) no significant cognitive impairments as demonstrated by a Mini-Mental State Examination score of at least 22[21] or other type of cognitive test; (6) no preexisting comorbid conditions that might interfere with mobility or function; (7) limited spasticity (score of 0 or 1) as measured by the Modified Ashworth Scale[5]; and (8) the ability to identify an individual or a caregiver who could assist in the home program.[46,59] In summary, potential reasons for a person to be excluded may include motor ability that is too high or too low, cognitive deficits that prevent adequate participation, and an existing high degree of functional use of the affected upper extremity.

FIG 32.3 The client is asked to demonstrate active wrist and finger extension in her dominant right hand. The client is able to achieve 20 degrees of wrist extension and 10 degrees of finger extension (at the metacarpal phalanges) from a flexed position. (Courtesy Remy Chu, OTR/L.)

A battery of assessments is typically administered to all clients included in a CIMT treatment program.[46] Results from these assessments are used to test certain research hypotheses, whereas other assessments are used for diagnostic purposes or to generate new hypotheses. Some typical assessments include the WMFT and MAL.

The WMFT consists of 15 motor items that examine contributions from the distal and proximal muscles of the arm. The tasks in this assessment are sequenced from proximal to distal and gross to fine motor. The majority of tasks are completed with the subject seated in a chair. Standard tasks, such as lifting the forearm to the table, reaching for an object, or lifting a pencil, are rated on a scale from 0 (does not attempt with the weaker arm) to 5 (movement appears normal), and the time to complete the task is measured (Fig. 32.4). The WMFT uses a grid or template that is taped to the desk to specify standardized measurements. The WMFT is administered before the intervention, immediately after the intervention, and at a designated follow-up time.

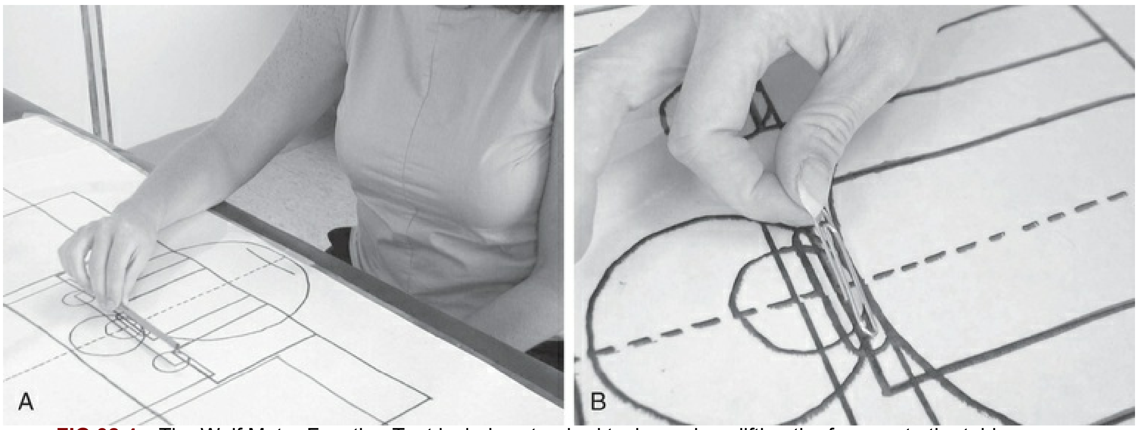

FIG 32.4 The Wolf Motor Function Test includes standard tasks such as lifting the forearm to the table and reaching for an object.

The MAL was developed for the purpose of assessing activities attempted outside the clinical setting. The MAL is a self-reported, 30-item instrument administered in an interview format. Subjects are asked to rate their performance on each activity reported, and emphasis is placed on clients' functional use of the hemiparetic upper extremity in their home environment. The assessment is administered approximately 10 times throughout the course of CIMT intervention. The instrument consists of specific functional activities, such as turning on a light switch or opening a drawer. The amount of functional use of the more involved upper extremity is rated by the participant from 0 (never used) to 5 (involved arm used the same as it was before the stroke).

Quality of movement (how well) is also self-rated from 0 (not used) to 5 (normal movement).

Therapeutic procedures using CIMT in the clinic are performed under the supervision of an OT practitioner (Fig. 32.5). The procedures are effective only if use of the affected upper extremity is carried over to the client's home and community environment. Clients are asked about their compliance in incorporating their affected upper extremity into functional activities as noted in a log or personal diary. The home diary is used to outline the clients' activities from the time at which they are discharged from the clinic until they return for their CIMT sessions. A typical daily schedule is often used. The schedule includes the time and length of rest periods.

FIG 32.5 A, Initiation of the constraint-induced movement therapy (CIMT) program during a self-feeding activity. The client requires minimal hand-over-hand physical assistance to take her first bite with her weaker right hand. Hand-over-hand physical assistance focuses on eliminating gravity as the client brings the spoon to her mouth. B and C, After 10 CIMT trials, the client is attempting to feed herself without physical assistance from the occupational therapist. (Courtesy Remy Chu, OTR/L.)

Specific shaping task practice is also listed on the daily schedule. A desired motor or behavioral objective is approached in small steps with an individualized shaping plan. During shaping, explicit feedback is provided to identify small improvements in motor or functional performance. The shaping task selected depends on the specific joint movements exhibiting impairment that have the greatest chance of improving and the client's preference among tasks that have a similar potential for producing specific improvements. Applying CIMT and shaping requires repetitive, supervised, constant practice. CIMT study protocols call for 6 hours of continuous task practice per day (Figs. 32.6 and 32.7).

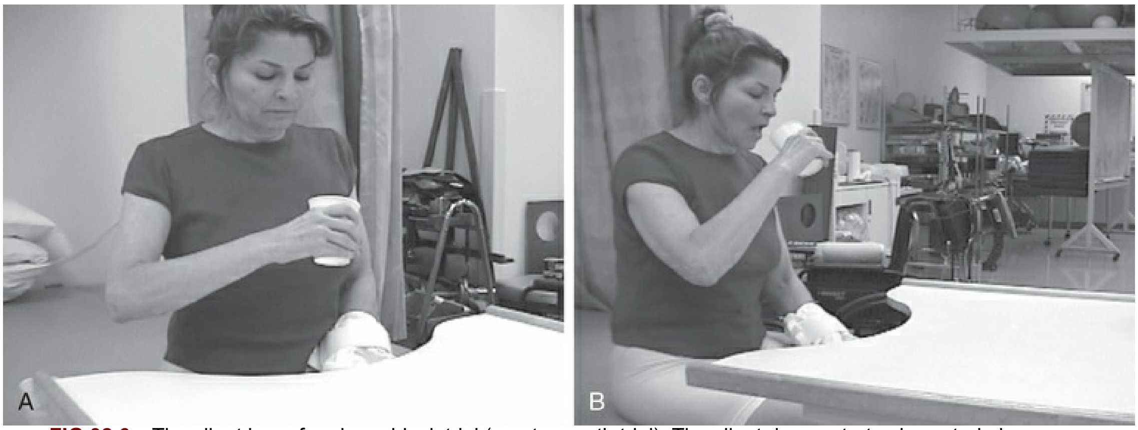

FIG 32.6 The client is performing a block trial (cup-to-mouth trial). The client demonstrates less strain in her neck and shoulder while bringing the cup to her mouth. (Courtesy Remy Chu, OTR/L.)

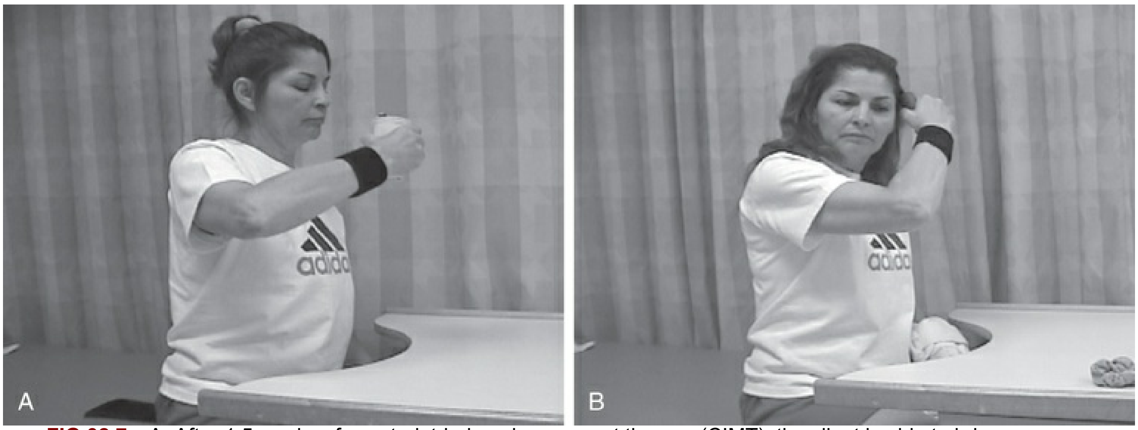

FIG 32.7 A, After 1.5 weeks of constraint-induced movement therapy (CIMT), the client is able to bring a cup to her mouth independently with the weaker right upper extremity. B, She is also able to bring her right hand to her head to brush her hair. (Courtesy Remy Chu, OTR/L.)

An important component of interventions designed to enhance motor learning is the feedback received by the client while attempting a movement strategy and the results of the movement action.[51] **Feedback** refers to the sensory experiences intrinsic to the client and the external information provided by the environment, which includes verbal comments from the OT practitioner. This combined type of feedback can be seen when a client attempts to place a hemiparetic arm into the wrong sleeve of a button-front shirt and receives the visual information that something does not "look correct," along with verbal directions by the OT practitioner that placing the arm in the other sleeve will make the task easier. **Knowledge of the results** is a form of external feedback in which the client assesses whether the correct results were achieved after completion of the motor action. The OT practitioner assists the client by providing feedback during performance of the motor task and on completion of the motor task to assess the results. These strategies are combined with shaping to foster a higher frequency of successful motor practice for functional tasks.

A more recent study that evaluated the immediate and long-term effects of upper extremity rehabilitation approaches for stroke compared functional task practice and strength training with standard care and found that task specificity and stroke severity are important factors in rehabilitation of arm use after an acute stroke.[81] Another recent approach that involves repetitive training of the paretic upper extremity on task-oriented activities has provided evidence of efficacy in stroke survivors. The Extremity Constraint Induced Therapy Evaluation (EXCITE) trial of individuals 3 to 9 months after stroke found that CIMT produced statistically and clinically relevant improvements in arm motor function that persisted for at least 1 year.[84] In summary, the initial *Cochrane Review* found a moderate significant effect on disability and a large significant effect on arm motor function with CIMT, its modified forms (mCIMT), and forced use (FU). The update to the *Cochrane Review* found that the majority of studies were underpowered and imprecise, making the overall evidence inconsistent.[11]

Robotics

Robotics, or robot-assisted therapies, involve the use of a robot to assist in initiation of movement, guidance, and resistance to movement and to provide feedback. Mirror-image motion enabler (MIME) robotic devices were developed to enable unrestricted unilateral or bilateral shoulder or elbow movement. The robotic unit applies force to the more affected forearm during goal-directed movements. A randomized study involving the use of a robotic device and a control group found that there were no significant differences between the groups on either of the ADL assessments but that the clients in the robotic group exhibited a trend toward greater improvement in Fugl-Meyer scores. These differences achieved statistical significance only if the shoulder and elbow portions of the Fugl-Meyer test were considered.[7] Another study examined robot-assisted movement therapy versus conventional therapy in individuals with chronic hemiparesis. This study found that after the first and second months of treatment, the group using robot-assisted therapy had significantly greater improvements in the proximal movement portion of the Fugl-Meyer test. The clients using the robots also had larger gains in strength and larger increases in reach extent after 2 months of treatment. At 6 months no significant differences were seen between the two groups on the Fugl-Meyer test, although the robot group did have significantly greater improvements on the Functional Independence Measure.[35]

In two other studies using robotic therapy, one found that significantly greater gains were attained after treatment in the robot-combined group than in the control group; however, the gains were not maintained at 6 months' follow-up.[36] The other study examined 19 clients following stroke with resultant hemiplegia who underwent a standardized passive exercise program using a robotic arm targeting the upper extremity. This study found no significant changes in preexercise and postexercise responses.[55] A study that examined robot-assisted therapy for long-term upper limb impairment after stroke found that robot-assisted therapy did not significantly improve motor function at 12 weeks as compared with usual therapy; however, outcomes improved over 36 weeks as compared to usual care.[34]

The conclusions regarding the use of robotics for rehabilitation of the upper extremity show that sensorimotor training with robotic devices improves upper extremity functional outcomes and motor outcomes of the shoulder and elbow. Overall, robot-assisted upper extremity therapy may assist in improving motor function during the inpatient period after a stroke.[1,18,79]

Virtual Reality Technology

Virtual reality technology allows individuals to experience and interact with three-dimensional environments. Merians and colleagues[41-43] found that computerized virtual environments have opened the doors to an "exercise environment where the intensity of practice and positive feedback can be consistently and systematically manipulated and enhanced to create the most appropriate, individualized motor learning approach."[43] Virtual reality, such as Wii gaming technology, has been studied and shown to represent a safe and provides an effective alternative to facilitate rehabilitation therapy and promote motor recovery.[61,62] "Adding computerized virtual reality to computerized motor learning activities provides a three-dimensional spatial correspondence between the amount of movement seen on the computer screen. This exact representation allows for visual feedback and guidance for the patient."[43]

Virtual reality is an innovative treatment approach that is in its infancy, but it has shown promise in improving motor function in clients who have had a stroke and are experiencing chronic hemiparesis.

Bilateral Training Techniques

As new theories of neural plasticity have developed, the use of **bilateral training techniques** for the upper limb following stroke have been discussed. Bilateral upper limb training is a technique in which clients practice the same activities with both upper limbs simultaneously. Theoretically, use of the intact limb assists in promoting functional recovery of the impaired limb through facilitative coupling effects between the upper limbs. Practicing bilateral movements allows activation of the intact hemisphere to facilitate activation of the damaged hemisphere through neural networks linked via the corpus callosum.[47,67] In a systematic review that examined 11 clinical trials, Stewart et al.[66] found that bilateral movement training alone, or in combination with sensory feedback, is an effective stroke rehabilitation protocol during the subacute and chronic phases of motor recovery. Further, the cumulative effect of bilateral arm training on motor capabilities in poststroke patients has been found to have strong evidence that supports bilateral arm training.[10]

Summary

The dynamic systems theory supports a heterarchical model of motor control in which motor acquisition is influenced by the client, the environment, and the occupations the client needs to perform or wants to perform. A task-oriented approach supports the use of occupation-based and client-centered interventions to assist clients in problem solving (eg, learning how they will perform their desired occupations in a variety of contexts to support transfer of motor learning).

CIMT is a task-oriented approach that focuses on constraining use of the unaffected upper extremity to facilitate motor recovery in the affected upper extremity during occupational performance. More research is needed in OT to support the use of a task-oriented CIMT approach to motor recovery to improve participation in occupation. Sensorimotor training with the use of robotic devices improves functional and motor outcomes of the shoulder and elbow; however, it does not improve functional and motor outcomes of the wrist and hand. In virtual reality technology, preliminary evidence has shown that this form of intervention may improve motor outcomes. Finally, bilateral arm training uses the intact extremity to assist the impaired extremity through facilitative coupling effects between both upper extremities.

Threaded Case Study

Richard, Part 2

At screening, Richard was eligible to participate in a CIMT program because his stroke had occurred more than 1 year earlier. He had residual right hemiparesis with selective motion in all joints. He was able to touch the top of his head with his weaker arm, bend his wrist, and grasp or release with slow movements. He had completed an inpatient and outpatient rehabilitation program. Richard had not had any major medical complications, had not suffered any falls in the past 6 months, and was able to walk without an assistive device. After screening, an upper extremity ROM assessment, tone assessment using the Modified Ashworth Scale, the Berg Balance Test, and the Folstein Mini-Mental State Examination were completed. Richard met all the criteria and was therefore a good candidate for CIMT.

Richard participated in the MAL interview throughout the intervention. Each task was modeled twice before the participant's performance, and the task was videotaped for scoring purposes. Specific tasks to determine grip strength and the amount of weight added to the task of lifting a box with shoulder flexion were also scored separately. He also completed the WMFT. After completion of the pretraining assessment, Richard and his wife were taught how to don and doff the mitt and use the home diary, and they both signed a behavioral contract. Richard was then scheduled for 14 days of consecutive intervention in which his less involved left arm was constrained by a mitt so that he was required to complete his daily activities with his more affected right arm. The behavioral contract stipulated that Richard would wear the mitt for 90% of waking hours. There was also a home program contract that included exceptions to wearing the mitt, such as while bathing and sleeping. Richard also kept a diary to record which upper extremity was used and the amount of time used during various daily activities, in addition to the amount of time the mitt was worn. Richard recorded all activities completed from the time he left the clinic until his return the following day.

In addition to the activity-based home program, Richard's intervention involved both a group setting and individual sessions. Each of the sessions lasted 6 hours. Tasks during the 6-hour sessions included shaping activities to ensure success in performance. Each small improvement in motor performance was reinforced with positive feedback. Tasks were progressively increased in difficulty as Richard's motor performance improved. To ensure that the activities were occupation based and client centered, they were developed according to the information provided and identified by the COPM.

After Richard arrived at the clinic, the therapist reviewed his diary and performed the MAL. The CIMT activities were identified through information obtained from the COPM. For example, Richard participated in group activities, such as playing cards, which required him to use his more affected hand to manipulate the cards while his less affected hand was constrained in the mitt. He further participated in activities such as cooking. He was responsible for set-up, preparation, and cleanup of the meal with his right upper extremity. His left upper extremity was constrained in the mitt, which necessitated use of his more affected right hand to chop vegetables. Richard would often attempt to use his less affected hand in the mitt and would require prompting from the therapist. To focus on activities that were meaningful for Richard, all activities during the 6-hour intervention session were based on his goals from the COPM. His CIMT activities became progressively more challenging, with repetitions of task practice requiring ROM, strength, endurance, and coordination. Verbal acknowledgment of daily achievements was provided.

After the 2-week intervention program, Richard learned to incorporate his more affected upper extremity into meaningful daily occupations. It became routine for Richard to initiate activities with his right upper extremity, although he primarily used his left upper extremity before the intervention. Richard's level of participation grew to include gardening, attending church, and turning the pages of the prayer book with his right hand. He also resumed his roles in cooking and performing household maintenance.

Critical Thinking Questions

1. How has Richard's motor control affected his ability to engage in meaningful occupation?

Because of impairments in motor control in his right upper extremity, Richard was unable to perform cooking tasks with both upper extremities. He also had difficulty with fasteners and manipulation of objects of different textures and sizes smaller than 1 inch. Richard was unable to turn the pages of his prayer book while in church and had difficulty with the transitional movements of sitting to standing and standing to sitting while in church. He was also unable to perform transition movements during gardening activities and was not able to manipulate cards with the affected upper extremity.

2. What motor control treatment strategies would enable Richard to engage more effectively in his daily occupations?

Richard's CIMT program consisted of restricting movement of the unaffected upper extremity by placing it in a splint, sling, or mitt for greater than 90% of his waking hours. He complied with this protocol for a period of 14 days and participated in training of the affected upper extremity through shaping for approximately 7 hours per day during the 10 weekdays of that period. This approach enabled Richard to regain functional use of his right dominant upper extremity for occupations such as preparing meals, dressing, and opening the pages of a prayer book.

Review Questions

1. How does motor control affect occupational performance?
2. What is the task-oriented approach to motor learning?
3. What is the dynamic systems theory and how does it explain motor control?
4. What is constraint-induced movement therapy and how does this approach increase functional use of a hemiparetic upper extremity after a neurological insult to the brain?
5. What is robot-assisted therapy and how does this approach improve motor control of the upper extremity?
6. What is virtual reality technology and how is this used to improve upper extremity motor control?
7. How are bilateral training techniques used to improve upper extremity motor control?
8. How would you develop a client-centered and occupation-based treatment program to facilitate motor learning?

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[a]References 13, 20, 49, 50, 64, 75, 78, and 87.

PART VI
Intervention Applications

OUTLINE

33

Cerebrovascular Accident (Stroke)

Glen Gillen

CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. List and describe evaluation procedures for survivors of a stroke.
2. Discuss the neuropathology of a stroke.
3. Identify risk factors associated with a stroke.
4. Identify multiple factors (e.g., impaired client factors, performance skills) that impede performance in areas of occupation after a stroke.
5. Describe evaluation procedures for impaired body functions related to neurobehavioral deficits.
6. Identify balance strategies (a body function) that support performance of areas of occupation.
7. Describe the motor control dysfunction (impaired body function) associated with stroke.
8. Identify standardized stroke assessments for multiple areas of dysfunction.
9. Apply a client-centered approach to stroke rehabilitation.

). Develop comprehensive, occupation-based treatment plans to remediate or compensate for underlying deficits.

KEY TERMS

Aphasia

Client-centered practice

Dysarthria

Ischemia

Motor control

Neurobehavioral deficit

Postural strategies

Shoulder pain

Subluxation

Task-oriented approach

Top-down approach to assessment

Transient ischemic attack

Weight bearing

This chapter focuses on occupational therapy (OT) assessment and intervention for individuals who have sustained a stroke. Specifically, it focuses on improving participation in chosen areas of occupation. After a person has a stroke, multiple client factors and performance skills are affected and potentially limit participation and engagement in occupation.[5] These multiple problems are addressed throughout this chapter.

Threaded Case Study

Jasmine, Part 1

Jasmine is a 39-year-old single mother of a 2-year-old boy. They live in a two-bedroom rented apartment. She has converted her dining area into a home office, where she works at her home-based business in desktop publishing. Jasmine drives her son to preschool each morning and shops on the way home before working for the rest of the day from home. While working on her computer, Jasmine experienced tingling and “clumsiness” in her left hand. She attributed this to long work hours. Still feeling “not quite right,” she attempted to stand to go to the bathroom and collapsed on the floor. She was able to crawl to the phone to call 911.

Jasmine next remembers waking up in the emergency department, where she was told that she had just experienced a stroke. Her neuroimaging studies eventually documented the presence of a right frontal-parietal infarct. Jasmine is unable to move or feel the left side of her body, has a left visual field cut, and tends to not respond to sensory stimuli on the left side of her body. The nursing staff are lifting Jasmine out of bed and providing full assistance for self-care and mobility. Jasmine was told that by the end of the week she will be transferred to the local rehabilitation hospital and will require “aggressive” occupational and physical therapy. Her son is under the care of his aunt and uncle. Jasmine has been crying often and is concerned that she will not be able to work or take care of her son. She is also concerned about losing her apartment; she explains that she has been “just getting by” recently. Jasmine is most concerned about returning home, being able to care for herself and her son, and returning to work.

Critical Thinking Questions

1. How will Jasmine's impaired body functions and body structures (e.g., loss of motor control, sensory loss, visual dysfunction, and neglect) affect her ability to return to her previous life style and engage in chosen areas of occupation?

2. What three assessments are most critical to administer? Why?

3. Which interventions should be considered to address Jasmine's inability to participate in activities of daily living such as self-care (e.g., toileting, dressing), mobility (e.g., bed mobility, transfers), instrumental activities of daily living (e.g., meal preparation, child care), and work throughout her rehabilitation stay?

Cerebrovascular accidents (CVAs), or strokes, continue to be a national health problem despite recent advances in medical technology. The American Heart Association[4] publishes stroke statistics that demonstrate the severity of this problem. Selected statistics include the following[4]:

- Stroke is a leading cause of long-term disability.
- On average, a U.S. citizen suffers a stroke every 40 seconds.
- Each year 795,000 people suffer a new or recurrent stroke. Approximately 610,000 strokes are first attacks, and 185,000 are recurrent.
- An estimated 6.6 million Americans over age 20 have had a stroke.
- Women have a higher lifetime risk of stroke than men.
- Of people who suffer a stroke, 28% are younger than 65 years. For people older than 55, the incidence of stroke more than doubles with each successive decade.
- The estimated overall annual incidence of stroke in U.S. children is 6.4 per 100,000 children (0 to 15 years).
- The incidence of stroke is about 1.25 times higher in men than in women.
- The aftermath of a stroke is a substantial public health and economic problem; stroke is a leading cause of serious, long-term disability in the United States.
- Stroke accounts for more than half of all clients hospitalized for acute neurological disease.
- Among long-term clients who sustained a stroke, 50% have hemiparesis, 30% cannot walk, 26% are found to be dependent in activity of daily living (ADL) scales, 19% are aphasic, 35% are clinically depressed, and 26% require home nursing care.

Obviously stroke rehabilitation as a practice area for occupational therapists is a specialization that crosses multiple settings, from the intensive care unit to community-based programs.

Definition of Stroke

A CVA, or stroke, is a complex dysfunction caused by a lesion in the brain. The World Health Organization (WHO) defines stroke as an "acute neurological dysfunction of vascular origin with symptoms and signs corresponding to the involvement of focal areas of the brain."[104] Stroke results in upper motor neuron dysfunction that produces hemiplegia, or paralysis of one side of the body, including the limbs and trunk and sometimes the face and oral structures that are contralateral to the hemisphere of the brain with the lesion. Thus, a lesion in the left cerebral hemisphere (left CVA) produces right hemiplegia. Conversely, a lesion in the right cerebral hemisphere (right CVA) produces left hemiplegia. When reference is made to the client's disability as right or left hemiplegia, the reference is to the paralyzed side of the body and not to the locus of the lesion.

Accompanying the motor paralysis may be a variety of dysfunctions other than the motor paralysis. Some of these dysfunctions include sensory disturbances, cognitive and perceptual dysfunction, visual disturbances, personality and intellectual changes, and a complex range of speech and associated language disorders. The neurological deficits must persist longer than 24 hours to be labeled a CVA.

Causes of Stroke

Bartels[10] describes a stroke as "essentially a disease of the cerebral vasculature in which failure to supply oxygen to the brain cells, which are the most susceptible to ischemic damage, leads to their death. The syndromes that lead to stroke comprise two broad categories: ischemic and hemorrhagic stroke." Ischemic strokes account for the majority of strokes.

Ischemia

Ischemia refers to insufficient blood flow to meet metabolic demand. Ischemic strokes may be the result of embolism to the brain from cardiac or arterial sources. Cardiac sources include atrial fibrillation (pooling of blood in the dysfunctional atrium leads to the production of emboli), sinoatrial disorders, acute myocardial infarction, endocarditis, cardiac tumors, and valvular (both native and artificial) disorders. Cerebral ischemia caused by perfusion failure occurs with severe stenosis of the carotid and basilar arteries, and with microstenosis of the small deep arteries.[4,10]

Age, gender, race, ethnicity, and heredity are considered nonmodifiable risk factors for ischemic strokes. In contrast, a major focus of stroke prevention and education programs is the potentially modifiable risk factors discussed in the following list.[4,51]

1. Hypertension is considered the single most important modifiable risk factor for ischemic stroke. Those with a blood pressure lower than 120/80 mm Hg have about half the lifetime risk for stroke as those with high blood pressure.[4]

2. Management of cardiac diseases, particularly atrial fibrillation, mitral stenosis, and structural abnormalities (patent foramen ovale and atrial septal aneurysm), can reduce the risk for stroke.

3. Management of diabetes and glucose metabolism can also reduce the risk for stroke.

4. Cigarette smoking increases the relative risk for ischemic stroke nearly two times.

5. Although excessive use of alcohol is a risk factor for many other diseases, moderate consumption of alcohol may reduce the incidence of cardiovascular disease, including stroke.

6. Use of illegal drugs, particularly cocaine, is commonly associated with stroke. Other drugs linked to stroke include heroin, amphetamines, lysergic acid diethylamide (LSD), phencyclidine (PCP), and marijuana.

7. Lifestyle factors (e.g., obesity, physical inactivity, diet, and emotional stress) are associated with a risk for stroke.

The responsibility for stroke prevention education (including prevention of recurrence) falls on each member of the stroke rehabilitation team.

Hemorrhage

Hemorrhagic strokes include subarachnoid and intracerebral hemorrhages, which account for only 13% of the total number of strokes.[4] This type of stroke has numerous causes. The four most common are deep hypertensive intracerebral hemorrhages, ruptured saccular aneurysms, bleeding from arteriovenous malformations, and spontaneous lobar hemorrhages.[60]

Related Syndromes

Cerebral anoxia and aneurysm can also result in hemiplegia. Some of the treatment approaches outlined in this chapter may be applicable to hemiplegia resulting from causes other than CVA or stroke, such as head injuries, neoplasms, and infectious diseases of the brain.

Transient Ischemic Attacks

Vascular disease of the brain can result in a completed stroke or in **transient ischemic attacks** (TIAs). A TIA is characterized by mild, isolated, or repetitive neurological symptoms that develop suddenly, last from a few minutes to several hours but not longer than 24 hours, and clear completely. A TIA is seen as a sign of an impending stroke.[4] Most TIAs occur in people with atherosclerotic disease. Of those who experience TIAs and do not seek treatment, an estimated one-third will sustain a completed stroke; another one-third will continue to have TIAs without a stroke; and one-third will experience no further attacks.[81] If the TIA is caused by extracranial vascular disease, surgical intervention to restore vascular flow (carotid endarterectomy) may be effective in preventing the stroke and resultant disability.

Effects of Stroke

The outcome of a stroke depends on which artery supplying the brain was involved (Fig. 33.1). Stroke diagnostic workups help localize the lesion and find a cause of the stroke. Techniques include cerebrovascular imaging such as computed tomography (CT), magnetic resonance imaging (MRI), and more recently, positron emission tomography (PET) and single-photon emission computed tomography (SPECT).[10] The information collected with these techniques (e.g., the extent of damage and location of the lesion) may help the occupational therapist identify neurological deficits that affect function. The information may also help the therapist develop hypotheses regarding recovery and plan appropriate treatment. Initial information may be collected during a medical record review that focuses on the chief complaint of the client on admission, previous medical and surgical history, results of diagnostic tests, and current pharmacologic management. The following section and Tables 33.1 and 33.2 explain patterns of impairment resulting from stroke in both the cortical and subcortical areas.

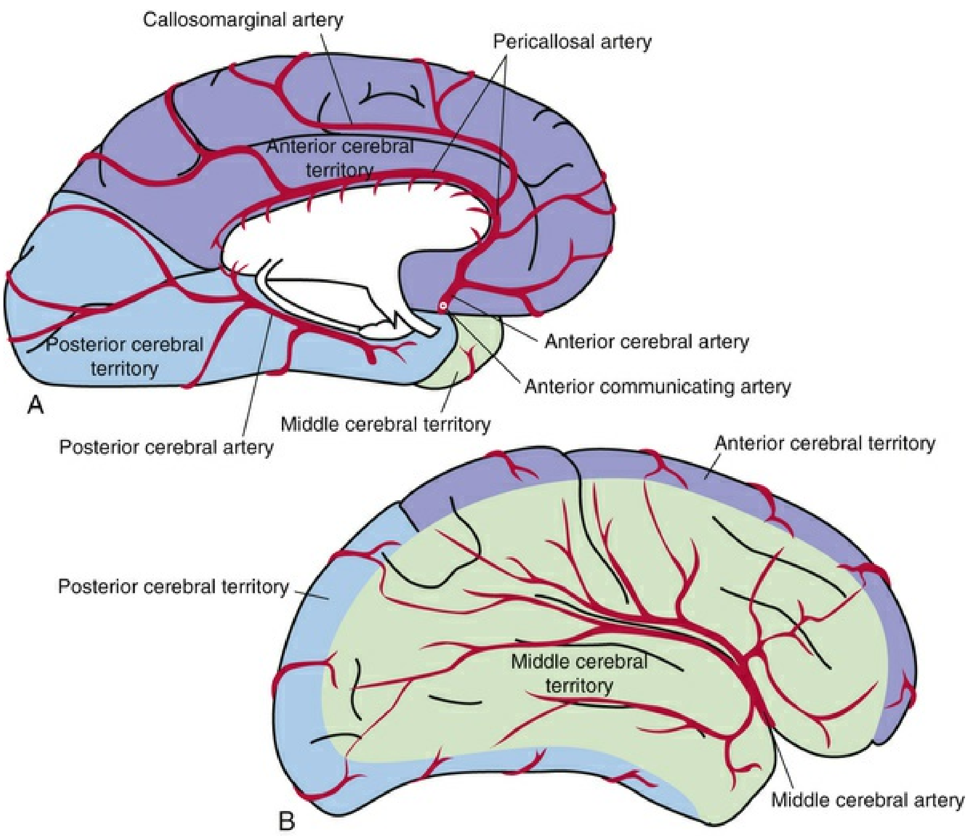
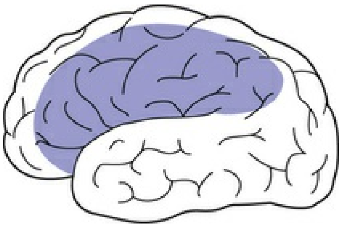
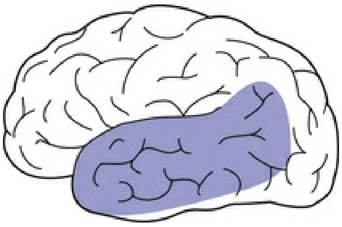
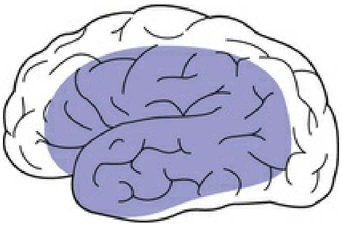
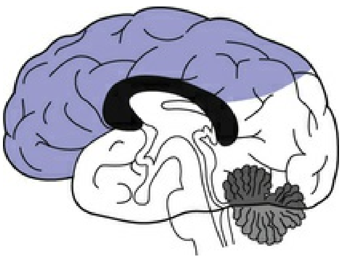
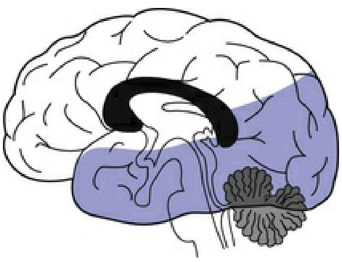


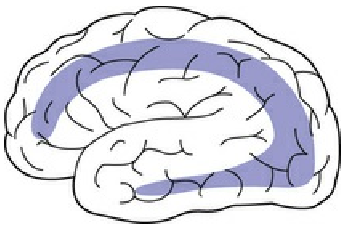
FIG 33.1 Blood supply to the brain. The middle cerebral, anterior cerebral, and posterior cerebral arteries supply blood to the cerebral hemispheres. A, Medial surface. B, Lateral surface. (Modified from Mettler FA: *Neuroanatomy,* ed 2, St Louis, 1948, Mosby. In Vanderah T, Gould D, editors: *Nolte's the human brain: an introduction to its functional anatomy,* ed 7, Philadelphia, 2016, Elsevier.)

TABLE 33.1

Cerebral Artery Dysfunction: Cortical Involvement and Patterns of Impairment

Artery	Location	Possible Impairments
Middle cerebral artery: upper trunk	Lateral aspect of the frontal and parietal lobe	• Dysfunction of either hemisphere: • Contralateral hemiplegia, especially of the face and upper extremity • Contralateral hemisensory loss • Visual field impairment • Poor contralateral conjugate gaze • Ideational apraxia • Lack of judgment • Perseveration

		• Field dependency • Impaired organization of behavior • Depression • Lability • Apathy • Right hemisphere dysfunction: • Left unilateral body neglect • Left unilateral visual neglect • Anosognosia • Visuospatial impairment • Left unilateral motor apraxia • Left hemisphere dysfunction: • Bilateral motor apraxia • Broca's aphasia • Frustration
Middle cerebral artery: lower trunk 	Lateral aspect of the right temporal and occipital lobes	• Dysfunction of either hemisphere: • Contralateral visual field defect • Behavioral abnormalities • Right hemisphere dysfunction: • Visuospatial dysfunction • Left hemisphere dysfunction: • Wernicke's aphasia
Middle cerebral artery: both upper and lower trunks 	Lateral aspect of the involved hemisphere	• Impairments related to both upper and lower trunk dysfunction, as listed in previous two sections
Anterior cerebral artery 	Medial and superior aspect of the frontal and parietal lobes	• Contralateral hemiparesis, greatest in the foot • Contralateral hemisensory loss, greatest in the foot • Left unilateral apraxia • Inertia of speech or mutism • Behavioral disturbances
Internal carotid artery	Combination of the middle cerebral artery distribution and anterior cerebral artery	• Impairments related to dysfunction of the middle and anterior cerebral arteries, as listed in previous sections
Anterior choroidal artery (a branch of the internal carotid artery)	Globus pallidus, lateral geniculate body, posterior limb of the internal capsule, medial temporal lobe	• Hemiparesis of the face, arm, and leg • Hemisensory loss • Hemianopia
Posterior cerebral artery 	Medial and inferior aspects of the right temporal and occipital lobes, posterior corpus callosum, and penetrating arteries to the midbrain and thalamus	• Dysfunction of either side: • Homonymous hemianopia • Visual agnosia (visual object agnosia, prosopagnosia, color agnosia) • Memory impairment • Occasional contralateral numbness • Right-sided dysfunction: • Cortical blindness • Visuospatial impairment • Impaired left-right discrimination • Left-sided dysfunction: • Finger agnosia • Anomia • Agraphia • Acalculia • Alexia
Basilar artery, proximal	Pons	• Quadriparesis • Bilateral asymmetric weakness • Bulbar or pseudobulbar paralysis (bilateral paralysis of the face, palate, pharynx, neck, or tongue) • Paralysis of the eye abductors • Nystagmus • Ptosis • Cranial nerve abnormalities • Diplopia • Dizziness • Occipital headache • Coma
Basilar artery, distal	Midbrain, thalamus, and caudate nucleus	• Papillary abnormalities • Abnormal eye movements • Altered level of alertness

		• Coma • Memory loss • Agitation • Hallucination
Vertebral artery	Lateral medulla and cerebellum	• Dizziness • Vomiting • Nystagmus • Pain in ipsilateral eye and face • Numbness in face • Clumsiness of ipsilateral limbs • Hypotonia of ipsilateral limbs • Tachycardia • Gait ataxia
Systemic hypoperfusion 	Watershed region on the lateral side of the hemisphere, hippocampus, and surrounding structures in the medial temporal lobe	• Coma • Dizziness • Confusion • Decreased concentration • Agitation • Memory impairment • Visual abnormalities caused by disconnection from the frontal eye fields • Simultanagnosia • Impaired eye movements • Weakness of shoulder and arm • Gait ataxia

From Gillen G, editor: *Stroke rehabilitation: a function-based approach,* ed 3, St Louis, 2011, Mosby.

TABLE 33.2

Cerebrovascular Dysfunction in Noncortical Areas: Patterns of Impairment

Location	Possible Impairments
Anterolateral thalamus	• Either side: • Minor contralateral motor abnormalities • Long latency period • Slowness • Right side: • Visual neglect • Left side: • Aphasia
Lateral thalamus	• Contralateral hemisensory symptoms • Contralateral limb ataxia
Bilateral thalamus	• Memory impairment • Behavioral abnormalities • Hypersomnolence
Internal capsule or basis pontis	• Pure motor stroke
Posterior thalamus	• Numbness or decreased sensibility of the face and arm • Choreic movements • Impaired eye movements • Hypersomnolence • Decreased consciousness • Decreased alertness • Right side: • Visual neglect • Anosognosia • Visuospatial abnormalities • Left side: • Aphasia • Jargon aphasia • Good comprehension of speech • Paraphasia • Anomia
Caudate	• Dysarthria • Apathy • Restlessness • Agitation • Confusion • Delirium • Lack of initiative • Poor memory • Contralateral hemiparesis • Ipsilateral conjugate deviation of the eyes
Putamen	• Contralateral hemiparesis • Contralateral hemisensory loss • Decreased consciousness • Ipsilateral conjugate gaze • Motor impersistence • Right side: • Visuospatial impairment • Left side: • Aphasia
Pons	• Quadriplegia • Coma • Impaired eye movement
Cerebellum	• Ipsilateral limb ataxia • Gait ataxia • Vomiting • Impaired eye movements

From Gillen G, editor: *Stroke rehabilitation: a function-based approach,* ed 3, St Louis, 2011, Mosby.

Internal Carotid Artery

In the absence of adequate collateral circulation, occlusion of the internal carotid artery results in contralateral hemiplegia, hemianesthesia, and homonymous hemianopia.[6,10] Additionally, involvement of the dominant hemisphere (i.e., the cerebral hemisphere containing the representation of speech/language and controlling the arm and leg used preferentially in skilled movements, usually the left hemisphere) is associated with aphasia, agraphia or dysgraphia, acalculia or dyscalculia, right-left confusion, and finger agnosia. Involvement of the nondominant hemisphere is associated with visual perceptual dysfunction, unilateral neglect, anosognosia, constructional or dressing apraxia, attention deficits, and loss of topographic memory.

Middle Cerebral Artery

Involvement of the middle cerebral artery (MCA) is the most common cause of stroke.[7,10,21] Ischemia in the area supplied by the MCA results in contralateral hemiplegia with greater involvement of the arm, face, and tongue; sensory deficits; contralateral homonymous hemianopia; and aphasia if the lesion is in the language-dominant hemisphere. There is pronounced deviation of the head and neck toward the side on which the lesion is located during the initial phase of the stroke.[22,31] Perceptual deficits, such as anosognosia, unilateral neglect, impaired vertical perception, visual spatial deficits, and perseveration, are seen if the lesion is in the nondominant hemisphere.[6]

Anterior Cerebral Artery

Occlusion of the anterior cerebral artery (ACA) produces contralateral lower extremity weakness that is more severe than that of the arm. Apraxia, mental changes, primitive reflexes, and bowel and bladder incontinence may be present. Total occlusion of the ACA results in contralateral hemiplegia with severe weakness of the face, tongue, and proximal arm muscles and marked spastic paralysis of the distal end of the lower extremity. Cortical sensory loss is present in the lower extremity. Intellectual changes, such as confusion, disorientation, abulia, whispering, slowness, distractibility, limited verbal output, perseveration, and amnesia, may be seen.[6,10]

Posterior Cerebral Artery

The scope of posterior cerebral artery (PCA) symptoms is potentially broad and varied because this artery supplies the upper brainstem region and the temporal and occipital lobes. Possible results of PCA involvement depend on the arterial branches affected and the extent and area of cerebral compromise. Some possible outcomes are sensory and motor deficits, involuntary movement disorders (e.g., hemiballism, postural tremor, hemichorea, hemiataxia, and intention tremor), memory loss, alexia, astereognosis, dysesthesia, akinesthesia, contralateral homonymous hemianopia or quadrantanopia, anomia, topographic disorientation, and visual agnosia.[6,10,31]

Cerebellar Artery System

Occlusion of the cerebellar artery results in ipsilateral ataxia, contralateral loss of pain and temperature sensitivity, ipsilateral facial analgesia, dysphagia and dysarthria caused by weakness of the ipsilateral muscles of the palate, nystagmus, and contralateral hemiparesis.[6,10,22,31]

Vertebrobasilar Artery System

A stroke in the vertebrobasilar artery system affects brainstem functions. The outcome of the stroke is some combination of bilateral or crossed sensory and motor abnormalities, such as cerebellar dysfunction, loss of proprioception, hemiplegia, quadriplegia, and sensory disturbances, along with unilateral or bilateral involvement of cranial nerves III to XII.

Medical Management

Specific treatment of stroke depends on the type and location of the vascular lesion, the severity of the clinical deficit, concomitant medical and neurological problems, the availability of technology and personnel to administer special types of treatment, and the cooperation and reliability of the client.

Early medical treatment involves maintenance of an open airway, hydration with intravenous fluids, and treatment of hypertension. Appropriate steps should be taken to evaluate and treat coexisting cardiac or other systemic diseases. Measures should be taken to prevent the development of deep venous thrombosis (DVT). DVT is the formation of a blood clot (thrombus) in a deep vein, usually in the lower extremity, a common risk in clients who have prolonged periods of bed rest and immobility. The incidence of DVT in individuals with stroke ranges from 22% to 73%. Emboli that are released from deep veins and subsequently lodge in the lungs are referred to as pulmonary emboli. Pulmonary embolism is the most common cause of death in the first 30 days after a stroke.[10,20]

The physician oversees routine surveillance for thrombosis, which includes daily evaluation of leg temperature, color, circumference, tenderness, and appearance. Preventive treatments for DVT may involve medication, the use of elastic stockings, the use of reciprocal compression devices, and early mobilization of the client.

Respiratory problems and pneumonia may complicate the early post-stroke course. The National Survey of Stroke reported that one-third of clients who had sustained strokes also had respiratory infections.[80]

Symptoms are a low-grade fever and increased lethargy. Medical management involves the administration of fluids and antibiotics, aggressive pulmonary hygiene, and mobilization of the client. Ventilatory insufficiency is a major factor contributing to the high frequency of pneumonia. The hemiparesis associated with stroke involves the muscles of respiration. Exercise programs that involve strengthening and endurance training of both the inspiratory and expiratory muscles help improve breathing and cough effectiveness and reduce the frequency of pneumonia.[20]

Cardiac disease is another frequently occurring condition that complicates the post-stroke course. The stroke itself may cause the cardiac abnormality, or the client may have had a preexisting cardiac condition. The former is treated in the same manner as any new cardiac diagnosis. A preexisting cardiac condition is reevaluated and the treatment regimen modified as appropriate. Monitoring of the heart rate and blood pressure, in addition to an electrocardiogram (ECG) during self-care evaluations, is frequently indicated to determine the cardiac response to activity.

During the acute phase, bowel and bladder dysfunction is common. The physician is responsible for ordering a specific bowel program that includes a time schedule, adequate fluid intake, stool softeners, suppositories, oral laxatives, and medications or procedures to treat fecal impaction. A timed or scheduled toilet program is essential in treating urinary incontinence. Catheterization may be necessary during stroke rehabilitation.

Evaluation and Intervention Procedures for Clients Who Sustained a Stroke

Tables 33.1 and 33.2 provide information related to patterns of impairments that are typically observed and that vary depending on the area of the brain that has been damaged. The location of the stroke is determined by CT or MRI and is generally documented in the medical record. Understanding this information is the first step of the evaluation process; it should take place before the OT practitioner meets the client because it helps the therapist focus his or her evaluation procedures and begin to understand which client factors are impaired and affecting performance in areas of occupation.

For example, Jasmine has documented damage in her right frontal and parietal lobes (most likely secondary to MCA occlusion). Patterns of impairment that are typically observed with this type of stroke include contralateral motor loss, contralateral sensory loss, difficulty interpreting spatial relationships (e.g., depth/distance, foreground from background), decreased attention or neglect of left-sided information (personal and extrapersonal), and left limb motor-planning deficits. These impairments may in turn affect Jasmine's ability to engage in meaningful areas of occupation. Her sensory-motor loss may prevent her from fulfilling her role as a mother (e.g., assisting her child in the bath, lifting her son into the crib, preparing meals) and as a worker (e.g., typing, filing). Simultaneously, her attention deficits (left-sided neglect) will make driving unsafe, interfere with self-care and care of her child, affect her computer use (e.g., finding information on the left side of the screen), and impede her ability to manage her household (e.g., read and write bills and checks, prepare meals.)

Typically, a client's clinical findings immediately after a stroke (the acute stage) represent the worst-case scenario. In other words, once the stroke is complete and the client who sustained the stroke has been medically stabilized, the lesion is considered static or not progressive. At this point, a client who sustained a stroke may exhibit little or no contralateral motor function (hemiparesis or hemiplegia) because of severe weakness, no response to contralateral sensory stimuli, and a severe attention deficit; the client may also require assistance performing his or her job. Fortunately, barring another neurological insult, the client is usually expected to improve from both a neurological and functional perspective. Unfortunately, predicting the amount of improvement and the length of time necessary for improvement to take place is difficult. Clinicians generally agree that the first 3 to 6 months after a stroke is the most crucial time and that the greatest improvement takes place during this period. This time frame remains controversial and should be used only as a guideline. For example, more studies[87] have documented improvements in upper extremity (UE) function in clients who sustained a stroke many years earlier. It is important to note that some clients may recover only slightly and slowly, whereas others may recover fully.

Given this information, it is important to understand that neurological recovery and functional recovery are different aspects to consider. An example of **motor control** (i.e., the process that must be performed to achieve movement) will be used to illustrate this point. Clients A and B may share similar findings (no motor function on the left side of the body) immediately after experiencing a stroke. Client A may recover substantial motor function and resume engagement in previous occupations, such as shopping and dressing, with few residual impairments (perhaps a "limp" or mild clumsiness) resulting from the stroke. Client B may not benefit from the same level of neurological motor recovery and yet still be able to resume engagement in previous occupations by using adaptive methods. Dressing may require learning new one-handed techniques, wearing clothing with a looser fit, and using equipment such as a reacher. Shopping may be accomplished with the use of powered mobility (e.g., scooter or wheelchair), an ankle-foot orthotic and a cane, or the Internet. Despite these differences, both client A and client B are able to participate in meaningful occupations.

Client-Centered Assessments

Law et al[68], involved with the development of the Canadian Occupational Performance Measure (COPM), stated:

Client-centered practice *is an approach to providing occupational therapy which embraces a philosophy of respect for, and partnership with, people receiving services. Client-centered practice recognizes the autonomy of individuals, the need for client choice in making decisions about occupational needs, the strengths clients bring to a therapy encounter, the benefits of client-therapist partnership, and the need to ensure that services are accessible and fit the context in which a client lives.*

Both Law et al.[64] and Pollack[76] suggest that therapists implementing this approach to evaluation include the following concepts:

1. Recognize that recipients of OT are uniquely qualified to make decisions about their occupational functioning

2. Offer the client a more active role in defining goals and desired outcomes

3. Make the client-therapist relationship an interdependent one to enable the solution of performance dysfunction

4. Shift to a model in which occupational therapists work with clients to enable them to meet their own goals

5. Focus the evaluation (and intervention) on the contexts in which clients live, their roles and interests, and their culture

6. Allow the client to be the "problem definer" so that he or she will in turn become the "problem solver"

7. Allow the client to evaluate his or her own performance and set personal goals

Through the use of these strategies, the evaluation process becomes more focused and defined, clients become immediately empowered, the goals of therapy are understood and agreed on, and a client-tailored treatment plan may be established. The COPM[65] is a standardized tool that uses a client-centered approach to allow the recipient of treatment to identify areas of difficulty, rate the importance of each area, and rate his or her satisfaction with current performance. It is a particularly useful tool to use with clients who sustained a stroke because of the multiple and extensive problems that this population experiences in performance of areas of occupation.

The COPM would be a good assessment to use with Jasmine. It would give the occupational therapist insight into the occupations that should be prioritized, assist in goal writing, and facilitate treatment planning. In addition, use of the COPM would empower Jasmine as an active participant in the rehabilitation process. Jasmine completed the COPM, and the results identified toilet transfers, computer use, grooming, feeding, and child care as the occupations that she wanted to pursue first; in other words, these occupations would be the focus of her initial OT. Jasmine indicated that gaining mastery in the occupations would make her feel better about herself ("boost my self-esteem") and give her hope that she could return to work ("and provide for my child").

Top-Down Approach to Assessment

A **top-down approach to assessment** has been described in the literature[95] and is applicable to the evaluation of clients who sustained a stroke. Principles of this approach include the following:

1. Inquiry into role competency and meaningfulness is the starting point for evaluation.

2. Inquiry is focused on the roles that are important to the client who sustained a stroke, particularly those in which the client was engaged before the stroke.

3. Any discrepancy of roles in the past, present, or future is identified to help determine a treatment plan.

4. The tasks that define the person are identified, in addition to whether those tasks can be performed and the reasons that the tasks are problematic.

5. A connection is determined between the components of function and occupational performance.

A top-down approach to evaluation is in contrast to a bottom-up approach, which first focuses on dysfunction of client factors.[95]

Effects of Neurological Deficits on Performance in Areas of Occupation

Using activity analysis and keen observation allows therapists to identify errors during task performance and to analyze the errors and determine the underlying deficits blocking independent functioning. Árnadóttir states that:

> *Therapists can benefit from detecting errors in occupational performance while observing ADL and thereby gain an understanding of the impairments affecting the patient's activity limitation. Therapists can use the information based on observed task performance in a systematic way as a structure for clinical reasoning to help them assess functional independence related to the performance and to subsequently detect impaired neurological body functions. Such information can be important when intervention methods are aimed at addressing occupational errors[6] (Fig. 33.2).*

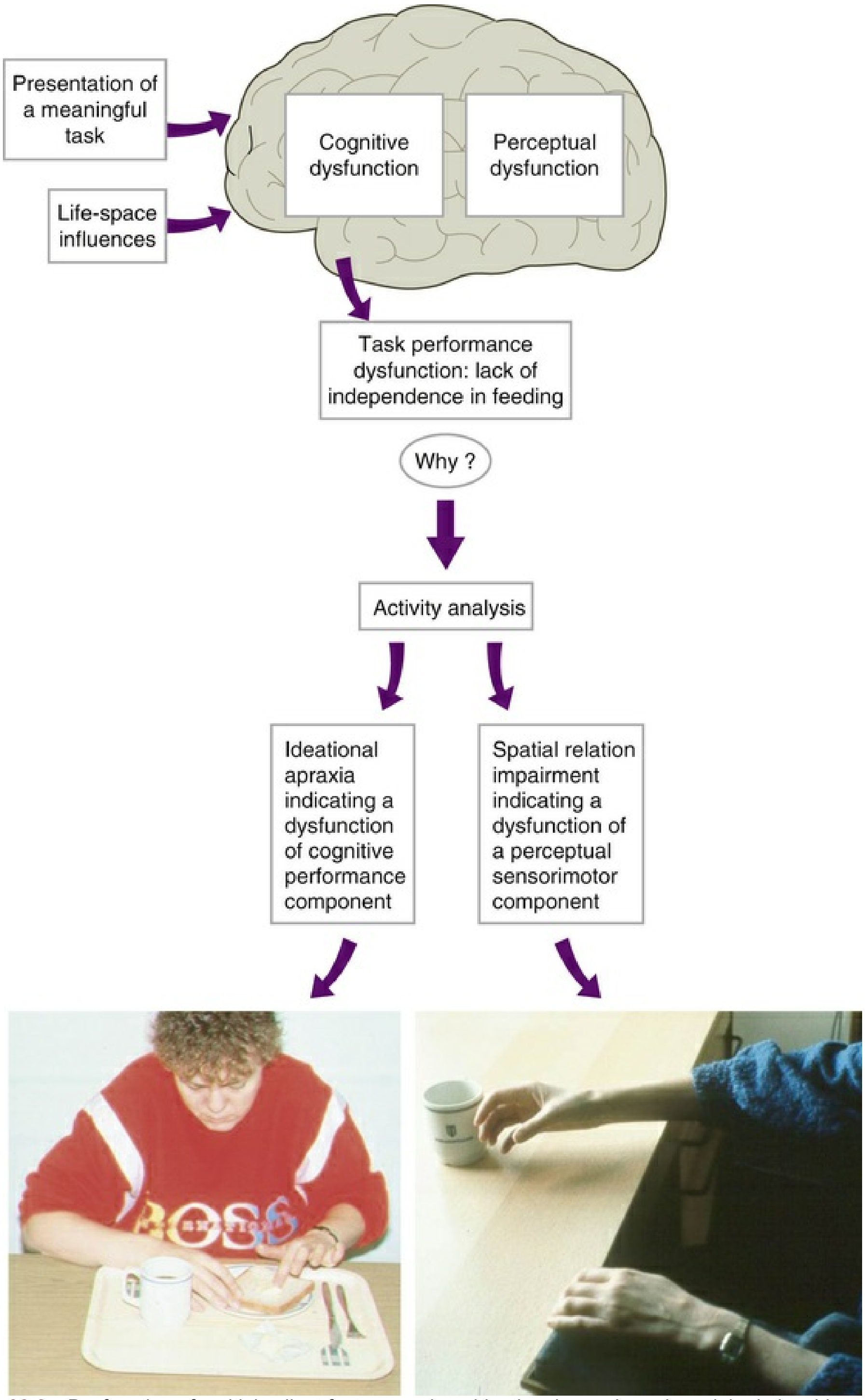


FIG 33.2 Dysfunction of multiple client factors, such as ideational apraxia and spatial relationships, can be revealed by activity and error analysis during functional tasks such as feeding. (Modified from Árnadóttir G: *The brain and behavior: assessing cortical dysfunction through activities of daily living,* St Louis, 1990, Mosby.)

Because performance of a single functional task (e.g., donning a shirt) requires the use of multiple underlying client factors and performance skills that may have been affected by a stroke, multiple variables may be evaluated in the context of one client-chosen activity (Fig. 33.3).[6,7]

Possible behavioral deficits interfering with function

Premotor perseveration: pulling up sleeve

Spatial-relation difficulties: differentiating front from back on shirt

Spatial-relation difficulties: getting an arm into the right armhole

Unilateral spatial neglect: not seeing shirt located on neglected side (or a part of the shirt)

Unilateral body neglect: not dressing the neglected side or not completing the dressing on that side

Comprehension problem: not understanding verbal information related to performance

Ideational apraxia: not knowing what to do to get shirt on or not knowing what the shirt is for

Ideomotor apraxia: having problems with the planning of finger movements in order to perform

Tactile agnosia (astereognosis): having trouble buttoning shirt without watching the performance

Organization and sequencing: dressing the unaffected arm first getting into trouble with dressing the affected arm; inability to continue the activity without being reminded

Lack of motivation to perform

Distraction: becomes interrupted by other things

Attention deficit: difficulty attending to task and quality of performance

Irritated or frustrated when having trouble performing or when not getting the desired assistance

Aggressive when therapist touches patient in order to assist her (tactile defensiveness)

Difficulties recognizing foreground from background or a sleeve of a unicolor shirt from the rest of the shirt

FIG 33.3 Possible behavioral deficits interfering with function while donning a shirt. (From Árnadóttir G: *The brain and behavior: assessing cortical dysfunction through activities of daily living*, St Louis, 1990, Mosby.)

Standardized Tools

Occupational therapists use assessment tools that are reliable, valid, and sensitive to change. In addition, assessment tools focused on task performance should be used. Tools that are focused on evaluation of client factors in isolation from performance of occupations, that use novel nonfunctional tasks, and that do not consider the effect of environmental context should be interpreted with caution. Tools are available to the occupational therapist that directly relate performance dysfunction observed during ADLs to the effect of underlying skills necessary for independent performance of activities.

The Arnadottir Occupational Therapy Neurobehavioral Evaluation[6,7] (A-ONE) objectively documents the way that dysfunction of client factors (e.g., left-sided neglect, apraxia, and spatial dysfunction) affects self-care and mobility tasks. The A-ONE has more recently been referred to as the ADL-focused Occupation-Based Neurobehavioral Evaluation.[8,9] The Assessment of Motor and Process Skills[40] (AMPS) uses predominantly instrumental activities of daily living (IADLs) to evaluate underlying performance skills related to the completion of various IADLs (e.g., reaching, grasping, and posture) and process skill dysfunction (e.g., using items and searching and locating). Table 33.3 provides a summary of standardized assessments used with clients who have sustained a stroke.

TABLE 33.3

Sample Assessments Used With Clients Who Sustained a Stroke

Instrument	Description and Use
Activity Card Sort (ACS)[12]	Uses a Q-sort methodology to assess participation in 80 instrumental, social, and high and low physical demand leisure activities. The cards have pictures of tasks people do every day, and clients sort the cards into different piles to identify activities they did before the stroke, activities they now do less often, and those they have given up since the stroke.
Arm Motor Ability Test (AMAT)[62]	Arm function evaluated by functional ability and quality of movement; test involves performance of 28 tasks (e.g., eating with a spoon, opening a jar, tying a shoelace, using the telephone)
Arnadottir Occupational Therapy Neurobehavioral Evaluation (A-ONE)[7]	Evaluates apraxias, neglect syndromes, body scheme disorders, organization/sequencing dysfunction, agnosias, and spatial dysfunction via basic activities of daily living (BADLs) and mobility tasks; directly correlates impairment and disability levels of dysfunction
Assessment of Motor and Process Skills[40]	Assessment tool covering 16 motor skills (e.g., reach, manipulation, calibration, coordination, posture, mobility) and 20 process skills (e.g., attends, organizes, searches and locates, initiates, sequences) that are evaluated within the context of client-chosen instrumental activities of daily living (IADLs) skills; clients choose familiar and culturally relevant tasks from a list of 50 standardized activities of various difficulties

Barthel Index[68]	Measure of disability in performing BADLs that ranges from 0 to 20 or 0 to 100 (by multiplying each item by 5); includes 10 items: bowels, bladder, feeding, grooming, dressing, transfer, toileting, mobility, stairs, and bathing
Beck Depression Inventory[13]	Self-rating scale of 21 items that has attitudinal, somatic, and behavioral components
Berg Balance Scale[14]	Balance assessment of 14 items scored on a 0- to 4-point ordinal scale
Boston Diagnostic Aphasia Examination[49]	Assesses sample speech and language behavior, including fluency, naming, word finding, repetition, serial speech, auditory comprehension, reading, and writing
Canadian Neurological Scale[30]	Stroke deficit scale that scores 8 items (e.g., consciousness, orientation, speech, motor function, facial weakness)
Canadian Occupational Performance Measure (COPM)[65]	Client-centered assessment tool based on clients' identification of problems in performance in areas of occupation (clients rate importance of self-care, productivity, and leisure skills and also their perception of performance and satisfaction with performance) Used as an outcome measure and a client satisfaction survey
Family Assessment Device[38]	Family assessment of problem solving, communication, roles, affective responsiveness, affective involvement, behavioral control, and general functioning
Frenchay Activities Index[54]	A 15-item scale for IADLs that evaluates domestic, leisure, work, and outdoor activities
Fugl-Meyer Test[43]	Motor function assessment that uses a 3-point scale to score the domains of pain, range of motion, sensation, volitional movement, and balance
Functional Independence Measure (FIM)[57]	Measure of disability in performing BADLs that includes 18 items scored on a 7-point scale; includes subscores for motor and cognitive function; performance areas include self-care, sphincter control, mobility, locomotion, cognition, and socialization
Functional Reach Test[37]	Balance evaluation; objectively measures length of forward reach in the standing posture
Functional Test for the Hemiparetic Upper Extremity[102]	Assessment of arm and hand function via 17 hierarchic functional tasks based on Brunnstrom's view of motor recovery; sample tasks are folding a sheet, screwing in a light bulb, stabilizing a jar, and zipping a zipper
Geriatric Depression Scale[106]	Self-rating depression scale of 30 items in a yes/no format
Glasgow Coma Scale[91]	Level of consciousness scale that includes 3 sections scoring eye opening, motor, and verbal responses to voice commands or pain
Jebsen Test of Hand Function[56]	Hand function evaluation; includes 7 test activities: writing a short sentence, turning over index cards, simulated eating, picking up small objects, moving empty and weighted cans, and stacking checkers during timed trials
Kohlman Evaluation of Living Skills (KELS)[92]	Living skills evaluation that includes ratings of 17 tasks (e.g., safety awareness, money management, phone book use, money and bill management)
Medical Outcomes Study/Short-Form Health Survey (SF-36)[101]	Quality of life measure that includes the domains of physical functioning, physical and emotional problems, social function, pain, mental health, vitality, and health perception
Mini-Mental State Examination[41]	Mental status screening test for orientation to time and place, registration of words, attention, calculation, recall, language, and visual construction
Motor Assessment Scale[25]	Motor function evaluation; includes disability and impairment measures, arm and hand movements, tone, and mobility (bed, upright, and ambulation)
Motricity Index[33]	Measures impairments in limb strength with a weighted ordinal scale
Neurobehavioral Cognitive Status Examination[59]	Mental status screening test that includes the domains of orientation, attention, comprehension, naming, construction, memory, calculation, similarities, judgment, and repetition
NIH Stroke Scale[23]	Stroke deficit scale that scores 15 items (e.g., consciousness, vision, extraocular movement, facial control, limb strength, ataxia, sensation, speech and language)
PCG Instrumental Activities of Daily Living[66]	IADL evaluation of telephone use, walking, shopping, food preparation, housekeeping, laundry, public transportation, and medication management
Rankin Scale[19]	Global disability scale with 6 grades indicating degrees of disability
Rivermead Mobility Index[29]	Uses a “pass” or “fail” scale to measure bed mobility, sitting, standing, transfers, and walking
Sickness Impact Profile[15]	Quality of life measure in the format of a 136-item scale with 12 subscales that measure ambulation, mobility, body care, emotion, communication, alertness, sleep, eating, home management, recreation, social interactions, and employment
Stroke Impact Scale[63]	A stroke-specific measure that incorporates function and quality of life into one measure. It is a self-report measure with 59 items and 8 subgroups, including strength, hand function, BADLs and IADLs, mobility, communication, emotion, memory and thinking, and participation.
TEMPA[34,35]	Upper extremity performance test composed of 9 standardized tasks (bilateral and unilateral) measured by 3 criteria: length of execution, functional rating, and task analysis; sample tasks are handling coins, picking up a pitcher and pouring water, writing and stamping an envelope, and unlocking a lock
Tinetti Test[93]	Evaluates balance and gait in the older adult population
Trunk Control Test[42]	Trunk control evaluated on a 0- to 100-point scale; tasks used include rolling, supine to sitting, and balanced sitting
Western Aphasia Battery[58]	Includes an “Aphasia Quotient” and a “Cortical Quotient,” scored on a 100-point scale; assesses spontaneous speech, repetition, comprehension, naming, reading, and writing

The A-ONE was used to objectively document the ways that Jasmine's various impairments (e.g., neglect, spatial relationship dysfunction, loss of motor control, and topographical disorientation) affected her ability to perform basic activities of daily living (BADLs) and mobility (e.g., bed mobility, transfers, wheelchair mobility, and walking when applicable). Errors observed and documented included not dressing the left side of her body, inability to locate grooming items on the left side of the sink, and difficulty dressing the lower part of her body and getting out of bed secondary to loss of motor control in her left limbs and trunk.

Adopting a Framework for Intervention

Therapists should consider overarching themes when deciding which interventions to use to address a client's inability to resume meaningful roles and successfully participate in chosen occupations. Evidence-based practice should serve as the foundation for all OT interventions. To be successful in this endeavor, practitioners must remain abreast of new and emerging research in the OT literature and in related fields. Review papers[a] and evidence-based libraries and search engines (e.g., the Cochrane Library) are sources of up-to-date information.

Over the past several years there has been a paradigm shift related to the intervention philosophies typically used with clients who sustained a stroke. In the past, sensorimotor approaches were used to treat individuals who sustained a stroke (see Chapter 31). These sensorimotor approaches were developed based on the understanding of the central nervous system (CNS) dysfunction at the time these clinicians were doing their research (mid-1900s). Although these interventions are commonly used, their effectiveness has been challenged as occupational therapists move toward models of evidence-based practice.[78] At present there is limited to no research to support these neurofacilitation approaches. Indeed, the Bobath approach (neurodevelopmental treatment [NDT]), although commonly used in the clinic, has not been shown to be superior to other treatment approaches and in fact is inferior to more current models of practice. For example, a large, nonrandomized, parallel-group study[52] ($N = 324$) compared the NDT approach with conventional treatment. Subjects were monitored for 12 months. The authors concluded that "the NDT approach was not found effective in the care of stroke patients in the hospital setting. Health care professionals need to reconsider the use of this approach."[52] Similarly, a systematic review of 16 studies involving 813 patients with stroke concluded that "there was no evidence of superiority of Bobath on sensorimotor control of upper and lower limb, dexterity, mobility, activities of daily living, health-related quality of life, and cost-effectiveness. Only limited evidence was found for balance control in favor of Bobath. This systematic review confirms that overall the Bobath concept is not superior to other approaches."[61]

In contrast, approaches that focus on the use of functional activities as the therapeutic change agent (e.g., **task-oriented approaches**) show promise from both a research and a clinical perspective.[69,70] A recent systematic review of task-oriented approaches concluded that "studies of task-related training showed benefits for functional outcome compared with traditional therapies. Active use of task-oriented training with stroke survivors will lead to improvements in functional outcomes and overall health-related quality of life."[79] The authors recommended "creating opportunities to practice meaningful functional tasks outside of regular therapy sessions."[79] A more recent evidence review concluded that "task-oriented training may be considered the foundation of interventions focused on improving occupational performance for those with motor impairment after stroke."[75] The authors further summarized that "commonalities among several of the effective interventions include the use of goal-directed, individualized tasks that promote frequent repetitions of task-related or task-specific movements."[75] One final note on the subject is that approaches focused on the use of functional tasks are more consistent with traditional and current principles of OT.[5]

Mathiowetz[69,70] outlined a series of intervention principles based on use of the OT task-oriented approach. These principles include the following:

- Help clients adjust to role and task performance limitations by exploring new roles and tasks.
- Create an environment that includes the common challenges of everyday life.
- Practice functional tasks or close simulations that have been identified as important by participants to find effective and efficient strategies for performance.
- Provide opportunities for practice outside therapy time (e.g., homework assignments).
- Minimize ineffective and inefficient movement patterns.

Functional Limitations Commonly Observed After Stroke

Multiple factors can impede effective and efficient performance of various tasks on which the client desires to focus during OT. The following sections review problem areas that are typically observed during work with clients who have sustained a stroke.

Inability to Perform Chosen Occupations While Seated

A commonly observed deficit after stroke is loss of trunk and postural control. Trunk and postural control may be considered a foundation for occupational performance. We require postural control to roll and get out of bed the first thing in the morning, feed a baby, sit at a desk to type, propel a wheelchair, eat, and so on. Impairment of trunk control may lead to the following problems[45]:

1. Dysfunction of limb control

2. Increased risk for falls

3. Impaired ability to interact with the environment

4. Visual dysfunction secondary to resultant head and neck malalignment

5. Symptoms of dysphagia secondary to proximal malalignment

6. Decreased independence in ADLs

Loss of trunk and postural control (i.e., "controlling the body's position in space for the dual purposes of stability and orientation"[82]) after a stroke may be manifested as an inability to sit in proper alignment, loss of righting and equilibrium reactions, inability to reach beyond the arm span because of lack of postural adjustments, and falling during attempts to function.

Clients who sustained a stroke and lose trunk control need to use the more functional UE for postural support to remain upright and prevent falls. In these cases the client effectively eliminates the ability to engage in ADLs and mobility tasks because lifting the more functional arm from the supporting surface can result in a fall. As Franchignoni et al.[42] noted, "Trunk control appears to be an obvious prerequisite for the control of more complex limb activities that in turn constitute a prerequisite to complex behavioral skills." Studies have found trunk control to be a predictor of gait recovery, sitting balance,[17] Functional Independence Measure (FIM) scores,[42] and scores on the Barthel Index[84] after a stroke.

Specific effects of a stroke on the trunk include the following:

1. Inability to perceive the midline as a result of spatial relationship dysfunction, leading to sitting postures that are misaligned from the vertical

2. Assumption of static postures that do not support engagement in functional activities (e.g., posterior pelvic tilt, kyphosis, lateral flexion)

3. Multidirectional trunk weakness[18]

4. Spinal contracture secondary to soft tissue shortening

5. Inability to move the trunk segmentally (i.e., the trunk moves as unit; examples of this phenomenon are clients using "logrolling" patterns during bed mobility and an inability to rotate the trunk while reaching for an item across the midline)

6. Inability to shift weight through the pelvis anteriorly, posteriorly, and laterally

Specific deficits in trunk control are evaluated during observation of task performance (Box 33.1). Observing tasks allows the therapist to evaluate trunk control in many directions (i.e., isometric, eccentric, and concentric control of the trunk muscle groups [extensors, abdominal muscles, and lateral flexors]) and the client's limits of stability. The phrase "limits of stability" refers to "boundaries of an area of space in which the body can maintain its position without changing the base of support"[87] or "an area about which the center of mass may be moved over any given base of support without disrupting equilibrium."[38] The therapist must differentiate between the client's perceived limits of stability and the actual limits of stability. After a stroke it is common to experience a disparity between the two because of body scheme disorder, fear of falling, or lack of insight into or awareness of disability. If the client's perceived limits are greater than his or her actual limits, there is a risk for falls. In other cases the client's perceived limits are less than the actual limits. In such instances the client will not attempt more dynamic activities or will rely too greatly on adaptive equipment.

Box 33.1

Trunk Control Evaluation During Task Performance: Examples of Postural Adjustments That Support Participation in Chosen Activities

Feeding

Anterior weight shift occurs to bring the upper part of the body toward the table, to prevent spillage of food from utensils, and to support a hand-to-mouth pattern.

Dressing

Lateral weight shift to one side of the pelvis occurs so that pants and underwear can be donned over the hips.

Oral Care

Anterior weight shift occurs so that saliva and toothpaste may be expectorated.

Transfer

The trunk extends with concurrent hip flexion to initiate a sit-to-stand transition.

Meal Preparation

The trunk flexes into gravity in a controlled fashion to support a reach pattern to the lower shelf of the refrigerator.

Treatment interventions aimed at increasing the client's ability to perform chosen tasks in seated postures include the following[45]:

1. Establishing a neutral yet active starting alignment (i.e., a position of readiness to function). This starting alignment (similar to a typist's posture) is a prerequisite to engaging the limbs in an activity. The desirable posture is as follows:

- Feet flat on the floor and bearing weight
- Equal weight bearing through both ischial tuberosities
- Neutral to slight anterior pelvic tilt
- Erect spine
- Head over the shoulders and shoulders over the hips

2. The client should attempt reaching activities from the previously described posture (Fig. 33.4).

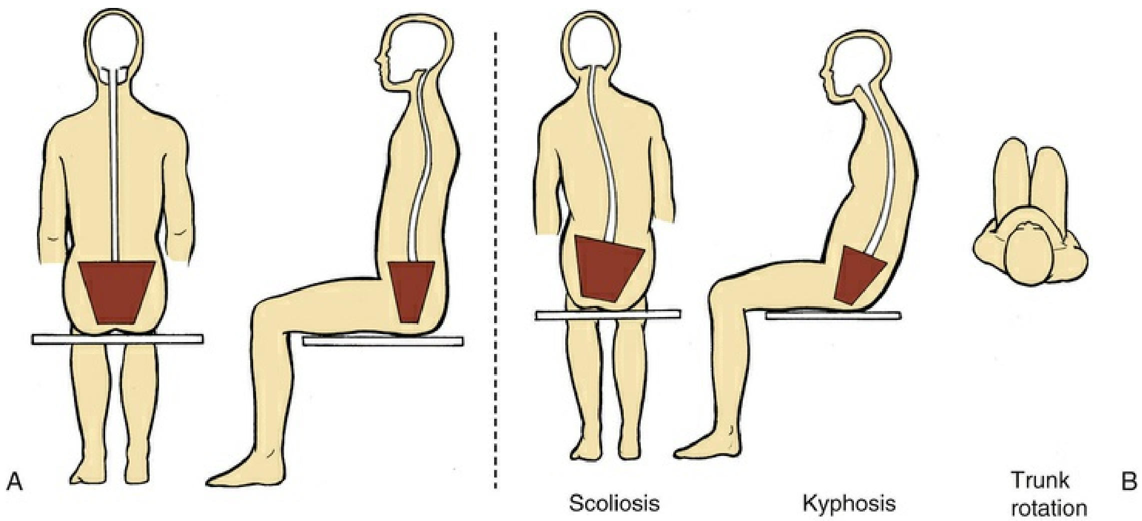


FIG 33.4 Normal (A) and post-stroke (B) sitting alignment. (From Donato SM, Pulaski KH: Overview of balance impairments: functional implications. In Gillen G, editor: *Stroke rehabilitation: a function-based approach,* ed 4, St Louis, 2016, Mosby.)

3. Establishing the ability to maintain the trunk in the midline by using external cues. Many clients have difficulty assuming and maintaining the correct posture. The therapist can provide verbal feedback (e.g., "Sit up nice and tall"). Visual feedback (e.g., using a mirror or the therapist assuming the same postural misalignment as the client) may be helpful. Environmental cues may be used to correct the posture. For example, the client may be instructed to maintain contact between the shoulder and an external target such as a bolster or wall, positioned so that the trunk is in the correct posture.

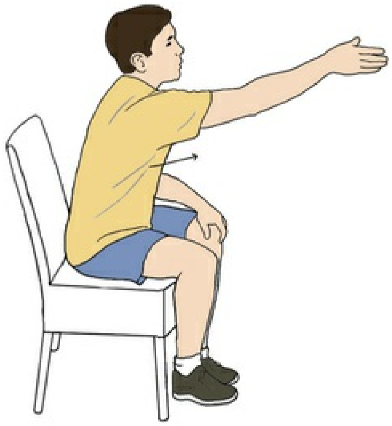
4. Maintaining trunk range of motion (ROM) by wheelchair and armchair positioning that maintains the trunk in proper alignment. The therapist can provide an exercise program focused on trunk ROM and flexibility. Activities that elicit the desired movement patterns can be chosen, and hands-on mobilization of the trunk can be used if needed. Types of trunk ROM that should be addressed include flexion, extension, lateral flexion, and rotation.

5. Prescribing dynamic weight-shifting activities to allow practice of weight shifts through the pelvis. The most effective way to train the client in weight shifts is to coordinate the trunk and limbs. Randomized controlled trials have confirmed that sitting training protocols that involve practice in reaching tasks beyond arm's length significantly improve function.[32] Successfully engaging in meaningful occupations that require reach beyond the span of either arm requires clients to adjust their posture. The client is encouraged to reach beyond arm span in all directions while seated (preferably while reaching for an object) and to analyze the corresponding postural adjustment of the pelvis and trunk. The position and goal of the task will dictate the required weight shift (Table 33.4).

TABLE 33.4

Effects of Object Positioning on Trunk Movements and Weight Shifts During Reaching Activities*

Position of Object	Trunk Response/Weight Shift
Straight ahead at the forehead level, past arm's length	• Trunk extension, anterior pelvic tilt • Anterior weight shift

	
On the floor, between the feet 	• Trunk flexion • Anterior weight shift
To the side at the shoulder level, past arm's length 	• Left trunk shortening, right trunk elongation, left hip hiking • Weight shift to the right
On the floor, below the right hip 	• Right trunk shortening, left trunk elongation

Behind the right shoulder, at arm's length 	• Trunk extension and rotation (right side posteriorly) • Weight shift to the right
At shoulder level, to the left of the left shoulder 	• Trunk extension and rotation (left side posteriorly) • Weight shift to the left
On floor, to left of left foot 	• Trunk flexion and rotation (left side posteriorly) • Weight shift to the left
Above the head, directly behind	• Trunk extension, shoulders move behind the hips • Posterior weight shift

*These examples are for a patient with left hemiplegia. The left-hand column indicates where to position objects during a reaching task (with the right upper extremity). The right-hand column indicates the resultant trunk position and weight shift.

From Gillen G, editor: *Stroke rehabilitation: a function-based approach,* ed 4, St Louis, 2016, Mosby.

6. Strengthening the trunk, best achieved by tasks that require the client to control the trunk against gravity. Some examples are bridging the hips in the supine position to strengthen the back extensors and initiating a roll with the arm and upper part of the trunk to strengthen the abdominal muscles. Strengthening occurs within the context of an activity.

7. Using compensatory strategies and environmental adaptations when trunk control does not improve to a sufficient level and the client is at risk for injury. Examples of interventions include wheelchair seating systems (e.g., lateral supports, lumbar rolls, chest straps, tilt-in-space frames with head supports) and adaptive ADL equipment (e.g., reachers, long-handled equipment) to decrease the amount of required trunk displacement (see Chapter 10).

For Jasmine, therapy first focused on her ability to keep her trunk stable (i.e., not moving) while using her limbs to engage in occupations. Occupations that do not require substantial weight shifting while sitting (e.g., hair care, upper body washing, feeding, card playing) were chosen first, followed by those that required progressively more weight shifting in all directions (e.g., wiping after use of the toilet, lower body dressing, scooting, reaching to the floor to pick up shoes, washing her feet). As needed, the therapist provided external support at Jasmine's shoulders during these activities to increase her confidence, prevent falls, and provide necessary support to compensate for Jasmine's weakness. As Jasmine improved, more challenging seated activities were chosen and external support was diminished.

Inability to Engage in Chosen Occupations While Standing

An inability to assume and maintain a standing posture has a significant effect on the type of activities in which a person may engage; it may also play a significant role in the eventual discharge destination for a hospitalized client recovering from a stroke. Impaired upright control has been correlated with an increased risk for falls[105] and with less than optimal functional outcomes[69] on the Barthel Index. Because many BADLs and IADLs, work, and leisure skills require control of standing postures, early training in upright control is a necessary component of stroke rehabilitation programs. **Postural strategies** (e.g., ankle, hip, and stepping strategies) are typically impaired after a stroke.

Similar to the deficits seen while sitting, upright standing postures are characterized by asymmetric weight distribution; unlike deficits occurring while sitting, the weight distribution while standing is seen through the lower extremities,[105] in addition to the trunk. Clients who sustained a stroke often experience an inability to bear weight through the affected leg. Reasons for this disability include fear of falling or buckling of the knee, patterns of weakness that will not support the weight of the body, spasticity impeding proper alignment (i.e., plantar flexion spasticity that effectively blocks **weight bearing** through the sole of the foot),[44] and perceptual dysfunction.

In addition to asymmetry and an inability to bear weight or shift weight through the affected leg, many clients who have sustained a stroke lose upright postural control and balance strategies.

Effective upright control depends on the following automatic postural reactions.[36,87,88]

1. Ankle strategies are used to maintain the center of mass over the base of support when movement is centered on the ankles. These strategies control small, slow, swaying motions, such as standing in a movie line, engaging in conversations while standing, and stirring a pot on a stovetop. They are most effective when the support surface (e.g., floor) is firm and longer than the foot. Ankle weakness, loss of ankle ROM, and proprioceptive deficits may all contribute to ineffective ankle strategies and balance.

2. Hip strategies are used to maintain or restore equilibrium. These strategies are used specifically in response to larger, faster perturbations, when the support surface is compliant, or when the surface is smaller than the feet (e.g., walking on a beam).[55]

3. A stepping strategy is used when ankle and hip strategies are ineffective or are perceived to be ineffective. This strategy results in movement of the base of support toward the center of mass movement. A step is taken to widen the base of support. Tripping over an uneven sidewalk or standing on a bus that unexpectedly stops elicits this strategy.

Both loss of postural reactions and an inability to bear and shift weight onto the affected leg will result in such functional limitations as gait deviations or dysfunction; an inability to climb stairs, transfer, and perform upright BADLs and IADLs; and an increased risk for falls. The assessment process provides the therapist with more specific information regarding the cause of the dysfunction. As Donato et al.[36] noted:

Specifically, therapists should observe what happens when patients have to move their center of mass over their base of support, move their head, stand on uneven surfaces, function in lower lighting, move from one type of surface to another, or function on a narrower base of support. Therapists should also observe patients' postural alignment, whether a bias in posture exists and in which direction that bias occurs, patients' limits of stability, the width between their feet during functional tasks, and what patients do after losing their balance.

Treatment strategies aimed at improving the patient's ability to perform chosen tasks in standing postures include the following[36,87,105]:

1. Establishing a symmetric base of support and proper alignment to prepare to engage in occupations. This starting alignment is assumed to provide ample proximal stability and to support engagement in functional tasks. The therapist may use hands-on support or visual or verbal feedback to establish proper alignment as follows:

- Feet approximately hip width apart
- Equal weight bearing through the feet
- Neutral pelvis
- Both knees slightly flexed
- Aligned and symmetric trunk

2. Establishing the ability to bear and shift weight through the more affected lower extremity.[36] The ability to bear weight may be graded at first. For example, if a client cannot assume a standing position because of postural insecurity or imbalance, sitting on a high surface (e.g., stool or raised therapy mat) allows the client to begin to bear weight but does not require bearing full body weight. As the client improves, full standing is encouraged, followed by graded weight shifts and progression to full weight bearing on the affected leg. For example, a modified soccer activity

requires the client to fully shift weight to kick the ball. The environment (e.g., work surface height and placement of objects) is manipulated in conjunction with the client's positioning to elicit the required weight shift.

3. Encouraging dynamic reaching activities in multiple environments to develop task-specific weight-shifting abilities. For example, kitchen activities that necessitate retrieval of cleaning supplies under the sink, in a broom closet, and in overhead cabinets require mastery of multiple postural adjustments and balance strategies.

4. Using the environment to grade task difficulty and provide external support. Proper use of the environment can decrease the client's fear of falling and simultaneously improve confidence and challenge underlying balance skills. Examples include working in front of a high countertop, using one hand for bearing weight as a postural support, and using a walker for support. The client must not rely too much on external supports because balance strategies may not be fully challenged to reach optimal recovery.

5. Training upright control within the context of the functional tasks that are graded. Tasks are graded in relation to the length of required reach, speed, and progressively more challenging bases of support. Examples include making a bed, changing a pet's food bowl, setting a table, stepping up on a curb, cleaning a wall mirror, playing horseshoes or shuffleboard, and doffing slippers in a standing posture. All these activities require shifting of body weight, balance strategies, and the ability to bear weight through both lower extremities. The choice of activity is driven by the client's desires, and the therapist designs positioning and setup of the activity to elicit the desired postural strategies (Fig. 33.5).

FIG 33.5 Activity is positioned to elicit the desired postural strategies. (From Donato SM, Pulaski KH: Overview of balance impairments: functional implications. In Gillen G, editor: *Stroke rehabilitation: a function-based approach,* ed 4, St Louis, 2016, Mosby.)

Jasmine was quickly engaged in activities that required standing despite persistent issues related to sitting balance. Standing was first attempted in front of stable work surfaces (e.g., kitchen counter, sink) to provide a balance point, increase Jasmine's feeling of security and safety, and highlight the functional relevance of standing. As needed, the therapist stabilized the weak joints (e.g., hip and knee) with manual support, and Jasmine wore an ankle-foot orthotic to protect the integrity of her ankle. As Jasmine improved, she was asked to begin to use the upper part of her body for function while controlling her standing. Examples include wiping the counter, organizing a shelf, and grooming while standing. Progressively more demanding occupations from a standing balance perspective were chosen (e.g., modified games, such as volleyball and Wii tennis;

vacuuming; emptying a dishwasher; and stand-pivot transfers), and external manual and environmental support was decreased as Jasmine improved. All occupations were chosen to improve Jasmine's ability to accept and shift weight through her left lower extremity.

Inability to Communicate Secondary to Language Dysfunction

Stroke may result in a wide variety of speech or language disorders, ranging from mild to severe. These deficits occur most frequently with stroke resulting from damage to the left hemisphere of the brain. They can also occur less frequently after damage to the right hemisphere. All persons with stroke should be evaluated by a speech-language pathologist for the presence of speech and language disorders. The speech-language pathologist can provide valuable information to other members of the rehabilitation team and to the family regarding the best techniques for communicating with a particular client. The occupational therapist should continue the work of the speech therapist in the treatment sessions, as appropriate. Carryover may occur in reinforcing communication techniques that the client is learning and in presenting instruction in ways that the client is able to understand and integrate.[89]

The specific speech and language dysfunctions described in the following sections can exist in mild to severe forms and in combination with one another.

Aphasia

Aphasia is an acquired communication disorder caused by brain damage that is characterized by impairment of language modalities (i.e., speaking, listening, reading, and writing); it is not the result of a sensory or motor deficit, a general intellectual deficit, confusion, or a psychiatric disorder.[50]

Global aphasia.

Global aphasia is characterized by loss of all language skills. Oral expression is lost, except for some persistent or recurrent utterance. Global aphasia is usually the result of involvement of the MCA of the dominant cerebral hemisphere. A client with global aphasia may be sensitive to gestures, vocal inflections, and facial expression. Consequently, the client may appear to understand more than he or she actually does.

Broca's aphasia.

Poor speech production and agrammatism characterize Broca's aphasia. This aphasia is manifested as slow, labored speech with frequent misarticulations. Syntactic structure is simplified because of the agrammatism, sometimes referred to as telegraphic speech. A client with this form of aphasia demonstrates good auditory comprehension except when speech is rapid, grammatically complex, or lengthy. Reading comprehension and writing may be severely affected, and a client with Broca's aphasia usually has deficits in monetary concepts and the ability to perform calculations.[89]

Wernicke's aphasia.

Wernicke's aphasia is characterized by impaired auditory comprehension and feedback, along with fluent, well-articulated paraphasic speech. Paraphasic speech consists of word substitution errors. Speech may occur at an excessive rate and may be hyperfluent. The client uses few substantive words and many function words. The client produces running speech composed of English words in a meaningless sequence. English-speaking clients produce neologisms (non-English nonsense words) interspersed with real words. Reading and writing comprehension is often limited, and mathematical skills may be impaired.[89]

Anomic aphasia.

Persons with anomic aphasia have difficulty in word retrieval. Anomia, or word-finding difficulty, occurs in all types of aphasia. However, clients in whom word-finding difficulty is the primary or only symptom may be said to have anomic aphasia. The speech of these clients is fluent, grammatically correct, and well articulated but accompanied by significant difficulty in word finding. This problem can result in hesitant or slow speech and the substitution of descriptive phrases for the actual names of things. Mild to severe deficits in reading comprehension and written expression occur, and mild deficits in mathematical skills may be present.[2,89]

Dysarthria

Clients with dysarthria have an articulation disorder, in the absence of aphasia, because of dysfunction of the CNS mechanisms that control the speech musculature. **Dysarthria** results in paralysis and incoordination of the organs of speech, which causes the speech to sound thick, slurred, and sluggish.

Communication With Clients Who Have Aphasia

Although the speech-language pathologist is responsible for the treatment of speech and language disorders, the occupational therapist can facilitate communication and meaningful interaction with clients who have aphasia. The use of gestures for communication should be encouraged. Having the client demonstrate through performance is the best way to ensure that the instructions are understood.

The occupational therapist can use routine ADLs as opportunities to encourage speech. The client should be reassured that the language disorder is part of the disability, not a manifestation of mental illness. Additional strategies for the occupational therapist to use with clients and their caregivers include the following:

- Understanding is facilitated when one person talks at a time. Extra noise creates confusion.
- Give the client time to respond.
- Carefully phrase questions to make it easier for the client to respond; for example, use "yes/no" and "either/or" questions.
- Use visual cues or gestures with speech to help the client understand.
- Never force a response.
- Use concise sentences.
- Do not rush communication because this may increase frustration and decrease the effectiveness of communication.[89]

Given that Jasmine sustained a right hemispheric stroke, aphasia would not typically be expected. Jasmine did exhibit severe sensory motor loss related to her left oral structures. She had moderate dysarthria, occasional drooling, and difficulty managing food in the left side of her mouth. Jasmine was encouraged to speak slowly and overenunciate. In addition, her occupational therapist taught her safe feeding strategies, including eating slowly, alternating solids and liquids, shifting food to the right side of her mouth, tilting her head to the right at a 45-degree angle, using her finger to sweep her mouth and clear out food pocketing on the left, and performing supervised oral care after each meal.

Inability to Perform Chosen Occupations Secondary to Neurobehavioral/Cognitive-Perceptual Impairments

A **neurobehavioral deficit** is defined as "a functional impairment of an individual manifested as defective skill performance resulting from a neurological processing dysfunction that affects performance components such as affect, body scheme, cognition, emotion, gnosis, language, memory, motor movement, perception, personality, sensory awareness, spatial relations, and visuospatial skills."[6] A major responsibility of the occupational therapist treating a client who has sustained a stroke is evaluating which neurobehavioral deficits are blocking independent performance of chosen occupations.

Árnadóttir[6] proposed a relationship among the ability to perform daily activities, neurobehavioral impairments, and the CNS origin of the neurobehavioral dysfunction (a stroke, for the purposes of this chapter). She supported this theory with the following relational statements:

1. Behaviors required for task performance are related to neuronal processing at the CNS level. Therefore, a relationship also exists between the defective behavioral responses of an individual with CNS damage during performance of ADLs and the dysfunction of neuronal processing and performance components resulting from the CNS damage.

2. Performance of daily activities requires adequate function of specific parts of the nervous system. Consequently, CNS impairment may result in dysfunction of specific aspects of ADLs. For example, a stroke caused by a lesion of the posteroinferior parietal lobe of the left hemisphere commonly results in bilateral motor apraxia. "This neurobehavioral impairment may make manipulation of objects difficult during functional activities such as combing hair, brushing teeth, or holding a spoon while eating."[6]

3. Neurological impairment can be observed through the client's engagement in daily activities. Thus, by analysis of ADLs, the integrity of the CNS can be evaluated (Box 33.2).

Box 33.2

Toothbrushing Task: Treatment of Neurobehavioral Impairments

Spatial Relationships and Spatial Positioning

- Positioning of the toothbrush and toothpaste while applying paste to the brush
- Placement of the toothbrush in the mouth
- Positioning of bristles in the mouth
- Placement of the brush under the faucet

Spatial Neglect

- Visual search for and use of the brush, paste, and cup in the affected hemisphere
- Visual search for and use of the faucet handle in the affected hemisphere

Body Neglect

- Brushing of the affected side of the mouth

Motor Apraxia

- Manipulation of the toothbrush during task performance

- Manipulation of the cap from the toothpaste
- Squeezing of toothpaste onto the brush

Ideational Apraxia

- Appropriate use of objects (e.g., brush, paste, cup) during a task

Organization and Sequencing

- Sequencing of the task (e.g., removal of the cap, application of paste to the brush, turning on the water, putting the brush in the mouth)
- Continuation of task to completion

Attention

- Attention to the task (to increase difficulty, distractions such as conversation, flushing the toilet, or running water may be added)
- Refocusing on the task after the distraction

Figure-Ground

- Distinguishing a white toothbrush and toothpaste from the sink

Initiation and Perseverance

- Initiation of the task on command
- Cleaning parts of the mouth for an appropriate period, then moving the bristles to another part of the mouth
- Discontinuation of the task when complete

Visual Agnosia

- Use of touch to identify objects

Problem Solving

- Search for alternatives if the toothpaste or toothbrush is missing

From Gillen G, editor: *Stroke rehabilitation: a function-based approach*, ed 4, St Louis, 2016, Mosby.

To properly evaluate the effect of neurobehavioral deficits on task performance, the therapist must develop activity analysis skills with the goal of analyzing which components of performance are necessary to achieve an outcome that is satisfactory to the client. Even the simplest of BADL tasks challenges multiple underlying skills (Boxes 33.3 and 33.4; also see Fig. 33.3).[6,82]

Box 33.3

Examples of Environmental and Task Manipulation to Challenge Component Skills During Meal Preparation

Spatial Neglect

- Place ingredients in both visual fields.
- Choose a task that requires use of the right and left burners.

Figure-Ground

- Place necessary utensils in a cluttered drawer.
- Use utensils that match the color of the counter.

Spatial Dysfunction

- Prepare items that require the client to pour ingredients from one container to another (e.g., pour pasta into a bowl or fill a pot with water).

Motor Apraxia

- Choose recipes that require manipulation of food items.
- Choose recipes that require control of distal extremity adjustments (e.g., using a ladle, whisking, and stirring).

Box 33.4

Sample Compensatory Strategies for Neurobehavioral Deficits Affecting Dressing Skills

Spatial Neglect

- Place necessary clothing on the right side of the closet and drawers.
- Move the dresser to the right side of the room.

Motor Apraxia

- Use loose-fitting clothing without fasteners.
- Use Velcro closures.

Spatial Dysfunction

- Use shirts with a front emblem to identify proper orientation.
- Lay out clothing in the proper orientation.

Árnadóttir[6,7] proposed a system of observing clients engaged in functional activities in which errors are allowed to occur (as long as they are safe), the errors are analyzed, and finally, impairments that are interfering with performance of tasks are detected so that an appropriate treatment plan can be developed. She cautioned that when the therapist analyzes errors and observed behavior, knowledge of neurobehavior, cortical function, activity analysis, and clinical reasoning must be considered in the results of the evaluation (Table 33.5).

TABLE 33.5

Evaluating the Effect of Neurobehavioral Dysfunction on Task Performance

Performance Area	Observed Behavior	Possible Impairment
Grooming	Difficulty adjusting grasp on razor or toothbrush	Motor apraxia
	Using a comb to brush teeth	Ideational apraxia
	Repetitive brushing of one side of mouth	Premotor perseveration
Feeding	Not eating food on left side of plate	Spatial neglect
	Overestimating or underestimating distance to glass, resulting in knocking over glass	Spatial relationship dysfunction
	"Forgetting" that a glass of orange juice is in hand, resulting in spillage as client attends to another aspect of meal	Body neglect
	Placing hand in cereal bowl	
Dressing	Client attempting to put socks on after sneakers	Organization and sequencing dysfunction
	Client unable to locate armholes in undershirt	Spatial relationship dysfunction
	Dressing only right side of body	Body neglect
	Client attempting to dress therapist's arms instead of his or her own	Somatognosia
Mobility	Client unable to locate bathroom in his or her hospital room	Topographic disorientation

	Client neglecting to lock brakes or remove wheelchair footrests before attempting to transfer	Organization and sequencing dysfunction
	After a transfer, only intact buttock is in contact with seat of chair	Body neglect

From Árnadóttir G: *The brain and behavior: assessing cortical dysfunction through activities of daily living*, St Louis, 1990, Mosby; and Gillen G, editor: *Stroke rehabilitation: a function-based approach*, ed 4, St Louis, 2016, Mosby.

Treatment aimed at counteracting the effects of neurobehavioral dysfunction may be based on an adaptive and compensatory approach or on a restorative and remedial approach.[47,72,74,82] A combination of approaches has also been suggested (Table 33.6).[1]

TABLE 33.6

Treatment Approaches for Neurobehavioral Deficits After Stroke

Compensatory and Adaptive Approach	Restorative and Remedial Approach	Combination Approach
• Repetitive practice of tasks • Top-down approach • Emphasizes intact skill training • Emphasizes modification • Uses environmental or task modifications to support optimal performance • Choice of activity driven by performance challenges, not by component deficits • Treats symptoms, not the cause • Client-driven compensatory strategies • Caregiver-therapist environmental adaptations • Task specific and not generalizable	• Restoration of component skills • Bottom-up approach • Deficit specific • Targets cause of symptoms and emphasizes components • Assumes that transfer of training will occur • Assumes that improved component performance will result in increased skill • Choice of activity driven by component deficits • Research demonstrates short-term results with skills generalizable to very similar tasks	• Rejects dichotomy between compensatory and restorative approaches • Uses optimally relevant occupations and environments as the treatment modality to challenge components • Choice of treatment driven by tasks relevant to client needs; tasks presented so that the underlying deficits are challenged via the task • Rejects use of contrived activities

Decisions regarding the selection of a particular treatment approach may be difficult. Neistadt[73,74] suggested evaluating a client's learning potential in the context of ADL evaluation and training, with a focus on such issues as the number of repetitions needed to learn new approaches to tasks and the type of transfer of learning that is demonstrated.

Toglia[94] has suggested that transfer of learning from one context to another (e.g., transferring skills learned from making a cup of tea in the OT clinic to meal preparation at home) may be facilitated by the therapist through the following methods:

1. Varying treatment environments

2. Varying the nature of the task

3. Helping clients become aware of how they process information

4. Teaching processing strategies

5. Relating new learning to previously learned skills

Toglia[94] has identified degrees of transfer of learning. The degree of transfer is defined by the number of task characteristics that differ from those of the original task. Examples of these characteristics are spatial orientation, mode of presentation (e.g., auditory or visual), movement requirements, and environmental context.

A near transfer of learning involves transfer between two tasks that have one or two differing characteristics. Intermediate transfer involves transfer of learning to a task that varies by three to six characteristics. A far transfer involves a task that is conceptually similar but has one or no characteristics in common. Finally, a very far transfer involves the "spontaneous application of what has been learned in treatment to everyday living."[94]

From her review of the literature, Neistadt[72] reached the following conclusions:

1. Near transfer from remedial tasks to similar tasks is possible for all clients with brain injury.

2. Intermediate, far, and very far transfer from remedial to functional tasks will occur only in clients with localized brain lesions and good cognitive skills and after training with a variety of treatment tasks.

3. Far and very far transfer from remedial to functional tasks will not occur in clients with diffuse injury and severe cognitive deficits.

Using a functional and meaningful task as a treatment modality promotes the acquisition of a desired skill, and the therapist may use this task to challenge multiple underlying impairments.[1,47,82]

It is up to the therapist to present the task by manipulating the environment in a way that challenges the underlying skills (see Box 33.3). If a compensatory approach is chosen, adaptive techniques are used to counteract the effects of the underlying neurobehavioral deficits (see Box 33.4).

Jasmine's left-sided neglect had a substantial impact on her ability to perform relevant occupations independently and safely. A variety of strategies was used to improve her ability to attend to the left side. Organized visual scanning was taught during daily activities such as feeding and grooming.[48] Occupations were chosen that required scanning to both the left and the right to be successful (e.g., finding ingredients in the refrigerator, locating the toothbrush on the left side of the sink and toothpaste on the right, reading, and describing a room). Vanishing physical and verbal cues were used as Jasmine progressed. Another strategy that was helpful for Jasmine was the use of a left-sided anchor. A red strip of tape was placed on the left side (e.g., the left side of the computer monitor, placemat, sink, book), and Jasmine focused on scanning to the anchor to ensure that she was attending to all of the information required to be successful at performing each occupation. Because Jasmine's neglect persisted, driving was not an option. Other modes of transportation were considered, including supervised use of public transportation, assistance with transport by friends and neighbors, and local Access-A-Ride companies. (See Chapter 11.)

Inability to Perform Chosen Tasks Secondary to Upper Extremity Dysfunction

Loss of UE control is common after a stroke; 88% of clients who sustain a stroke have some level of UE dysfunction.[77] The client's ability to integrate the affected arm into chosen tasks may be limited by multiple factors, including the following[46]:

1. Pain

2. Contracture and deformity

3. Loss of selective motor control

4. Weakness[21]

5. Superimposed orthopedic limitations

6. Loss of postural control to support UE control

7. Learned nonuse[90]

8. Loss of biomechanical alignment[24]

9. Inefficient and ineffective movement patterns

Integration Into Function

UE evaluation procedures should focus primarily on assessing the client's ability to integrate the UE into the performance of functional tasks—in other words, to use the affected UE to support performance in areas of occupation. Standardized evaluations, such as the Test d'Evaluation des Membres Supérieurs de Personnes Agées (TEMPA),[34,35] Arm Motor Ability Test (AMAT),[62] Jebsen Test of Hand Function,[56] and AMPS[40] (see Table 33.3) are available to objectively measure the client's ability to use the affected extremity during performance of tasks. In addition, self-reported measures of UE function are recommended. Examples include the following:

1. The Motor Activity Log is a self-reported questionnaire (reported by the patient or family) related to actual use of the involved UE outside structured therapy time. It uses a semistructured interview format. Quality of movement ("how well" scale) and the amount of use ("how much" scale) are graded on a 6-point scale. At present there are 30-, 28-, and 14-item versions of the tool. Sample items include holding a book, using a towel, picking up a glass, writing/typing, and steadying oneself.[99,100]

2. The 36-item Manual Ability Measure (MAM-36) is a new Rasch-developed, self-reported disability outcome measure.[27,28] It contains 36 gender-neutral, commonly performed everyday hand tasks. The patient is asked to report the ease or difficulty of performing such tasks. It uses a 4-point rating scale, with 1 indicating "unable" (I am unable to do the task all by myself); 2 indicating "very hard" (It is very hard for me to do the task, and I usually ask others to do it for me unless no one is around); 3 indicating "a little hard" (I usually do the task myself, although it takes longer or more effort now than before); and 4 indicating "easy" (I can do the task without any problem). The MAM-36 has been validated and is psychometrically sound reflecting the use of occupation-based tasks to determine hand function.[27a]

The UE may be used during functional performance in different ways (Table 33.7), including, but not limited to, the following[42]:

1. Weight bearing or accepting partial body weight through a limb. Weight bearing through the hand and forearm with an extended elbow is a pattern used during ADLs and mobility tasks. Establishment of weight bearing is a goal of UE rehabilitation.[16] Effective control of weight bearing

depends on the presence of sufficient trunk and scapula stability to accept partial body weight, control of active elbow extension, and ability of the hand to bear weight without losing the palmar arches. Once weight bearing has been established, the client can effectively use the arm as a postural support (e.g., by supporting upper body weight with the affected arm while wiping crumbs from the table with the more functional arm), as an aid during transitional movements (e.g., while pushing up from lying on the side to sitting), and for preventing falls (increased postural support is provided).[46]

2. Moving objects across a work surface with a static grasp (supported reach). Activities such as ironing clothes, opening or closing a drawer, polishing furniture, and sliding a paper across the table are all examples of UE control of movement that does not occur with the arm in space. The hand is in contact with the objects involved in the task or is supported on the work surface; therefore, these types of tasks do not require the same control as (and may require less effort than) activities performed while the client is reaching in space, such as removing dishes from a cabinet or reaching for food in the refrigerator. This movement pattern can be used for multiple tasks and at the same time strengthens the various muscle groups used to eventually support reach in space.[46]

3. Reach and manipulation. Reviews of research on UE motor control[2,46] have identified two components of function during reaching activities. The first is the transportation component, which is defined as the trajectory of the arm between the starting position and the object. The second is the manipulation component, which is the formation of grip by combined movements of the thumb and index finger during arm movement. Finger posturing anticipates the real grasp and occurs during transportation of the hand toward the object.[2] Shaping of the hand is independent of the manipulation itself. Trombly's reaching studies of clients with left hemiparesis documented that the ability to reach smoothly and with coordination was significantly less on the affected than on the unaffected side.[97] The continuous movement strategy was lost, movement time was longer, peak velocity occurred earlier, and weakness indicators were present.

TABLE 33.7

Suggestions for Categorizing Upper Extremity Tasks

Category	Tasks
No functional use of the arm	• Teach shoulder protection • Self range of motion • Positioning
Postural support/weight bearing (forearm or extended arm)	• Bed mobility assistance • Support upright function (e.g., work, leisure, activities of daily living [ADLs]) • Support during reach with the opposite hand • Stabilize objects
Support reach (hand on a work surface)	• Wiping a table • Ironing • Polishing • Sanding • Smoothing out laundry • Applying body lotion • Washing body parts • Vacuuming • Locking wheelchair brakes
Reach	• Multiple possibilities to engage the upper extremity in ADLs, leisure, and mobility; grade tasks by height/distance reached, weight of object, speed, and accuracy

From Gillen G, editor: *Stroke rehabilitation: a function-based approach*, ed 4, St Louis, 2016, Mosby.

Trombly[96] demonstrated that although muscular activity did not improve in the clients in her study, the discontinuity improved over time. She stated that the “level and pattern of muscle activity of these subjects depended on the biomechanical demands of the task rather than any stereotypical neurological linkages between the muscles.”

Clients are commonly observed demonstrating the use of stereotypical movement patterns of the UE. These patterns are characterized by scapula elevation and fixation, humeral abduction, elbow flexion, and wrist flexion. Mathiowetz and Bass Haugen[70] suggested that the use of these movement patterns is evidence of attempts to use the remaining systems to complete tasks. They gave an example of a client with weak shoulder flexors trying to lift an arm. The client flexes the elbow when trying to raise the arm because this movement strategy shortens the lever arm and eases shoulder flexion.

A recent evidence-based review[75]documented that the following interventions resulted in improved occupational performance for those with motor control limitations:

- Repetitive task practice: This term was used to describe training approaches that included performance of goal-directed, individualized tasks with frequent repetitions of task-related or task-specific movements.

- Constraint-induced movement therapy (CIMT) or modified constraint-induced movement therapy (mCIMT): A method of training that involves restraint of the unaffected limb for ~ 90% of waking hours, forcing use of the affected limb during daily activities. The other components of CIMT include shaping and intensive and repetitive task training using the affected limb for 6 hours per day for 2 weeks. Modified CIMT is a shortened version of the original CIMT. During mCIMT, the amount of time for intensive training of the affected limb, the restraint time of the nonaffected limb, or both are decreased and/or distributed over a longer period of time (Box 33.5).

Box 33.5

Main Points of Constraint-Induced Movement Therapy

1. Counteracts learned nonuse.

Hypothesized causes of learned nonuse include therapeutic interventions implemented during the acute period of neurological suppression after a stroke, an early focus on adaptations to meet functional goals, negative reinforcement experienced by patients as they unsuccessfully attempt to use the affected limb, and positive reinforcement experienced by using the less involved hand and/or successful adaptations.

2. Motor inclusion criteria.

Control of the wrist and digits is necessary to engage in this type of intervention. Current and past protocols have used the following inclusion criteria: 20 degrees of extension of the wrist and 10 degrees of extension of each finger; 10 degrees of extension of the wrist, 10 degrees of abduction of the thumb, and 10 degrees of extension of any two other digits; or the ability to lift a washrag from a table using any type of prehension and then release it.

3. Main therapeutic factor.

Massed practice and shaping of the affected limb during repetitive functional activities appear to be the therapeutic change agents. "There is thus nothing talismanic about use of a sling or other constraining device on the less-affected limb."[46]

4. Choices of activity and the therapist's interventions.

Select tasks that address the motor deficits of the individual client, assist clients in carrying out parts of a movement sequence if they are incapable of completing the movement on their own at first, provide explicit verbal feedback and verbal reward for small improvements in task performance, use modeling and prompting of task performance, use tasks that are of interest and motivational to the patient, ignore regression of function, and use tasks that can be quantified related to improvements.

5. Outcome measures.

The Motor Activity Log (actual use outside of structured therapy, or "real-world" use), Arm Motor Ability Test, Wolf Motor Function Test, and Action Research Arm Test have been used to document outcomes.

6. Cortical reorganization.

Constraint-induced movement therapy is the first rehabilitation intervention that has been demonstrated to induce changes in the cortical representation of the affected upper limb.

7. Research validity.

The rigorous research that has been and continues to be carried out to demonstrate the effectiveness or efficacy of constraint-induced movement therapy should be used as a gold standard for other rehabilitation interventions that are used traditionally (e.g., neurodevelopmental therapy) but have little or no research support.

8. Evidence-based support.

On the basis of available evidence, constraint-induced movement therapy appears to be an effective intervention for those living with stroke who have learned nonuse and fit the motor inclusion criteria.

From Gillen G: Upper extremity function and management. In Gillen G, editor: *Stroke rehabilitation: a function-based approach*, ed 4, St Louis, 2016, Mosby.

- Strengthening and exercise: All forms of strengthening and exercise, including yoga and tai chi, were combined into the intervention category of strengthening and exercise in this review.
- Mental practice: A training method during which a person cognitively rehearses a physical skill in the absence of actual movements. Most often this type of training is coupled with traditional task-oriented practice.
- Virtual reality: Participants take part in various goal-directed activities in a computer-based, interactive, multisensory-simulated environment designed to replicate real-world experiences.
- Mirror therapy: During mirror therapy, a mirror or mirror box is placed in the midsagittal position between the extremities of interest. The individual is then encouraged to concentrate on the mirror reflection of the uninvolved extremity performing movements or receiving sensory stimulation while the involved extremity remains hidden out of sight behind the mirror. This procedure creates a visual illusion whereby the activities of the uninvolved extremity are attributed to the involved extremity.

• Action observation: Participants watch another person performing common functional actions (most often by watching a prerecorded video) with the intention of imitating the observed actions. Accordingly, action observation is followed by actual task performance.

The following are examples of using treatment activities to improve the client's ability to integrate the UE into tasks.[a]

1. Using objects of different sizes and shapes to encourage control of the hand during reach and manipulation

2. Choosing activities that are appropriate to the client's level of available motor control

3. Using CIMT techniques (see Box 33.5): techniques in which the less affected UE is constrained (e.g., with a sling and splint or similar device) to compel use of the affected extremity, thereby providing massed practice of graded activities for the affected side to increase functional use[86]

4. Specifically training the arm to be used in weight bearing, reach, and manipulation situations within the context of ADLs and mobility

5. Presenting the client with graded tasks related to the number of degrees of freedom, the level of antigravity control required, and the resistance involved in the task (Fig. 33.6).

FIG 33.6 The task is designed to elicit the desired motor pattern; the purpose of the task drives the motor output. (From Gillen G: Upper extremity function and management. In Gillen G, editor: *Stroke rehabilitation: a function-based*

approach, ed 4, St Louis, 2016, Mosby.)

Jasmine had very little motor activity throughout her left UE. Therapy focused on having Jasmine position her arm correctly (on the work surface and within her sight lines) during activities to prevent it from dangling all day and to use her arm as a stabilizer (e.g., using the weight of her arm to stabilize a paper while writing or holding a book open). As Jasmine improved, she was encouraged to use her arm in weight bearing as a postural support (e.g., pushing up when transitioning from the supine position to a seated position, pushing up to stand, reaching back to sit, and using the arm as support when standing at a sink or counter). Occupations were chosen that matched her available motor control and challenged her current level.

Upper Extremity Complications After Stroke

Subluxation.

Subluxation, or malalignment caused by instability of the glenohumeral joint, is a common occurrence after stroke. The subluxation may be inferior (head of the humerus below the glenoid fossa), anterior (head of the humerus anterior to the fossa), or superior (head of the humerus lodged under the acromion-coracoid).[83] Cailliet[24] and Basmajian[11] described the mechanism of inferior subluxation, in which the humeral head drifts inferior to the glenoid fossa. This common subluxation occurs as a result of malalignment of the scapula and the trunk. The normal position of the scapula is one of upward rotation, an orientation that cradles the head of the humerus and stabilizes it in alignment. The weight of the arm combined with instability and malalignment contributes to subluxation.

A common misunderstanding about subluxation is that it is associated with pain. The literature does not support this relationship.[107] Because the shoulder is unstable after a stroke, care must be taken to support the flail shoulder in bed (e.g., using pillows to maintain alignment), in a wheelchair (e.g., with lap boards or pillows), and in the upright position (e.g., putting the hands in a pocket or taping the shoulder). Treatment to reduce subluxation should focus on achieving trunk alignment and scapula stability in a position of upward rotation.[83]

Abnormal skeletal muscle activity.

A change in the resting state of the limb and postural muscles is common after stroke.[16] Immediately after a stroke, a change in available, or resting, skeletal muscle activity occurs. Most commonly, the acute state is characterized by low tone (“low-tone stage”). During this low-tone stage, the limbs and trunk become increasingly influenced by the pull of gravity. Little or no muscle activity is available at this stage, which results in deviations from the normal resting alignment of the musculoskeletal system.

An inability to recruit and maintain muscle activity is generally the greatest limiting factor at this stage. Because of the generalized lack of muscle activity and the dependent nature of the trunk and limbs, secondary problems can occur,[44] including the following:

1. Edema affecting the dorsal surface of the hand and pooling of fluids under the extensor tendons, thereby effectively blocking active or passive digit flexion

2. Overstretching of the joint capsule of the glenohumeral joint

3. Eventual shortening of muscles that are passively positioned in an effort to support a weak limb (Commonly, flaccid UEs are positioned in the client's lap, on a pillow, on a lap tray, or in a sling. Although these support the arm, the static positions result in prolonged positioning of certain muscle groups [internal rotators, elbow flexors, and wrist flexors] in a shortened position, which places them at risk for mechanical shortening. Interestingly, these are the muscle groups that tend to become spastic as time progresses.)

4. Overstretching of the antagonists to the previously mentioned muscles

5. Risk of joint and soft tissue injury during ADLs and mobility tasks (Because of the lack of control associated with a low-tone stage, the arm dangles and is not positioned appropriately during dynamic activities. Common examples include an arm being caught in the wheel during wheelchair

mobility, pinning of the arm during bed mobility or rest, sitting on the arm after a transfer, or weight bearing through a flexed wrist during engagement in self-care activities.)

Progression to a state of increased or excessive skeletal muscle activity (increased tone), such as clonus, stereotypic posturing of the trunk and limbs, hyperactive stretch reflexes, and increased resistance to passive limb movements that are dependent on velocity, may occur within several days or months of the stroke.[44]

As spasticity increases, the risk for soft tissue shortening is heightened. This factor may lead to a vicious circle of spasticity to soft tissue shortening to overrecruitment of shortened muscles to increased stretch reflexes. Secondary problems that may occur if the spasticity is not managed in a therapy program include the following[44]:

1. Deformity of the limbs, specifically the distal end of the upper limb (elbow to digits)

2. Maceration of palm tissue

3. Possible masking of underlying selective motor control

4. Pain syndromes resulting from loss of normal joint kinematics (These syndromes are usually related to soft tissue contracture that blocks full joint excursion. A typical example is loss of full passive external rotation of the glenohumeral joint. Attempts at forced abduction in these cases will result in a painful impingement syndrome of the tissues in the subacromial space.)

5. Impaired ability to manage BADL tasks, specifically UE dressing and bathing of the affected hand and axilla when flexor posturing is present

6. Loss of reciprocal arm swing during gait activities

Prevention of pain syndromes and contracture

Protection of unstable joints.

During the low-tone stage, joints tend to become malaligned secondary to loss of muscular stabilization. In these cases clients are at risk for injury to unstable joints (e.g., traction injuries and joint trauma) because of the joint instability. The glenohumeral and wrist joints are particularly at risk. The glenohumeral joint (usually already inferiorly subluxated at this stage) is at risk for a superimposed orthopedic injury if another individual unknowingly pulls on the affected arm during self-care and mobility or during unskilled passive range of motion (PROM) of the joint. The unstable glenohumeral joint is in a malaligned state, which puts the client at risk for an impingement syndrome during PROM if normal joint mechanics is not addressed. Key joint motions of concern are upward rotation of the scapula and external (lateral) rotation of the shoulder. If these motions are not present and ROM is forced, the client is at risk for the development of an impingement and pain syndrome.[44]

Clients with low tone also have an unstable wrist. Care should be taken to protect the wrist if the client is not controlling the joint during ADL and mobility tasks. Clients commonly practice a bed mobility or lower extremity dressing sequence and then complete the task while bearing weight through a malaligned flexed wrist. These clients are at risk for orthopedic injury (traumatic synovitis) and may be considered candidates for splinting to protect the wrist.[46]

Maintaining soft tissue length.

Clients who have both increased and decreased skeletal muscle activity are at risk for soft tissue contracture secondary to the immobilization that occurs during both low-tone and increased-tone stages. Maintenance of tissue length is a 24-hour regimen. It involves frequent variations in resting postures during waking hours, teaching the client and significant others appropriate ROM procedures, daytime and nighttime positioning programs, and staff and family education so that positioning and exercise programs may be carried out in the home environment.[44]

Prolonged static positioning (e.g., prolonged use of a sling) must be avoided. Teaching clients to adjust their resting postures during the day will help prevent soft tissue tightness.

Positioning programs.

The same wheelchair and bed positioning programs should not be applied to every client. Instead, positioning should be individualized and should focus on (1) promoting normal resting alignment of the trunk and limbs in an effort to maintain tissue length on both sides of the joints; (2) providing stretch to muscle groups that have been identified as being prone to contracture or already shortened; and (3) placing particular focus on maintaining passive external rotation of the shoulder.[3]

Soft tissue elongation.

If soft tissue shortening and length-associated changes have already developed, the treatment of choice is low-load/prolonged stretch (LLPS). LLPS involves placing the soft tissues in question on submaximal stretch for prolonged periods. This technique is quite different from the common PROM with terminal stretch (high-load/brief stretch) programs commonly used to treat this population.[71]

LLPS can be implemented in various ways, including splinting, casting, and positioning programs. For example, during a UE assessment a client is noted to have tightness in the internal rotators, overactive internal rotation during attempts to move, and weakened external rotators. An effective LLPS program would involve having the client rest in a supine position with the arm abducted to 45 degrees and in external rotation. This position has been shown to decrease the potential for contracture.[3]

LLPS can also be achieved through splinting programs. A common example is the use of a splint designed to elongate the long flexors of the hand during sleeping hours.

Orthotics.

Commonly a controversial subject in the management of stroke, orthotics should be considered on a case-by-case basis and may be quite effective for many clients.[71] The most common uses for orthotics during the low-tone stage are for maintaining joint alignment, protecting the tissues from shortening or overstretching, preventing injury to the extremity, and serving as an adjunctive treatment to control edema.[71] Specifically, orthotic support may be needed to provide palmar arch support and maintain neutral wrist deviation and a neutral position of the wrist between flexion and extension. In most cases the fingers do not require splinting in this stage of recovery.[71]

Orthotics may also be effective for clients in whom spasticity is developing. In these cases the splints may be used to maintain soft tissue length, provide LLPS, place muscles at their resting lengths on both sides of the joints, and attempt distal relaxation by promoting proximal alignment.[71]

Client management.

In addition to the interventions already described, it is helpful to train the client to manage his or her UE. For a client with low tone, the most important information to share with the client and significant others is the method for protecting the unstable joints and maintaining full ROM. In the spastic stage, the treatment of choice is to teach positioning that will provide prolonged elongation of the overactive muscles and prevent contracture. Examples of positions that may be prescribed during leisure or self-care activities include the following[44]:

1. Weight bearing on the extended arm (elongates the commonly shortened UE musculature)

2. In the supine position, hands behind the head while allowing the elbows to drop toward the bed (provides stretch of the internal rotators)

3. In the supine position, a pillow protracting the scapula and under the elbow to promote glenohumeral joint alignment

4. Lying on a protracted scapula to maintain stretch of the retractors and scapulothoracic mobility

5. Supporting the involved wrist with the more functional hand and reaching down toward the floor with both hands (This pattern will elongate muscles that tend to contract during difficult activities, which is particularly helpful after gait activities or difficult self-care activities.)

6. Cradling the affected arm with the stronger arm, lifting it to chest level, and gently raising and lowering (staying below 90 degrees) and gently abducting or adducting the arm (Fig. 33.7).

Cautionary note: Clasping the hands and lifting the affected arm overhead should be discouraged because of the risk for increasing pain, causing an impingement syndrome, and stressing the carpal ligaments (Fig. 33.8). Similarly, overhead pulleys should be avoided.

FIG 33.7 "Rock the baby." The client lifts the right upper extremity to chest level (A), adducts (B), and abducts (C) horizontally to allow trunk rotation.

FIG 33.8 Because of multiple biomechanical concerns (e.g., impingement), self–overhead range of motion is discouraged.

The keys to prescribing a proper resting posture are (1) to identify muscle groups in the trunk and upper limb that are shortening, overactive, or at risk for the development of shortening and (2) to select a comfortable posture that elongates the muscle group for a prolonged period.

Jasmine and her family were taught appropriate positioning when Jasmine is in bed and on chairs and during upright activities. In addition, Jasmine learned how to safely perform self-ROM exercises and was provided with a resting hand orthotic at night.

Nonfunctional Upper Extremity

Although restoration of UE control is a realistic goal for some clients, many clients will not regain enough control to integrate the affected UE into ADL and mobility tasks. Clients who will not regain sufficient control require extensive retraining in BADLs and IADLs (see Chapter 10) with one-handed techniques and prescription of appropriate assistive devices (Box 33.6). Persons in this population are also candidates for dominance retraining. Control of deformity to prevent body image issues is paramount for these clients.

Box 33.6

Examples of Assistive Devices Used After Stroke to Improve Occupational Performance

Rocker knife

Elastic laces and lace locks

Adapted cutting board

Dycem

Plate guards

Pot stabilizer

Playing card holder

Suction devices to stabilize mixing bowls and cleaning brushes

Inability to Perform Chosen Tasks Secondary to Visual Impairment

Processing of visual information is a complex act that requires intact functioning of multiple peripheral nervous system and CNS structures to support functional independence. The site of the lesion determines the visual dysfunction and the effect on performance of tasks (Fig. 33.9).[7]

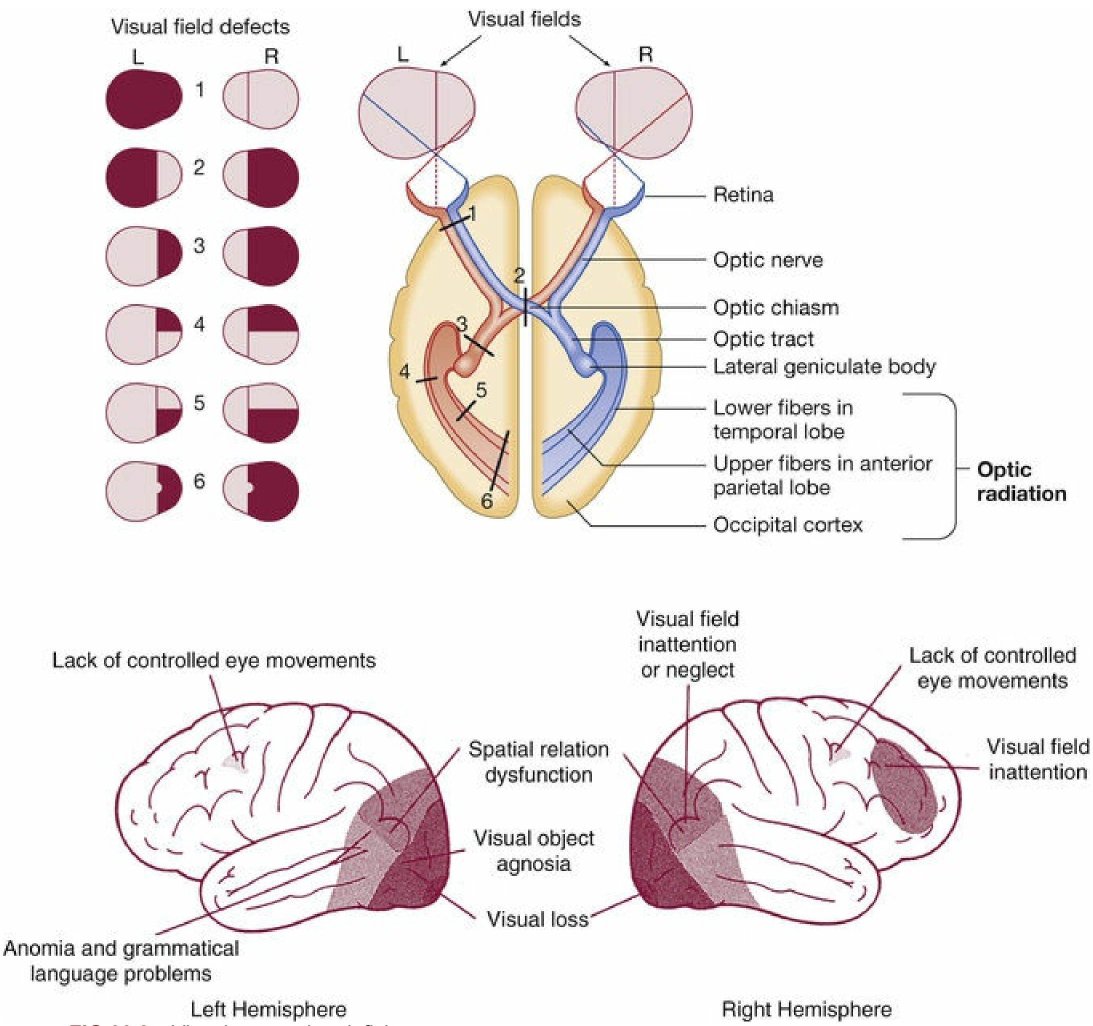


FIG 33.9 Visual processing deficits. (*Top* from Walker BR, et al: *Davidson's principles and practice of medicine,* ed 22, Edinburgh, 2014, Churchill Livingstone; *Bottom* from Árnadóttir G: *The brain and behavior: assessing cortical dysfunction through activities of daily living,* St Louis, 1990, Mosby.)

Visual dysfunction and its treatment are detailed in Chapter 24. In general, treatment approaches may focus on remediation, such as eye calisthenics, fixations, scanning, visual motor techniques, and bilateral integration. Adaptive techniques are also used, including a change in working distance, the use of prisms, adaptations for driving and reading, changes in lighting, and enlarged print.[85]

Psychosocial Adjustment

The psychological consequences of a stroke are substantial. The incidence of depression in this population is 35%, according to statistics collected by the American Heart Association.[4] The highest reported incidence is found in clients in acute and rehabilitation hospitals, and the lowest is in samples of those living in the community after stroke. Other psychological manifestations that have been documented in survivors of stroke include anxiety, agoraphobia, substance abuse, sleep disorders, mania, aprosody (difficulty expressing or recognizing emotion), behavioral problems (e.g., sexual inappropriateness, verbal outbursts, aggressiveness), lability (alteration between pathological laughing and crying), and personality changes (e.g., apathy, irritability, social withdrawal).[39]

A critical role of the occupational therapist is to help the client adjust to hospitalization and, more important, to disability. Much patience and a supportive approach by the therapist are essential. The therapist must be sensitive to the fact that the client has experienced a devastating and life-threatening illness that has caused sudden and dramatic changes in his or her life roles and performance. The therapist must be cognizant of the normal adjustment process and must gear the approach and expectations of performance to the client's level of adjustment. Frequently, the client is not ready to engage in rehabilitation measures with wholehearted effort until several months after the onset of the disability.

Family education is extremely important throughout the treatment program. Family members are better equipped to assist their loved one in adjusting to disability when they are knowledgeable about the disability and its implications.

Many clients dwell on the possibility of full recovery of function; they should gradually be made aware that some residual dysfunction is likely. The therapist may approach this probability by discussing in objective terms what is known about the prognosis for functional recovery after stroke. It may be necessary to review this information many times before the client begins to apply it to his or her recovery. This education should be done in a way that is honest and yet does not destroy all hope.

Falk-Kessler[39] has provided occupational therapists with guidelines related to interventions for the psychological manifestations of stroke, including the following:

- Fostering an internal locus of control related to recovery
- Using therapeutic activities to improve self-efficacy or confidence in the performance of specific activities
- Promoting the use of adaptive coping strategies, such as seeking social support, information seeking, positive reframing, and acceptance
- Promoting success in chosen occupations to improve self-esteem
- Encouraging social support networks, such as families, friends, or support groups
- Using occupations to promote social participation

In addition to the aforementioned interventions, it is important to remember that pharmacologic interventions have been shown to be effective in this population and should not be overlooked[39] as part of a team approach. Such interventions include, but are not limited to, antidepressants for depression or for individuals with a pathologic affect, benzodiazepines for generalized anxiety disorder, and neuroleptic medications for those with post-stroke psychosis.[26]

The OT program should focus on the skills and abilities of the client. The client's attention should be focused, through the performance of activity, on his or her remaining and newly learned skills. The OT program can also include therapeutic group activities for socialization and sharing of common problems and their solutions. The discovery that there are residual abilities and perhaps new abilities and success at performing many daily living skills and activities that were initially thought to be impossible can improve the client's mental health and outlook.

Summary

Stroke is a complex disability that challenges the skills of professional healthcare workers. Although the number and effectiveness of approaches for the remediation of affected motor, sensory, perceptual, cognitive, and performance dysfunctions have increased considerably (Box 33.7), many limitations in treatment remain. The occupational therapist must bear in mind that the degree to which the patient achieves treatment goals depends on the CNS damage and recovery, neurological impairment residuals, psychosocial adjustment, and the skilled application of appropriate treatment by all concerned health professionals.

Box 33.7

Summary of Recent Reviews of Evidence-Based Interventions to Improve Occupational Performance After Stroke

- *Motor impairments limiting occupational performance:* Evidence suggests that repetitive task practice, constraint-induced or modified constraint-induced movement therapy, strengthening and exercise, mental practice, virtual reality, mirror therapy, and action observation can improve upper extremity function, balance and mobility, and/or activity and participation. Commonalities among several of the effective interventions include the use of goal-directed, individualized tasks that promote frequent repetitions of task-related or task-specific movements.[75]

- *Cognitive impairments affecting occupational performance:* Evidence is available from a variety of clinical trials to guide interventions regarding general cognition, apraxia, and neglect. The evidence regarding interventions for executive dysfunction and memory loss is limited. There is insufficient evidence regarding impairments of attention and mixed evidence regarding interventions for visual field deficits. The effective interventions have some commonalities, including being performance focused, involving strategy training, and using a compensatory as opposed to a remediation approach.[75]

- *Psychological/emotional impairments affecting occupational performance:* Evidence from well-conducted research supports the use of problem-solving or motivational interviewing behavioral techniques to address depression. The evidence is inconclusive for using multicomponent exercise programs to combat depression after stroke and for the use of stroke education and care support and coordination interventions to address post-stroke anxiety. One study provided support for an intensive multidisciplinary home program in improving depression, anxiety, and health-related quality of life.[53]

- *Improving performance in areas of occupation and participation:* Most of the literature targeted interventions based on activities of daily living (ADLs) and collectively provided strong evidence for the use of occupation-based interventions to improve ADL performance. The evidence related to instrumental activities of daily living (IADLs) was much more disparate, with limited evidence to support the use of virtual reality interventions and emerging evidence to support driver education programs to improve occupational performance post stroke. Only six studies addressed leisure, social participation, or rest and sleep, and evidence was sufficient to support only leisure-based interventions.[103]

Some patients remain severely disabled despite the noblest efforts of rehabilitation workers, whereas others recover quite spontaneously with minimal help in a short period. Most patients benefit from the professional skills of occupational therapists and other rehabilitation specialists and achieve improvement of performance skills and resumption of meaningful occupational roles.

Jasmine demonstrated a clear relationship between her impaired body functions (e.g., loss of motor control, sensory loss, visual dysfunction, and neglect) and her ability to return to her previous life style and engage in chosen areas of occupation. Through the development of an occupational profile, standardized assessments and skilled observation made while Jasmine was performing her chosen occupations of feeding, grooming, toilet transfers, computer use, and child care, it was determined that several impairments were affecting Jasmine's ability to perform independently:

- Feeding: Jasmine was unable to cut or open containers secondary to unilateral UE weakness on the left; she had a tendency to eat only the food on the right side of her plate; and she was unable to locate utensils on the left side of the plate. In addition, food remained between her left gums and cheek ("pocketing") after meals, resulting in oral hygiene issues and putting Jasmine at risk for aspiration.
- Grooming: Jasmine had difficulty opening and applying toothpaste with one hand. She attended only to the right side of her body while grooming, with the left side of her mouth and hair not being cared for during oral and hair care.
- Toilet transfers: Jasmine required moderate physical assistance to transfer to the toilet secondary to an inability to bear weight on her left leg and an inability to control her trunk (she falls laterally when sitting on the toilet). The occupational therapist also noted that when Jasmine "completed" the transfer to the toilet, only the right side of her body was sitting on the toilet. She neglected to include the left side of her body in the transfer and left it in the wheelchair.
- Computer use: During attempts to use the computer, Jasmine became easily frustrated and made comments such as, "I feel like a failure" and "I can't even provide for my child anymore." Jasmine agreed to attempt to write a letter to her friend on the computer. Multiple mistakes were noted because Jasmine seemed to "not see" the left-sided keys, could not control the shift keys, and generally appeared disorganized in her approach to the task.
- Simulated child care: A weighted doll was used to observe Jasmine's ability to care for her child. It was quickly decided that this area of occupation would be deferred until Jasmine's status improved. Jasmine and her occupational therapist made this decision collaboratively on the basis of safety concerns and Jasmine's emotional status. Jasmine was gravely concerned about her ability to care for her child. The occupational therapist wanted to focus on occupations that Jasmine could master, build her confidence, and upgrade her occupations systematically according to Jasmine's abilities.

These findings were determined based on the initial assessment choices. The first assessment administered was the COPM.[64,65] Because multiple areas of occupation are limited after a stroke, it is imperative to use a tool such as this to determine the client's priorities for intervention. These priorities, in turn, become the client's initial goals. In addition, the FIM[57] and the A-ONE[6,9] were used to objectify limitations in daily function and to determine limiting factors. The FIM is typically used in inpatient rehabilitation settings and documents the level of caregiver burden related to BADLs and mobility. The A-ONE is complementary to the FIM and determines the reasons for lack of independence by evaluating client factors that result in errors in occupational performance by skilled observations of tasks performed in natural contexts.

Several interventions were considered to address Jasmine's inability to participate in chosen occupations (toilet transfers, computer use, grooming, feeding, and child care). Task-specific training of grooming, feeding, and toileting served as the basis for her initial OT. A system of vanishing physical and verbal cues was used as Jasmine relearned the tasks at hand. Jasmine had substantial motor loss in her left limbs, thus making training with adaptive equipment imperative. Examples included a rocker knife and Dycem for feeding and a grab bar and raised toilet seat. To ensure continued integration of her affected upper limb, Jasmine was taught to use her left limb as a stabilizer during tasks. She was also taught to keep her arm positioned on a surface and in her line of sight. A strategy that was used to help Jasmine overcome her neglect was use of a perceptual anchor. In addition to her left arm being positioned on the left side of a surface, a strip of red tape was placed on the left edge of work surfaces (e.g., on the table to the left of her place setting and on the left side of the sink). As Jasmine gained mastery of these tasks, task-specific training of work tasks via similar strategies was introduced.

Review Questions

1. Define stroke and list two of its causes.
2. Name three modifiable risk factors associated with stroke.
3. Define TIA.
4. Name three functional deficits that occur as a result of loss of trunk control.
5. Name two components of a client-centered approach to evaluation.
6. What are two frames of reference used to treat neurobehavioral impairments after stroke?
7. Name three postural reactions that support standing activities.
8. How does aphasia differ from dysarthria?

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[a]References 2, 24, 44, 46, 83, and 88.

34

Traumatic Brain Injury

Michelle Tipton-Burton [a]

CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Describe the pathology underlying traumatic brain injury (TBI).
2. State current medical, surgical, and pharmaceutical interventions for acute TBI.
3. Identify levels of consciousness in individuals with TBI by using standard scales.
4. Describe the clinical picture of individuals with TBI, including common physical, cognitive, and psychosocial sequelae.
5. Identify occupational therapy (OT) evaluation methods for lower, intermediate, and higher functioning individuals with TBI.
6. Identify several standard OT assessments for physical, cognitive, and psychosocial impairment after TBI.
7. Describe OT intervention methods for lower, intermediate, and higher functioning individuals with TBI.
8. Describe the continuum of care services available for an individual with TBI in the acute, subacute, and post-acute stages of rehabilitation.

KEY TERMS

Compensatory model
Decerebrate rigidity
Decorticate rigidity
Diffuse axonal injuries (DAIs)
Environmental interventions
Impaired initiation
Interactive interventions
Neuromuscular reeducation
Neuroplasticity
Pelvic alignment
Post-traumatic amnesia (PTA)
Postural deficits
Rehabilitative model
Sensory regulation
Tone normalization
Traumatic brain injury (TBI)
Unilateral neglect syndrome

Case Study

Marisol

Marisol, an 18-year-old Hispanic woman, was an unrestrained passenger in a sport utility vehicle involved in an accident. Marisol sustained a severe brain injury in the crash. She is a high school graduate who lives with her boyfriend and works as a waitress. A computed tomography (CT) scan showed a basilar skull fracture and diffuse subdural hematoma. Approximately 2 weeks after she had been injured, she was transferred to an acute rehabilitation unit to participate in a journey to recovery program, which is designed for clients whose progress is expected to be slower than that of typical acute care clients. This is determined by the extent of the injury; typically these clients are at level II or III on the Rancho Los Amigos (RLA) Scale.

The results of the occupational therapy (OT) evaluation indicated that Marisol was dependent for all mobility and daily activities of living as a result of deficits in motor and process skills. She also displayed significant deficits in various client factors. Her right upper extremity had full active and passive range of motion with minimal ataxia in all joints. Her left upper extremity had decreased range of motion at her shoulder, elbow, and wrist. Severe spasticity was noted throughout her left upper extremity. Marisol was alert and able to visually attend and track. She was nonverbal and being fed through a gastrointestinal (GI) tube. When positioned at the edge of the bed, she required total assistance to maintain a sitting position, including support of her head and trunk. She did not display sitting balance.

Occupational therapy was begun to foster Marisol's ability to engage in self-care and some instrumental activities of daily living (IADLs) by accomplishing the following: (1) improving her left upper extremity range of motion, (2) reducing spasticity in her left upper extremity, (3) improving functional use of her right upper extremity to facilitate participation in self-care tasks, (4) improving head and trunk control so that she could sit upright in a wheelchair, (5) participating in bed mobility and transfers, and (6) improving cognition such that she could participate in a self-care and self-feeding program and communicate with others.

Critical Thinking Questions

1. How should Marisol's injury be characterized?

2. What is her cognitive state?

3. How might Marisol's progress be measured?

4. How will her various problems be treated?

Epidemiology

Traumatic brain injury (TBI) is defined as an alteration in brain function, or other evidence of brain pathology caused by an external force. There may be a resultant loss of consciousness, **post-traumatic amnesia (PTA)**, skull fracture, or objective neurological findings that can be attributed to the traumatic event on the basis of radiologic findings or a physical or mental status examination.[26,73,78]

TBI is the most common cause of death and disability in young people.[26] More than 52,000 Americans die; 235,000 are hospitalized; and 2.2 million are treated and released from an emergency department (ED). Among children up to age 14, TBI results in an estimated 2,685 deaths, 37,000 hospitalizations, and 435,000 ED visits. The number of people with TBI who are not seen in an ED or who receive no care is unknown. The direct and indirect costs of TBI in the United States have been estimated to be in excess of $60 billion annually.[11] Survivor costs account for more than $31 billion, and fatal brain injuries cost another $16.6 billion.[59,79] The Centers for Disease Control and Prevention (CDC) estimates that at least 5.3 million Americans currently have a long-term or lifelong need for help to perform activities of daily living (ADLs) as a result of TBI.[10]

According to the CDC, the leading causes of TBI are falls (40.5%), struck by against (15.5%), motor vehicle accidents (14.3%), assaults (10.7%), and other (19%).[10] Men are three times more likely to die as a result of TBI than are women. The highest rate of TBI is among those age 65 or older, and the leading cause of TBI varies by age group: age 65 or older—falls; ages 5 to 24—motor vehicle accidents; and newborn to 4 years—assault.[10]

The etiology of TBI is closely associated with age and gender. Children younger than age 5 tend to be injured in falls and motor vehicle crashes and by adults inflicting violence. Those ages 5 to 15 are also injured on bicycles, skateboards, and horses; as pedestrians; and during sports activities. From age 15 to 40, high-speed motor vehicle and motorcycle crashes are the most common causes of TBI. After age 40, the incidence of violence-related injury approaches that of motor vehicles, particularly in metropolitan areas. Young and middle-aged males are 1.5 times more likely to be injured than their female counterparts. The two age groups at highest risk for TBI are newborns to age 4 and teens from age 15 to 19.[10] Elderly individuals are injured just as often (80%) by a fall or during a pedestrian mishap as they are in motor vehicle accidents.[22,50] Blasts are a leading cause of TBI in active duty military personnel in war zones.[10]

Nontraumatic or acquired brain injuries include toxicity from drug overdose, chronic substance abuse, carbon monoxide poisoning, and environmental exposure; anoxia from cardiopulmonary arrest or near-drowning; brain abscess or tumors, meningitis, and encephalitis from bacteria, viruses, acquired immunodeficiency syndrome (AIDS), fungi, or parasites; nutritional deficiencies; genetic and congenital disorders; chronic epilepsy; and degenerative diseases, such as dementia.[53]

Concussions

A concussion is an injury to the brain that occurs because of a blow to the head, or because a fall or blow to another part of the body causes rapid back-and-forth movement of the head. When a concussion occurs, the individual may experience symptoms such as headache, dizziness, blurred vision, memory lapses or loss, alterations in judgment or decision making, or changes in coordination. It is important to know that loss of consciousness frequently does not accompany a concussion. Concussions can be difficult to identify because the symptoms can be vague, and often individuals minimize or fail to report symptoms. Concussions are difficult to treat. Rest is usually the best intervention, although a physician may recommend that the individual refrain from contact sports and avoid strenuous or challenging cognitive activities, such as exercise and driving. The symptoms of a concussion can last several days or even weeks or months. Repeated concussions can have greater effects on the trauma to the brain and require even longer recovery times. Long-term effects of concussions can include attention deficits and symptoms of other types of nerve and brain damage.

Chronic Traumatic Encephalopathy

Chronic traumatic encephalopathy (CTE) is a progressive **degenerative disease** seen in people with a history of repetitive brain trauma, including symptomatic concussions and subconcussive hits to the head that do not cause symptoms.[42]

Individuals with CTE may show symptoms of dementia (eg, memory loss, aggression, confusion and **depression)**, which generally appear years or many decades after the trauma. Baseline tests, such as the imPACT test (Immediate Post-Concussion Assessment and Cognitive Testing[41]), have been created to assess potential cognitive impairment in athletes in contact sports. However, as yet no test is available to detect CTE in a living person; the condition can be determined only by autopsy.

Although the aforementioned conditions often have characteristics similar to those resulting from TBI (particularly with regard to rehabilitation approaches), this chapter's primary focus is assessment of and intervention for individuals with traumatic brain injury.

Substance abuse is strongly linked to TBI. At least 20% of adolescents and adults who are hospitalized and at least 30% of those requiring rehabilitation are intoxicated at the time of their injury.[45] An even greater number of individuals have a previous history of alcohol or other substance abuse in the year preceding the injury. The American Psychiatric Association's *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition: DSM-5* defines substance abuse as (1) failure to fulfill major role obligations at work, school, or home; (2) use of a substance in situations in which it is physically hazardous; (3) substance-related legal problems; or (4) continued use despite persistent or recurrent social or interpersonal problems related to use.[3,18,45,51] Therefore, knowledge of the acute and chronic sequelae of substance abuse disorders is crucial when assessing and treating individuals with brain injuries. Unsurprisingly, individuals who use alcohol or other drugs after sustaining a brain injury do not recover as well as those who don't use alcohol or other drugs.

Recovery from any type of brain injury depends on the client's age and preinjury capabilities, the severity of the injuries incurred, and the quality of intervention and support available during recovery. Unfortunately, recurrent brain injury is all too common and occurs in those who have previously sustained trauma, have developmental disabilities, or have acquired disabilities associated with other causes.

Prevention of secondary complications is critical throughout all stages of the recovery process—at the time the person is resuscitated (ie, at the site of injury), in acute medical care settings, during acute and post-acute rehabilitation programs, and when the individual is trying to reintegrate into his or her family and community. Many of the available medical and therapeutic interventions target these secondary complications. A well-coordinated team of knowledgeable professionals, family members, and supportive community caregivers can optimize the outcome for a given individual.[13]

Pathophysiology

Neuropathologists and neurosurgeons currently categorize the early stages of TBI as primary (occurring at the moment of impact) and secondary (occurring in days to several weeks after the injury). Prevention of primary injury includes never driving under the influence; reducing distractions while driving (eg, texting, phone calls); using safety belts and air bags; and wearing protective helmets during sports such as bicycling, snowboarding, roller blading, and skiing; all these measures can minimize the impact of the initial cause of injury. Prevention also includes making living areas safer for older adults, such as removing fall hazards and installing grab bars.

Prevention of secondary injury typically begins at the point of contact, with those providing first aid at the scene of the trauma. It continues with emergency medical services (EMS), resuscitation and transport, and acute medical and surgical management; it then carries over to rehabilitation settings. (The section on medical interventions, later in the chapter, particularly discusses secondary interventions to prevent further disability.)

An individual with TBI will typically have some combination of primary focal and diffuse brain injury, depending on the cause and mechanism of the initial injury. In best case scenarios, a minimal amount of secondary brain damage and functional disability occurs as a result of brain swelling, hypotension, hypoxia, and systemic injury; prompt recognition of these complications and appropriate intervention improve survival and the functional outcome.[26]

Focal Brain Injury

Focal brain injury is caused by a direct blow to the head after collision with an external object or a fall, a penetrating injury resulting from a weapon, or collision of the brain with the inner tables of the skull. The bones of the face or skull may or may not be fractured. Common findings in individuals with a focal injury resulting from falls include intracerebral and brain surface contusions, particularly in the inferior and dorsolateral frontal lobes, the anterior and medial temporal lobes, and less commonly, the inferior cerebellum. Assault and missile wounds can occur anywhere in the brain, depending on the direction of force. Other surface areas of the brain, including those not directly below the blow to the head, can also suffer contusions as a result of collision of the brain with the inner tables of the skull. The directly injured area is referred to as the *coup*, and the site of the indirect injury is known as the *contrecoup*.[31,32]

If there are injuries to the coverings of the brain, especially the dura, pia, and arachnoid, other focal hemorrhages occur. Epidural hematomas (EDHs) are associated with skull fractures in adults with disruption of the integrity of the meningeal arteries; children may have arterial disruption with or without a skull fracture. Individuals with an EDH may initially be alert after the blow to the skull; as the hematoma develops between the skull and the dura, it can cause pressure on underlying brain tissue (secondary injury) with rapid deterioration in mental and physical status. Prompt recognition and neurosurgical treatment can save lives and limit morbidity.[38]

Subdural hematomas (SDHs) occur between the dura and the brain surface through tearing of bridging veins. The rate of hemorrhage is often slower than that of an EDH because venous bleeding is more gradual than arterial. An SDH may occur just as frequently on the side of the head opposite the direct blow; therefore, an EDH can occur on one side of the brain adjacent to the trauma and an SDH on the other. SDHs tend to spread around the entire surface of one hemisphere or, less commonly, in the posterior fossa. Acute SDH is diagnosed within 48 hours of injury, subacute SDH within 2 to 14 days after injury, and chronic SDH after 2 weeks. The fall or blow to the head in individuals with subacute or chronic SDH may have occurred days before the person arrives at the hospital with symptoms typical of changes in mental status. The urgency of treatment for SDH depends on the clinical condition of the individual and the extent of adjacent brain tissue affected, as observed radiologically.[72]

Multifocal and Diffuse Brain Injury

In multifocal and diffuse brain injuries, there may be sudden deceleration of the body and head, with variable forces transmitted to the surface and deeper portions of the brain. Motor vehicle, bicycle, and skateboard crashes are typical etiologic factors, but falls from a high surface or off a horse or bull can also result in multifocal and diffuse injuries.

Intracerebral hemorrhage (ICH) is nearly always a focal injury with missile wounds and is common after falls and assaults. Within the first week after TBI, particularly in clients with blood-clotting abnormalities, ICH may appear on follow-up CT scans. With a high-speed deceleration injury, multiple small, deep ICHs occur throughout the neuraxis; on high-resolution CT or magnetic resonance imaging (MRI), they are typically visible at the junction between gray and white matter and in the basal ganglia, corpus callosum, midbrain, and/or cerebellum.

Subarachnoid hemorrhage (SAH) and intraventricular hemorrhage (IVH) occur when the pia or arachnoid is torn. SAH caused by trauma is less frequently associated with vasospasms than is SAH caused by rupture of an aneurysm. A large IVH can block the flow of cerebrospinal fluid (CSF) and result in acute hydrocephalus. Thus, clinical evaluation for a possible ruptured aneurysm causing brain dysfunction, which may result from a fall or motor vehicle crash, is important with either of these entities.

Diffuse axonal injuries (DAIs) are prototypical lesions caused by rapid deceleration. The degree of injury may vary from primary axonotomy, with complete disruption of the nerve, to axonal dysfunction, in which the structural integrity of the nerve remains intact but there is loss of ability to transmit normally along neuronal pathways. The clinical severity of DAI is measured by the depth and length of coma (ie, the time from the onset of injury until the individual performs purposeful activity) and associated signs, such as pupillary abnormalities.[51]

Prevention of Secondary Brain Injuries

The brain, like any body tissue, reacts to injury with swelling or edema, neurochemical injury cascades, changes in blood flow, and inflammation. Unlike other tissues, however, the brain is confined in a closed container, the skull; this protects it from outside injury, but also restricts the amount of swelling or blood accumulation that can occur. The brain is also the organ least able to tolerate loss of blood flow or oxygen. Secondary injury occurs as a result of the effects of brain swelling in a closed space, loss of perfusion, and decreased delivery of oxygen to healthy and damaged tissue. Recovery is related to the extent of the initial pathology and secondary injury.[25] Improved outcomes result when secondary, delayed insults are prevented or respond to treatment.

Guidelines for the management of severe TBI to minimize the impact of secondary injury have been developed over the past 10 years by the American Association of Neurological Surgeons (AANS) and the Brain Trauma Foundation. Some of the areas addressed include resuscitation of blood pressure and oxygenation, management of elevated intracranial pressure (ICP) or hypertension, nutrition after acute trauma, and seizure prophylaxis. These care recommendations are based on a critical review of the available literature on the management of individuals with TBI, and they are categorized into three groups: *standards*, which represent a high degree of clinical certainty; *guidelines*, which represent a moderate degree of clinical certainty; and *options*, which represent a low degree of clinical certainty.[12] Each of these terms (standards, guidelines, and options) is used as a label for forms of intervention for individuals who have sustained a TBI.

Areas of intervention that are considered standards are relatively few and relate to interventions that may be more harmful than helpful. They include the following:

- In the absence of increased ICP, chronic prolonged hyperventilation should be avoided.
- Steroids are not recommended to reduce ICP.
- Prophylactic anticonvulsants are not recommended for preventing late (ie, after the first week) post-traumatic seizures (PTSs).

Guidelines, which have a moderate degree of certainty regarding efficacy, include the following for individuals with severe TBI: (1) all geographic regions should have an organized trauma care system to provide emergency care; (2) hypotension (systolic blood pressure [SBP] below 90 mm Hg) or hypoxia (apnea, cyanosis, oxygen saturation below 90% in the field, or a partial arterial oxygen pressure [PaO_2] of 60 mm Hg) must be corrected immediately and the condition monitored; (3) ICP monitoring is appropriate for injuries in individuals younger than age 40 with an SBP pressure below 90 mm Hg, with a Glasgow Coma Scale (GCS) score between 3 and 8, or when CT scans show hematomas, contusions, edema, or compressed basal cisterns; (4) intervention should be initiated to lower the ICP if it exceeds 20 to 25 mm Hg; (5) effective ICP treatments include mannitol, high-dose barbiturate therapy, ventriculostomy for drainage of CSF, and craniectomy (ie, removal of portions of the skull to allow external brain swelling [bone flap]); and (6) enteral or parenteral nutritional support at 140% of the basal rate in nonparalyzed and 100% in paralyzed individuals, with 15% of calories provided as protein within 7 days of TBI.

PTSs are classified as *immediate* when they occur during the first 24 hours after injury, *early* when they occur during the first 7 days, and *late* after the first 7 days. Prophylactic treatment with phenytoin or carbamazepine during the first week after TBI is an intervention option recognized by both the AANS and the American Academy of Physical Medicine and Rehabilitation (AAPM&R). Both organizations recognize that the efficacy of prophylactic treatment diminishes greatly after the first week and therefore recommend discontinuation of anticonvulsant medication as standard treatment after the first week.[11,12] If late PTSs develop, treatment is warranted because the reoccurrence rate is greater than 80%.[35] All clients and caregivers should learn recognition of and first aid for seizures, in addition to risk modification. Avoidance of alcohol, street drugs, and prescribed medications that lower the seizure threshold is important for clients recovering from TBI. The groups at highest risk of developing PTS are those with penetration of metal and bone into the brain substance, biparietal contusions, multiple intracranial operations, and any injury that causes more than a 5-mm lateral shift on CT scans.[21]

Implementation of the aforementioned standards and guidelines more typically takes place in designated trauma centers, where physicians, nurses, and allied health providers are accustomed to treating large numbers of individuals with TBI. Studies in both academic and community hospital settings have shown that morbidity and mortality can be reduced appreciably by following the AANS guidelines.[64]

Ongoing optimal medical and health management can facilitate an individual's recovery and ability to participate in his or her own rehabilitation. Early detection and prompt management of sleep and mood disorders, pain, hydrocephalus, heterotopic ossification, and endocrinopathies, all common sequelae of TBI, must be addressed. Medical therapeutic interventions should be based on behavioral, cognitive, and functional performance factors that are observable and measurable by members of a rehabilitation team.

Case Study

Dewayne

Dewayne, an 18-year-old with multiple cerebral contusions, has right arm and leg tremors with intentional movement and severe rigidity. He also has increased tone in his left arm and leg. He is dependent for all self-care and mobility.

After a baseline evaluation conducted over 2 days, both occupational and physical therapists note that the tremors increase with any voluntary movement. Medication is introduced to reduce the tremors, and feedback is provided to the prescribing physician about Dewayne's performance of self-care activities and bed mobility. Over the next 2 weeks, Dewayne developed the ability to use his right hand to wipe his face with minimal assistance, which takes 10 seconds, and his medication dose is tapered, with no worsening of the tremor.

Meanwhile, the flexor tone on his left side is increasing, especially at the elbow; this prevents progress in upper body dressing. A temporary musculocutaneous nerve block with bupivacaine results in increased ability to extend his left arm so that dressing now requires only moderate assistance; the next day, a phenol nerve block is performed, at the therapist's suggestion, for longer term relief of the elbow flexion tone. This intervention is directed toward a focal area of difficulty for the client, which is his ability to use his left arm for upper body self-care. Alternative interventions include systemic tone-reducing medications, which may have adverse side effects, and inhibitive casting of the elbow, which may help but makes the limb less useful while casted.

Coma and Levels of Consciousness

A TBI typically results in an altered level of consciousness. The continuum of consciousness ranges from coma to conscious awareness. After a brain injury, an individual's progression along this continuum of consciousness depends on the client's age and previous health status, the severity of the injury, and the methods of medical, therapeutic, and environmental management.

Consciousness is a state of environmental awareness and self-awareness. Coma is the absence of awareness of self and the environment despite maximal external stimuli. No periods of wakefulness occur in the coma state.[65] When sedating and hypnotic medications are discontinued, the coma rarely lasts longer than 4 weeks. When the coma resolves, the person becomes either partially aware of self and the environment (minimally conscious) or, if no awareness is present, "vegetative."

The Glasgow Coma Scale has been the traditional method used by healthcare professionals to assess levels of consciousness after TBI (Table 34.1). The GCS has been used to quantify the severity of brain injury and predict outcome. The three behavioral areas assessed in the GCS are best motor response, verbal response (talking), and eye opening. The most reliable is the motor score; when it reaches 5, which signifies a purposeful response to pain (eg, pushing away noxious stimuli), or 6, which represents an ability to follow simple commands, the injured individual is no longer in a coma or vegetative state. This is an important landmark in recovery from TBI.[79]

TABLE 34.1

Glasgow Coma Scale

Examiner's Test		Individual's Response	Assigned Score
Eye opening	Spontaneous	Opens eyes on own	4
	Speech	Opens eyes when asked to in a loud voice	3
	Pain	Opens eyes when pinched	2
	Pain	Does not open eyes	1
Best motor response	Commands	Follows simple commands	6
	Pain	Pulls examiner's hand away when pinched	5
	Pain	Pulls a part of the body away when pinched by examiner	4
	Pain	Flexes body inappropriately to pain (decorticate posturing)	3
	Pain	Body becomes rigid in an extended position when examiner pinches (decerebrate posturing)	2
	Pain	Has no motor response to pinch	1
Verbal response (talking)	Speech	Carries on a conversation correctly and tells examiner where and who he or she is and the month and year	5
	Speech	Seems confused or disoriented	4
	Speech	Talks so examiner can understand but makes no sense	3
	Speech	Makes sounds that examiner can't understand	2
	Speech	Makes no noise	1

Adapted from Rosenthal M: *Rehabilitation of the head-injured adult*, Philadelphia, 1984, FA Davis.

The vegetative state is most succinctly described as wakefulness without awareness. A person in a vegetative state has the following characteristics: (1) no awareness of self or the environment, and inability to interact with others; (2) no sustained, reproducible, or voluntary behavioral responses to sensory stimuli; (3) no language comprehension or expression; (4) sleep/wake cycles of variable length; (5) ability to regulate temperature, breathing, and circulation to permit survival with routine medical and nursing care; (6) incontinence of bowel and bladder; and (7) variably preserved cranial nerve and spinal reflexes. A persistent vegetative state refers to a condition of past and continuing disability with an uncertain future; the typical onset is within 1 month of a TBI or nontraumatic brain injury or after a month-long metabolic or degenerative condition. The condition may improve and the client may achieve a minimally conscious state (MCS) over time. If the client does not improve, the term permanent vegetative state is appropriate and signifies that the chance of regaining consciousness before death is exceedingly small.[71] Recovery of consciousness is rare for individuals in a persistent vegetative state 12 months after a TBI or 3 months after a nontraumatic brain injury.[77]

Practice parameters for the care of individuals in a persistent vegetative state indicate that appropriate diagnosis of the condition is crucial; a physician with experience in this area should participate in the determination. Once the diagnosis has been established, the prognosis should be explained in detail to the family, surrogates, and caregivers. Appropriate care respects the individual's comfort, hygiene, and dignity. Careful observation of any signs of emergence to MCS is important in determining the intensity of therapeutic interventions. Positioning and other interventions to manage tone and prevent contractures should be included. The amount of extraordinary care is guided by the advance directives or presumed directives supplied by the client's surrogate.[67]

Many individuals emerge from a persistent vegetative state to MCS in which there is definite behavioral evidence of awareness of self, environment, or both. Clearly discernible, reproducible behavior in one or more of the following areas must be demonstrated: (1) ability to follow commands, (2) gestural or verbal yes/no responses (regardless of accuracy), (3) intelligible verbalizations, and (4) purposeful movements or affective responses that are appropriate reactions to environmental stimuli. Examples include reaching for objects; touching or holding objects and accommodating for their size and shape; engaging in eye pursuit movements or sustained fixation in direct response to stimuli; and smiling, crying, vocalizing, or gesturing in response to relevant stimuli. Convenient ways to assess for MCS are testing an individual with situational orientation questions ("Are you standing?" "Are you in a chair?") and giving the individual an object of common use (eg, washcloth or comb) to see whether he or she tries to use it appropriately. Testing for MCS should be done in a quiet environment when the client is alert (ie, not under sedating medication or in a physical position that encourages inattention). Requested commands should not exceed the client's physical capabilities and should not involve reflexive movements.[27] Serial assessment tools that can be useful for measuring the cognitive progress of individuals in MCS include the JFK Coma Recovery Scale–Revised (JFK-Revised), Wessex Head Injury Matrix (WHIM), Coma–Near Coma Scale, Sensory Stimulation Assessment Measure, and the Western Neuro Sensory Stimulation Profile.[15,28,62]

Another important landmark in recovery is post-traumatic amnesia, which is probably the single best measurable predictor of functional outcome in the research literature (Table 34.2). PTA is the length of time from the injury to the moment when the individual regains ongoing memory of daily events. Some evidence suggests that the duration of PTA is highly correlated with individual outcomes. A longer PTA is associated with poorer long-term cognitive and motor abilities and a decreased ability to return to work and school. PTA that lasts 4 weeks or longer is correlated with significant long-term disability.[57] PTA is measured with the Galveston Orientation and Amnesia Test (GOAT) or the Orientation Log.[52] The latter test is easier to administer to individuals with moderate to severe TBI in which the examiner may not know the details of circumstances immediately before the injury and in which the injured individual has begun to remember events.[43,52]

TABLE 34.2

Relationship of Severity of Injury to Duration of Post-Traumatic Amnesia (PTA)

Severity of Injury	Duration of PTA
Very mild	<5 min
Mild	5–60 min
Moderate	1–24 hr
Severe	1–7 days
Very severe	1–4 weeks
Extremely severe	>4 weeks

From Rosenthal M: *Rehabilitation of the head-injured adult*, Philadelphia, 1984, FA Davis.

The Rancho Los Amigos Scale of Cognitive Functioning is a descriptive measurement of eight (and sometimes 10) levels of awareness and cognitive function.[68] Progression through the levels occurs most typically with traumatic injuries. However, in some very severely injured individuals, the recovery curve may actually skip a level (typically level IV, an agitated confused state). Other clients may never be as low as level I or II, but they may be agitated and confused for several weeks (level IV). These individuals may experience periods during which they also function at level V or VI. Thus, this scale can be helpful to staff and family members in designing specific behavioral interventions for a given. Box 34.1 presents a complete description of the RLA scale.

Box 34.1

Rancho Los Amigos Levels of Cognitive Functioning

Level I No response	The individual appears to be in a deep sleep and is completely unresponsive to any stimuli presented.
Level II Generalized response	The individual reacts inconsistently and nonpurposefully to stimuli in a nonspecific manner. Responses are limited in nature and are often the same, regardless of the stimulus presented. Responses may be physiologic changes, gross body movements, or vocalization. Often the earliest response is to deep pain. Responses are likely to be delayed.
Level III Localized response	The individual reacts specifically but inconsistently to stimuli. Responses are directly related to the type of stimulus presented, as in turning the head toward a sound or focusing on an object presented. The individual may withdraw an extremity or vocalize when presented with a painful stimulus. He or she may follow simple commands in an inconsistent, delayed manner, such as closing the eyes, squeezing, or extending an extremity. After the external stimulus has been removed, the individual may lie quietly. He or she may also show a vague awareness of self and body by responding to discomfort by pulling at a nasogastric tube or catheter or resisting restraints. The individual may show bias by responding to some people (especially family and friends) but not to others.
Level IV	The individual is in a heightened state of activity with a severely decreased ability to process information. He or she is detached from the present and responds primarily

Confused, agitated	to his or her own internal confusion. Behavior is frequently bizarre and nonpurposeful relative to the immediate environment. The individual may cry out or scream out of proportion to the stimuli even after removal and may exhibit aggressive behavior, attempt to remove restraints or tubes, or crawl out of bed in a purposeful manner. However, the individual does not discriminate among people or objects and is unable to cooperate directly with treatment effort. Verbalization is frequently incoherent and inappropriate to the environment. Confabulation may be present; the individual may be euphoric or hostile. Thus, gross attention is very short, and selective attention is often nonexistent. Being unaware of present events, the individual lacks short-term recall and may be reacting to past events. He or she is unable to perform self-care (eg, feeding and dressing) without maximal assistance. If not disabled physically, the individual may perform motor activities (eg, sitting, reaching, and ambulating), but as part of the agitated state and not as a purposeful act or on request.
Level V Confused, inappropriate, nonagitated	The individual appears alert and is able to respond to simple commands fairly consistently. However, with increased complexity of commands or lack of any external structure, responses are nonpurposeful, random, or at best fragmented toward any desired goal. The individual may exhibit agitated behavior, not on an internal basis (as in level IV), but rather as a result of external stimuli and usually out of proportion to the stimuli. He or she has gross attention to the environment but is highly distractible and lacks the ability to focus attention on a specific task without frequent redirection back to it. With structure, the individual may be able to converse on a social, automatic level for short periods. Verbalization is often inappropriate; confabulation may be triggered by present events. Memory is severely impaired, with confusion of past and present in the reaction to ongoing activity. The individual lacks initiation with regard to functional tasks and often shows inappropriate use of objects without external direction. He or she may be able to perform previously learned tasks when they are structured for him or her, but the individual is unable to learn new information. He or she responds best to self, body, comfort, and often family members. The individual can usually perform self-care activities with assistance and may accomplish feeding with maximal supervision. Management on the unit is often a problem if the individual is physically mobile because he or she may wander off either randomly or with the vague intention of going home.
Level VI Confused, appropriate	The individual shows goal-directed behavior but is dependent on external input for direction. The response to discomfort is appropriate, and the individual is able to tolerate unpleasant stimuli (eg, nasogastric tube) when the need is explained. The individual follows simple directions consistently and shows carryover for tasks that have been relearned (eg, self-care). He or she is at least supervised with old learning but is unable to maximally assist in new learning with little or no carryover. Responses may be incorrect because of memory problems, but they are appropriate to the situation. Responses may be delayed, and the individual shows a decreased ability to process information with little or no anticipation or prediction of events. Past memories have more depth and detail than recent memory. The individual may show beginning awareness of his or her situation by realizing that he or she doesn't know an answer. The individual no longer wanders and is inconsistently oriented to time and place. Selective attention to tasks may be impaired, especially with difficult tasks and in unstructured settings, but the individual is now functional for common daily activities (30 minutes with structure). He or she shows at least vague recognition of some staff members and has increased awareness of self, family, and basic needs (eg, food), again in an appropriate manner, in contrast to level V.
Level VII Automatic, appropriate	The individual appears appropriate and oriented in the hospital and home settings and goes through the daily routine automatically but is frequently robot-like. The individual exhibits minimal to absent confusion but has shallow recall of what he or she has been doing. He or she shows increased awareness of self, body, family, foods, people, and interaction in the environment. The individual has superficial awareness of, but lacks insight into, his or her condition, demonstrates decreased judgment and problem solving, and lacks realistic planning for the future. He or she shows carryover for new learning, but at a decreased rate. He or she requires at least minimal supervision for learning and for safety purposes and is independent in self-care activities and supervised in home and community skills for safety. With structure the individual is able to initiate tasks in social and recreational activities in which he or she now has an interest. Judgment remains impaired, such that the individual is unable to drive a car. Prevocational or avocational evaluation and counseling may be indicated.
Level VIII Purposeful and appropriate	The individual is alert and oriented, is able to recall and integrate past and recent events, and is aware of and responsive to his or her culture. He or she shows carryover for new learning if it is acceptable to him or her and his or her life role. The individual needs no supervision after activities are learned within his or her physical capabilities. He or she is independent in home and community skills, including driving. Vocational rehabilitation is indicated, to determine ability to return as a contributor to society (perhaps in a new capacity). The individual may continue to show decreased ability, relative to premorbid abilities, in reasoning, tolerance for stress, judgment in emergencies, or unusual circumstances. His or her social, emotional, and intellectual capacities may continue to be at a decreased level but are functional for society.
Levels IX and X are used at some out-client facilities to identify higher functioning individuals.	
Level IX Purposeful, appropriate: stand-by assistance on request	• Independently shifts back and forth between tasks and completes them accurately for at least 2 consecutive hours. • Uses assistive memory devices to recall daily schedule and to-do lists and to record critical information for later use with assistance when requested. • Initiates and carries out steps to complete familiar personal, household, work, and leisure tasks independently and unfamiliar personal, household, work, and leisure tasks with assistance when requested. • Aware of and acknowledges impairments and disabilities when they interfere with task completion and takes appropriate corrective action, but requires stand-by assistance to anticipate a problem before it occurs and take action to prevent it. • Able to think about the consequences of decisions or actions with assistance when requested. • Accurately estimates abilities but requires stand-by assistance to adjust to task demands. • Acknowledges others' needs and feelings and responds appropriately with stand-by assistance. • Depression may continue. • May be easily irritable. • May have low tolerance for frustration. • Able to self-monitor appropriateness of social interaction with stand-by assistance.
Level X Purposeful, appropriate: modified independent	• Able to handle multiple tasks simultaneously in all environments, but may require periodic breaks. • Able to independently procure, create, and maintain own assistive memory devices. • Independently initiates and carries out steps to complete familiar and unfamiliar personal, household, community, work, and leisure tasks, but may require more than the usual amount of time and/or compensatory strategies to complete them. • Anticipates impact of impairments and disabilities on ability to complete daily living tasks and takes action to prevent problems before they occur, but may require more than the usual amount of time and/or compensatory strategies. • Able to independently think about the consequences of decisions or actions, but may require more than the usual amount of time and/or compensatory strategies to select the appropriate decision or action. • Accurately estimates abilities and independently adjusts to task demands. • Able to recognize the needs and feelings of others and automatically respond in appropriate manner. • Periods of depression may occur. • May show irritability and low tolerance for frustration when sick, fatigued, and/or under emotional stress. • Social interaction behavior is consistently appropriate.

Adapted from the Adult Brain Injury Service: *Original scale, levels of cognitive functioning*, Downey, CA, 1980, Rancho Los Amigos Medical Center.

Many studies have analyzed factors such as the client's age, the severity and cause of the injury, substance abuse, and the client's psychosocial status in predicting outcomes after TBI; however, these factors have definite limitations in predicting the recovery of an individual.[a] Individuals with TBI improve over a period of months to years, especially once the individual becomes aware of his or her altered capabilities.[66] Monitoring an individual's personal rate of recovery is probably more predictive of future recovery than any other factor.

Clinical Picture

Physical Status

An individual with TBI may exhibit a variety of symptoms, depending on the type, severity, and location of the injury. Individuals may have limitations in most of the areas discussed in the following sections, or they may have subtle deficits evident only during more complex activities. Table 34.3 shows some of the most common clinically diagnosed physical signs and symptoms of a client who has sustained a TBI.

TABLE 34.3

Clinical Signs and Symptoms Commonly Seen in a Client With a Traumatic Brain Injury

Sign	Lesion Location	Clinical Characteristics	Interventions
Decerebrate rigidity	Midbrain, pons, diencephalon	Extended internally rotated shoulders; extended elbows; flexed wrists, fingers; extended internally rotated hips, extended knees, ankle plantar flexion, inversion; increased rigidity when awake	Positioning, range of motion (ROM), neuromuscular blocks, early casting
Decorticate rigidity	Cortical white matter, internal capsule, thalamus, cerebral peduncle, basal ganglia	Internally rotated shoulder; flexed elbow, wrists, fingers; extended, internally rotated hips; knee flexion; ankle plantar flexion, inversion; increased rigidity when awake	Positioning, ROM, neuromuscular blocks, early casting
Bruxism	—	Persistent jaw clenching, grinding of teeth with or without temporomandibular dislocation or subluxation	Neuromuscular blocks, oral orthotics
Spasticity	Upper motor neuron syndrome; corticospinal pathways	Velocity-dependent resistance, hyperreflexia/clonus, muscle shortening; present in face, neck, trunk, limbs; worse when awake and with effort	Bed/chair positioning, ROM, weight bearing, neuromuscular blocks, inhibitive casting, enteral and intrathecal medications, tendon releases, relaxation techniques
Rigidity and bradykinesia; parkinsonism	Substantia nigra, extrapyramidal pathways; also with medications that block dopamine	Velocity-independent resistance; lead pipe, cogwheel types of rigidity; worse when awake	Positioning, ROM, functional activities, medications
Torticollis		Dystonic posture of the neck; spasticity and/or contracture of the sternocleidomastoid, splenius muscles	Positioning, modalities and ROM, medications, neuromuscular blocks
Myoclonus	Variable	Abrupt, shocklike involuntary jerks in large (limb) or small muscles when sleep or awake	Medications, neuromuscular blocks
Tremor	Variable	Involuntary rhythmic oscillations while awake	Weighted devices, weight bearing, medications, neuromuscular blocks, appropriate assistive devices
Dystonia	Variable	Dynamic contraction/relaxation of muscles with slow, writhing or repetitive twisting movements or sustained contortions; usually distal limb(s)	Positioning, ROM, neuromuscular blocks, medications, appropriate assistive devices
Athetosis	Basal ganglia, medications with effect on dopamine	Slow, sinuous movements of the face, tongue, or limbs	Relaxation techniques, taper offending medications
Chorea	Contralateral neostriatum, thalamus	Involuntary dancelike or jerky movements without rhythmic pattern; distal	Medications
Hemiballismus/ballismus	Contralateral subthalamic nucleus, thalamus, cerebellum	Sudden irregular flinging movements starting in the hip or shoulder, occasionally facial or oral with or without rotator component; worse with arousal/excitement, absent in sleep	Medications
Tics	Variable	Sudden stereotypic coordinated automatic movements or vocalizations while awake	Medications, behavioral management, relaxation techniques
Pseudobulbar athetoid syndrome	Bilateral pyramidal tract	Postural dystonia with fragmentary athetosis, with or without bradykinesia; often preserved intellect/personality	Positioning, appropriate assistive devices

Data from Mayer NH, Keenan MAE, Esquenzi A: Limbs with restricted or excessive motion after traumatic brain injury. In Rosenthal M, Griffith ER, Kreutzer JS, Pentland B, editors: *Rehabilitation of the adult and child with traumatic brain injury*, ed 3, Philadelphia, 1999, FA Davis; Mayer NH: Choosing upper limb muscles for focal intervention after traumatic brain injury, *J Head Trauma Rehabil* 19:119, 2004; Zafonte R, Elovic E, Lombard L: Acute care management of post-TBI spasticity, *J Head Trauma Rehabil* 19:89, 2004.

Decorticate, Decerebrate, and Motor Rigidity

Rigidity is the presence of increased resistance to passive movement throughout most of the range that is independent of stretch velocity.[51] Comatose individuals often display one of two common positions, decorticate rigidity or decerebrate rigidity. In **decorticate rigidity**, the upper extremities (UEs) are in a spastic flexed position with internal rotation and adduction. The lower extremities (LEs) are in a spastic extended position but also internally rotated and adducted. Decorticate rigidity results from damage to the cerebral hemispheres, particularly the internal capsules, which causes an interruption in the corticospinal tracts (which emerge from the cortex and send voluntary motor messages to all extremities).

In **decerebrate rigidity**, both the UEs and LEs are in a position of spastic extension, adduction, and internal rotation. The wrists and fingers flex, the ankles are in plantar flexion with the feet inverted, the trunk extends, and the head retracts. Decerebrate rigidity occurs as a result of damage to the brainstem and extrapyramidal tracts (which send involuntary motor messages from the brainstem to the extremities). Individuals with decerebrate rigidity have a poorer prognosis than do those exhibiting decorticate rigidity.[16,31]

Cogwheel or lead pipe rigidity resembling Parkinson's disease can occur, typically in individuals with severe TBI. It may respond to dopamine agonists, such as levodopa/carbidopa or amantadine. Dystonia of the neck (torticollis), jaw, or distal ends of the limbs can also occur and may require treatment with motor point blocks.[55]

Abnormal Muscle Tone and Spasticity

Although decorticate rigidity and decerebrate rigidity are associated with the most severe types of abnormal muscle tone and tend to occur in comatose individuals, hypertonicity may range from minimal to severe in any muscle group. Individuals functioning at a higher cognitive level than coma generally display a combination of hypotonicity (ie, decreased tone, or flaccidity) and hypertonicity (ie, increased tone, or spasticity). Flaccidity (hypotonicity) is a decrease in normal muscle tone. It is usually attributed to peripheral nerve injury resulting in soft muscle feel, in which the muscles offer no resistance to passive movement. Spasticity (hypertonicity or hypertonia) is an involuntary increase in muscle resistance that is dependent on velocity.[51] The **Modified Ashworth Scale**, a widely used assessment of muscle tone, scores muscle tone on a scale of 0 to 4[8]:

0	No increase in muscle tone
1	Slight increase in muscle tone, manifested by a catch and release or by minimal resistance at the end of the range of motion (ROM) when the affected part or parts is moved in flexion or extension
1+	Slight increase in muscle tone, manifested by a catch, followed by minimal resistance throughout the remainder (less than half) of the ROM
2	More marked increase in muscle tone through most of the ROM, but the affected part or parts are easily moved
3	Considerable increase in muscle tone, passive movement difficult
4	Affected part or parts rigid in flexion or extension

Because individuals with spasticity cannot voluntarily relax their limbs, voluntary movement of an affected limb may be impossible. Spasticity can be seen as early as a few days after brain injury, or it may take 3 to 6 months to develop. In as little as 2 weeks, spasticity may cause muscles to shorten permanently, which in turn can cause joints to lose motion. The condition of permanent shortening is called a *muscle contracture.*

OT Practice Notes

It is important to instruct all staff members involved in the client's care that tone can fluctuate as a result of changes in position, volitional movement, medication, infection, menstruation, illness, pain, environmental factors (ie, ambient temperature), and emotional state.[7]

Primitive Reflexes

If damage to the midbrain has occurred, impaired righting reactions are commonly observed. Similarly, damage to the basal ganglia can result in the absence of equilibrium reactions and protective extension. The absence of righting reactions, equilibrium reactions, and protective extension places the individual at significant risk for further injury from falls during such activities as transfers, getting out of bed, toileting, bathing, and dressing.

Muscle Weakness

A decrease in muscle strength without the presence of spasticity can occur as a result of peripheral nerve or plexus injuries and lack of physical activity caused by secondary factors associated with TBI (eg, compromised respiration, fractures, and infection). A functional muscle and sensory test may be indicated when an individual exhibits decreased strength in the limbs. Additionally, impaired gross and fine motor coordination will be evident and should be assessed.

Decreased Functional Endurance

Decreased endurance and vital capacity usually accompany reduced muscle strength as a result of medical complications such as infections, poor nutrition, or prolonged bed rest. Increasing the individual's muscle strength and endurance is a primary goal in the acute stage and in the initial stages of rehabilitation.

Ataxia

Ataxia results from impairment of the cerebellum itself or the motor pathways leading to and from the cerebellum; it can also occur with impaired proprioception. Ataxia is a movement abnormality characterized by incoordination, impaired sitting and standing balance, or both.[7] Ataxia can occur in the entire body, in the trunk, or in the UEs and LEs; it presents as jerkiness during movement. An individual with ataxia has lost the ability to perform the small adjustments in the distal and proximal ends of extremities that are necessary for smooth, coordinated movement.

The degree of ataxia ranges from mild to severe. An individual with ataxia in the trunk displays impaired postural stability when sitting and standing. He or she has difficulty maintaining the trunk in a stable position to free the UEs or LEs for activities. The individual may compensate for this deficit by grasping a stable surface, such as a tabletop. Ataxia in the UEs causes dysfunction in activities in which the individual attempts to perform a combination of gross and fine motor movements, such as bringing a glass of water to the mouth. The UE oscillates back and forth, causing the water to spill. Ataxia in the LEs results in an impaired ability to ambulate while maintaining balance; falls can easily occur with this condition.

Postural Deficits

Postural deficits develop as a result of an imbalance in muscle tone throughout the body. An individual may inadvertently accentuate the postural deficits by using ineffective strategies to compensate for impaired motor control; delayed or absent righting reactions; or impaired vision, cognition, or perception. Therapists must have a thorough knowledge of the postural deficits of their clients to position them properly in a wheelchair with the appropriate seating system, which is necessary to obtain an upright posture, maintain good postural alignment, and prevent further postural deformities. Frequently exhibited abnormal postures include the following:

1. *Pelvis.* Posterior pelvic tilt is often due to prolonged bed rest in the supine position, which causes loss of ROM in the lower part of the back. Posterior pelvic tilt results in sacral sitting and facilitates kyphosis. Pelvic obliquity is observed when one side of the pelvis sits lower than the other side as a result of hypertonicity of the quadratus lumborum on the involved side.

2. *Trunk.* Kyphosis, scoliosis, and lordosis may all be present as a result of weak or spastic trunk muscles (eg, pectoralis, abdominal, spinal, and paraspinal). It is also common to observe lateral flexion toward the involved side (trunk shortening) with elongation of muscle on the opposite side.

3. *Head and neck.* Forward flexion or hyperextension of the neck and lateral flexion of the head often accompany lateral flexion of the trunk.

4. *Scapula.* The scapula may be depressed, protracted or retracted, downwardly rotated, or all of these at once. This results from an imbalance in scapular muscle tone; some muscles are hypertonic, whereas others are hypotonic.

5. *Upper extremities.* UEs may be bilaterally or unilaterally involved. In unilateral involvement, it is common to see variations in ROM, tone, and strength in each muscle group and joint of the arm, forearm, wrist, and hand.

6. *Lower extremities.* Severe extension patterns are often observed in both LEs, which can pose a problem with wheelchair positioning; this is evident when the individual thrusts forward and slides out of the seating system. Hip adduction, internal rotation, knee flexion, plantar flexion, and inversion of the feet can all be observed.

Limitations of Joint Motion

Loss of ROM in the joints is a common problem. It is often difficult to distinguish between several possible causes of decreased ROM, such as increased muscle tone, volitional resistance, contractures, heterotopic ossification, fractures or dislocations, and pain. Because the intervention addressing decreased ROM depends on the cause, the therapist should consult a physician to determine the cause of the decreased ROM before initiating intervention. Distal limb fractures are often overlooked in acute trauma settings when clients are unable to communicate because of cognitive deficits. Therapists are typically the first to detect the hard end feeling of joints with limited ROM typical of heterotopic ossification, the formation of lamellar bone in soft tissue.[36]

Sensation

Clients with TBI may exhibit signs of absent or diminished sensation, including problems with light touch, differentiation between sharp and dull sensations, proprioception, temperature, pain, and kinesthesia. Additionally, impaired senses of taste and smell, caused by cranial nerve injury, may be observed.[7] Lost or diminished stereognosis, two-point discrimination, and graphesthesia (ie, the ability to interpret letters written on the hand without visual input) may be present. Hypersensitivity, which can often interfere with postural alignment, may also occur.

Integration of Total Body Movements

Total body movements involve the integration of head, neck, and trunk control with dynamic sitting and standing balance while reaching, bending, stooping, and ambulating. To perform total body movements, the individual must coordinate and modulate gross and fine motor movements of the trunk, head, neck, and limbs while performing ADLs. An individual with severe physical involvement often displays poor sitting and standing balance and is unable to maintain an upright position to free the UEs for activities. Individuals functioning at a more advanced level may exhibit subtle deficits in total body movements that make it difficult to bend down, reach overhead to retrieve items in a cabinet, or stoop to retrieve an item that has fallen to the floor. Integrated total body movements are necessary for the performance of all ADLs.

Dysphagia

Dysphagia, or difficulty completing the four stages of chewing and swallowing, is caused by damage to the cranial nerve or brainstem (see Chapter 27). There is a higher incidence of oral preparatory–, oral-, and pharyngeal-stage dysphagia than esophageal-stage dysphagia for individuals with TBI. Typically, more than one stage of chewing and swallowing is impaired.[5,6]

An individual may display oral muscular hypotonicity or hypertonicity, instability of the jaw, and abnormal oral reflexes such as rooting, biting, sucking, gagging, and coughing, which prevent or impair the activity of speaking or eating. As a result of cognitive deficits, the individual may experience difficulty sequencing chewing, swallowing, and breathing.

Self-Feeding

Clients with TBI may be unable to sustain attention long enough to feed themselves. If impulsivity is apparent, these clients will have difficulty monitoring the amount and rate of food brought to the mouth, thus causing coughing and possibly aspiration. Oral apraxia, an inability to perform an intended action or execute an act on command with the mouth or lips, may occur. If clients have ideational apraxia, they will have difficulty understanding the demands required of the self-feeding activity and will be unable to recognize utensils as tools for eating. Because they may also have lost the motor plan for self-feeding (ideomotor apraxia), they may be unable to gain access to the neurological motor pattern for bringing food to the mouth. Hemianopia (visual field cut) or visual neglect may prevent them from seeing half of the plate of food.

Cognitive Status

Cognitive deficits are always evident to varying degrees and can affect many aspects of the individual's quality of life, as mentioned in previous sections. The most common cognitive deficits include decreased attention and concentration, impaired memory, impaired initiation and termination of activities, decreased safety awareness and poor judgment, impulsivity, and difficulty with executive functions and abstract thinking (eg, problem solving, planning, integration of new learning, and generalization).

Attention and Concentration

Reduced attention and concentration impair the ability to maintain focus on an activity without becoming distracted and the ability to resume an activity when interrupted. Clients with TBI often lose the ability to concentrate for a length of time and the ability to filter out distractions from the surrounding environment. The inability to attend to and concentrate on activities severely impedes the ability to function at work and school and complete ADLs. Although deficits in attention and concentration can diminish as neurological recovery progresses, such deficits can remain to varying degrees throughout an individual's life. Even clients who experience mild TBI can demonstrate subtle deficits in attention and concentration that often linger for years after the injury and can affect everyday functioning.

Memory

Impaired memory, the most frequently observed cognitive deficit in clients with TBI, can remain a lifelong problem. Memory impairment ranges from forgetting several words just heard (immediate memory), to forgetting which family members visited the night before (short-term memory), to forgetting events that occurred years before the injury (long-term memory). Despite neurological recovery, most of these clients continue to demonstrate difficulty learning new information. Safety concerns include getting lost, leaving doors unlocked, and leaving a stove on; clients with impaired memory typically require supervision if compensatory methods cannot be used. This loss of independence can be emotionally devastating because clients with TBI often have insight into both who they were before the injury and their accomplishments, goals, and plans for the future, many of which are severely disrupted and perhaps lost as a result of TBI.

Memory losses are also labeled in relation to the time of the injury or brain damage. Loss of memories for events before the time of the specific injury is referred to as retrograde amnesia. The client may forget events that occurred just before the accident or forget events that happened several days, weeks, and even months before the accident. After TBI the client is often unable to form new memories, and this is referred to as anterograde amnesia; this period can last for days, weeks, or even months after the injury.

Initiation and Termination of Activities

Impaired initiation and termination of activities affect the ability to start and end activities. An inability to initiate activities without assistance affects the individual's ability to live independently. In general, clients who exhibit deficits in initiation demonstrate the greatest progress in a rehabilitation setting that provides assistance and structure. After returning home, these individuals may regress and have difficulty completing basic daily activities if the necessary structure has not been set up. Similarly, clients may exhibit difficulty terminating an activity once it has been started, which is a type of perseveration. For example, a client may begin brushing the teeth but may be unable to end the task because he or she feels compelled to continue. Perseveration sometimes involves a thought process. Clients may be unable to concentrate on one activity because they are perseverating on the idea that another activity (eg, the laundry) must be completed.

Safety Awareness and Judgment

Frontal lobe damage often results in an impairment in insight about a person's limitations and in impulsivity, or the inability to consider consequences before acting. Such individuals demonstrate poor safety awareness and judgment. For example, the client may attempt to rise out of a wheelchair without locking the brakes or moving the footrests. A more mobile client who has been reintegrated into the community may attempt to cross streets without observing traffic signals or remove pots from the stove or oven without using protective oven mitts or pot holders. It is important for the OT to structure the client's environment to reduce accidents and increase the client's awareness of his or her limitations through repeated opportunities to practice and relearn safe and appropriate behavior.

Processing of Information

Most people with TBI experience some degree of difficulty processing external information from the environment. A delay in response time is often noted and can range from a few seconds to several minutes. It is important for the therapist to recognize the presence of delayed processing and distinguish the delay from the absence of function. For example, during sensory evaluation a client may exhibit a delay in response to a dull stimulus. The therapist may mistakenly interpret the individual's delayed processing time as an absence seizure or impairment of sensory awareness. A delay in the processing of external information from the environment can involve visual, auditory, sensory, and perceptual processing.

Executive Functions and Abstract Thought

Executive function skills include the ability to plan, organize, set goals, understand the consequences of one's actions, and modify behavior in accordance with environmental responses. Abstract thinking is the ability to hold and manipulate a concept in one's mind by using critical reasoning and analytic skills. Many clients with TBI exhibit concrete thinking, in which they are able to interpret information only at the most literal level. For example, individuals with impaired executive and abstract functions may be able to complete a meal preparation activity accurately and safely only if step-by-step directions are provided. If the directions do not specifically direct the reader to modify the cooking temperature, these individuals may burn the food because they are unable to foresee the consequences of maintaining the stove on a high setting.

Generalization

Generalization of new learning is the ability to learn a specific task and transfer the skills needed for that task to a similar activity. Deficits in executive function skills, abstract thinking, and short-term memory significantly impair the generalization of new learning. For example, an individual who has learned in a day treatment setting the skills for completing a laundry task may be unable to transfer the skills at home or at a different laundromat. Such deficits often occur as a result of concrete thinking and the inability to form abstractions. Although the cognitive pattern for completing laundry tasks with the laundry machine in the clinical setting is established, the individual cannot transfer that cognitive pattern to a similar but unfamiliar laundry machine in a different environment. Impaired generalization of new learning is one of the most significant problems impeding the individual's ability to resume independent functioning in a community setting.

Visual Status

Visual skills involve the ability to accurately see stimuli from the external environment (see Chapter 24). Visual skills do not involve the identification of objects, which is a function of perception. Among the many deficits in visual skills that may result from TBI are accommodative dysfunction (causing blurred vision), convergence insufficiency (the inability to maintain a single vision while fixating on an object), lateral or medial strabismus, nystagmus, hemianopia, and impairment of scanning and pursuits. Saccades (fast, jerky movements of the eyes as they change from one position of gaze to another, as is needed to read a book) may also be compromised by TBI. Reduced blink rate, ptosis (drooping of the eyelid), and lagophthalmos (incomplete eyelid closure) are also common visual deficits resulting from damage to the oculomotor nerve.[7]

Dysfunction in any of these visual elements can profoundly affect daily life function. Individuals rely on vision indirectly in social and interpersonal interactions. Vision is used as a cueing and feedback system for motor skills such as ambulation and for eye-hand coordination activities. Deficits in vision can affect all daily life activities, including the areas of hygiene and grooming, meal preparation and eating, wheelchair mobility, reading and writing, and driving.

Perceptual Skills

Perception is the ability to interpret stimuli from the external environment (see Chapter 25). Perception is a function of the secondary cortical areas of the right hemisphere, including the secondary visual area, the secondary somatosensory area, the secondary auditory area, and the multimodal parietal-occipital-temporal area. Perceptual deficits are more often a result of right hemisphere damage but may also occur with lesions in the left hemisphere. Perception can be grouped into the following categories: visual perception, body schema perception, motor perception, and speech and language perception. An individual with impairments in visual perceptual may exhibit difficulty in right-left discrimination, figure-ground discrimination, form constancy, position in space, and topographic orientation. Visual perceptual deficits also include visual agnosia, in which the individual displays difficulty recognizing familiar objects and people. For example, prosopagnosia is the inability to connect faces with names. Prosopagnosia results from damage to the multimodal association area.[7]

Body schema perception is awareness of the spatial characteristics of a person's own body. This awareness is derived from the neural synthesis of tactile, proprioceptive, and pressure sensory associations about the body and its individual parts. A common problem in people with TBI is anosognosia, a failure to recognize deficits or limitations. This may lead to the body schema perceptual dysfunction of **unilateral neglect syndrome**, in which the individual has lost the ability to integrate perceptions from one side of the body or environment (usually the left). Unilateral neglect is commonly caused by a lesion in the right parietal lobe but can also occur as a result of frontal and occipital lobe damage. Clients with left unilateral neglect may disown their left extremities and treat them as though they belong to someone else. For example, these individuals may shave only the right side of their face or dress only the right side of their body.[7]

Aphasia is a disturbance in the comprehension or formulation of language (or both) caused by dysfunction in specific brain regions, typically the left hemisphere.[20] A few left-handed individuals have language dominance in the right hemisphere. Establishing reliable communication is crucial in treating a person with aphasia. If auditory comprehension is compromised, gestural demonstration of instructions or activities is more reliable. Common types of aphasia involving disorders of comprehension include the Wernicke and transcortical sensory types. Affected individuals have longer periods of PTA because they do not understand orientation questions, and although their spoken language is fluent, it includes verbal paraphasias, or word substitutions. Clients with aphasia may also misinterpret speech and become suspicious and agitated. Insight into their communication deficit may be limited.

The nonfluent aphasias (Broca's aphasia and transcortical motor aphasia) are characterized by relatively preserved comprehension but effortful or explosive speech with phonemic paraphasias (eg, “bork” for “fork”). Conduction aphasia (ie, intact comprehension, fluent speech, impaired repetition) and anomic aphasia are characterized by circumlocution and frequently paraphasias. Individuals with these types of aphasia are typically aware of their problems and are often frustrated by their limitations. They should be encouraged to use gestures to express their immediate desires and needs.

Dyslexia (disturbance in reading), agraphia (disorder of writing), and dyscalculia (disturbance in calculation) frequently accompany the aphasias. However, with traumatic aphasias, these capabilities may be better preserved than with stroke; treating therapists should always attempt alternative modes of communication.

Dysprosody or aprosody is impaired production or comprehension of the tonal inflections or emotional tone of speech. Executive dysprosody is an inability to inflect one's voice to convey emotion. It can occur with cerebellar, basal ganglia, or right frontal lobe injury. Receptive dysprosody is an inability to perceive the emotional content of other people's spoken language. It occurs with right temporal or parietal injury and less often with left hemisphere injury. Individuals with this disorder may miss the point of a joke or story because they cannot comprehend the subtle innuendoes and implicit meanings conveyed through tonal qualities and inflections.[80] Even more disabling is the inability to interpret anger, humor, or sarcasm during communication with others.[19] Perceptual motor dysfunction is impairment in motor planning, or an apraxia. It is a disorder of learned movement that cannot be explained by weakness, lack of sensation, inattention, or comprehension of the requested task.[19]

The apraxias are usually a result of impairment of the premotor cortex, corpus callosum, or connections between the temporal and parietal lobes and frontal motor cortex.[39] It is in these cortical areas that established motor patterns for specific activities are stored and accessed for the execution of common movement patterns. **Ideational apraxia** is an inability to understand the demands of a task or use of the wrong motor plan for a specific task. For example, individuals suffering from ideational apraxia may not understand that a shirt is an item of clothing to be placed on the torso and UEs. Not understanding the demands of the task, they may be unable to activate the motor plan for UE dressing or may activate the wrong plan and attempt to place their legs through the sleeve holes. This deficit is sometimes referred to as a dressing apraxia. **Ideomotor apraxia** is loss of the kinetic memory of a movement pattern for a specific activity. Individuals with this disorder may understand that a shirt is an item of clothing to be placed on the torso and UEs, but they may be unable to execute the appropriate movement plan because it is no longer accessible. Constructional apraxia is an inability to accurately assemble pieces of an object to form a three-dimensional whole. For example, a former carpenter who suffers from constructional apraxia may be unable to put together the wooden pieces of a basic birdhouse kit.

Psychosocial Factors

Researchers have found that the greatest concerns of clients 1 or more years after TBI are the psychosocial deficits that prevent them from rebuilding a satisfactory quality of life. As the time after injury increases, clients and family members view such psychosocial factors as more detrimental than both the physical and cognitive sequelae of TBI.

In Marisol's case, it was initially difficult to assess her psychosocial status because she was nonvocal. The team was able to assess her mood on the basis of her level of participation and affect during therapy. Marisol would laugh appropriately and become visibly more interactive, with brighter affect, when her boyfriend arrived to visit.

Marisol continued to engage in positive interactions throughout her 4-month in-client and day treatment stay. Her discharge plan involved moving to Georgia with her mother. When the move was discussed with Marisol, it was evident that she was quite saddened by the knowledge that she would no longer be able to see her boyfriend. The team observed her closely to assess whether her sadness would eventually culminate in depressive symptoms.

Self-Concept

One of the most difficult psychosocial sequelae of TBI is alteration of the individual's self-concept. Self-concept is the internal image a person holds about personal human identity, sexual and gender identity, body image, personal strengths and limitations, and position in the family, peer group, and community systems. An individual's self-concept changes drastically after TBI. One of the most difficult characteristics of TBI is that although short-term memory is often impaired, long-term memory commonly remains intact. Individuals with TBI often have a clear memory of who they were before their injury and must now resolve the emotional conflict of having to replace their preinjury self-concept with a post-injury self-concept that is both meaningful and satisfying. Affected individuals sometimes describe this process as an unwanted death and rebirth. They say that the person who lived before the injury is now gone, replaced by someone who is very different from the person they remember themselves to have been.[63]

Social Roles

Self-concept is derived largely from the social roles the person attains in the family, peer group, and larger community systems. Frequently, an individual with TBI loses most preinjury roles and the activities that supported those roles. Family and peer group roles change. Family members and friends are often readily visible during the acute and subacute stages of TBI rehabilitation. However, as the time after injury increases, family and friends become progressively less involved with the individual, which frequently leads to feelings of isolation and abandonment. Many individuals with TBI report that the feeling of isolation and the inability to form and maintain social relationships are their most troubling post-injury concerns. Loss of the role of dating partner or spouse commonly leaves clients with TBI with a deep sense of loss and failure if they cannot rebuild a post-injury life that includes intimacy with another human being, partnership in a committed relationship, and parenting of children. Loss of the work role and inability to support oneself are intimately tied to feelings of dependence and lack of personal control.[48]

Independent Living Status

As a result of the physical, cognitive, and psychosocial sequelae of TBI, many affected individuals find they require supportive living arrangements or must live with their parents. Loss of the ability to live independently in the community further reinforces feelings of dependence and decreased personal control. As a result of these role losses, adults who sustain TBI commonly experience role strain and feel that they cannot reenter their communities. The TBI, particularly if it occurred between the ages of 18 and 30, disrupts the developmental transition from adolescence to adulthood and leaves individuals feeling inadequate and unable to attain a post-injury adult status. Depression, withdrawal, and apathy are common psychosocial sequelae of the alterations in self-concept discussed earlier and of the loss of desired social roles.[56]

Dealing With Loss

People with TBI and their family members often go through a process that resembles the stages of death and dying experienced by the terminally ill.[49] These stages begin with denial, in which affected individuals deny that they are experiencing physical, cognitive, or psychosocial deficits. Denial can impede therapy because these clients may refuse to participate, in the belief that it is unnecessary. Denial gradually subsides as they continually confront their limitations in ADLs. Anger follows denial. Clients grow increasingly aware of their deficits and become frustrated and angry because recovery is slower than desired. Bargaining is the next stage. Clients strike a deal with the Creator or fate and offer to work as diligently as possible in therapy if only their preinjury lifestyle could be restored. The bargaining stage is often marked by increased motivation and optimism. Depression tends to emerge next. Eventually, clients begin to realize the severity of the injury and its effect on the rest of their lives. Acceptance of the injury and its resultant limitations, the next stage in the process, is necessary for clients to become sufficiently motivated to attempt to build a post-injury life that although drastically different from their preinjury goals and expectations, is nevertheless meaningful and personally valuable. These stages may require years of transition. Frequently, denial, anger, and bargaining occur in the first few months to a year after the injury. Depression sets in as the individual is able to let go of some of the denial and becomes aware of the effect that the injury will have on the future. It may take years before he or she can truly accept the injury and alterations in personality, skill, and lifestyle and move on to rebuild a new life.

The process of denial, anger, depression, and acceptance does not generally proceed in a linear fashion. Clients with TBI commonly experience repeated periods of denial, anger, and depression throughout their years of rehabilitation. Renewed denial, anger, and depression may occur in response to a new environmental demand, such as a change in life condition (eg, a need to move from the parental home to a community group home) or the development of further physical, cognitive, or psychosocial deterioration over time (eg, the need for increased ambulatory assistance because of deterioration in visual skills).

Affective Changes

Depression, increased emotional lability, involuntary emotional displays of mood that are overly frequent and excessive, and decreased affect can result from the neurological damage itself. Individuals with left hemisphere damage tend to exhibit increased depression and emotional lability. Lesions of the left orbitofrontal lobe often cause severe depression and heightened affect (including excitement, agitation, and tearfulness). Lesions of the left dorsolateral frontal lobe commonly result in a decreased or flat affect. Individuals with these lesions may appear depressed even though they feel fine. Neurological damage to the right hemisphere frequently causes a strange sense of euphoria or lack of emotional response to the severity of injury.[63]

People with brain injury often have difficulty recognizing others' emotions. Because this ability is essential for guiding appropriate emotional and behavioral responses toward others, this type of impairment poses various psychosocial and emotional problems.[59]

Behavioral Status

Behavioral impairments are a natural part of the recovery process. The Rancho Los Amigos cognitive level IV is typically described by the rehabilitation team as the “agitated, confused” level.[68] During this stage of recovery, affected individuals can be described as restless and combative. They may be responding to internal body experiences, or some external environmental stimuli may be provoking the agitation. Commonly observed behavior includes yelling, swearing, grabbing, and biting. Behavioral problems can be disturbing to both the individual's family and the intervention team; therefore, behavioral management is an essential component of TBI rehabilitation.

Ethical Considerations

Working with clients who have behavior problems can be frustrating and sometimes frightening. Untrained staff members can be injured, and they often reinforce the client's negative behavior through their own actions and responses.

A comprehensive behavior management program should be established for anyone who exhibits behavior that interferes with active participation in therapy and achievement of goals. The goals and objectives of a comprehensive program include maintaining a safe environment for individuals and staff members at all times, developing and consistently implementing behavior management techniques, minimizing the use of all restrictive modalities, and providing an environment that facilitates participation and appropriate behavior in the hospital setting and after discharge.[70]

Interventions used in an effective behavior management program include one-on-one coaching, intervention with psychotropic medications, and individually designed behavior management guidelines and interventions. One-on-one coaching, usually performed by a trained nursing assistant or rehabilitation technician, is especially necessary for clients who are at risk of harming themselves or others. In many cases, implementation of a behavior management program is necessary 24 hours a day, 7 days a week. A coach helps reinforce the client's behavior plan and redirects inappropriate or maladaptive behavior. Medications are required to regulate sleep and minimize agitation and combative behavior until clients can control the behavior on their own. Because pain may often provoke agitation, assessing a client's level of pain and providing appropriate medication may resolve the restlessness, agitation, and/or inability to sleep. Medications must be chosen carefully to prevent side effects such as clouding of awareness and psychomotor slowing. Clients should have specific behavioral end points, such as establishing adequate sleep at night, facilitating attention during functional activities, and reducing the frequency of verbal or physical outbursts.

Environmental modifications are a proactive approach to prevent and minimize undesirable behavior. Such modifications may include use of a cubicle or net bed, an alarm system, a helmet, and walkie-talkies. A drug and alcohol policy is frequently necessary; it is well documented that many individuals with TBI have preexisting alcohol or drug problems (or both).[71]

The first step in becoming more comfortable when working with clients who have behavior problems is to understand why the problems occur and how they manifest themselves.

Clients exhibiting agitation, combativeness, disinhibition, and refusal to cooperate and participate in activities typically have difficulty filtering distractions and can become agitated in noisy environments. Providing a quiet room during interventions and use of a cubicle bed may help minimize noise and reduce outbursts.

A disinhibited individual may lack awareness of the external environment and may make indiscriminate sexual remarks or gestures to others. Ignoring comments, redirecting inappropriate behavior, and modeling acceptable behavior are typical therapeutic interventions.

Clients who refuse to cooperate and participate in intervention can be the most challenging because this behavior may affect their ability to remain in an acute rehabilitation program. The lack of participation is typically organically based and due to cognitive deficits such as impaired initiation and lack of insight into the disability. It is important to document such behavior throughout the course of care; however, when clients refuse to participate, documenting progress can be challenging. Interventions include providing consistent structure through daily schedules and goal sheets that provide visual cues for expectations, and also visual and physical guidance through activities until clients are capable of completing tasks without assistance.

OT Practice Notes

Behavior management is essential in all TBI rehabilitation programs. It is important to develop and implement a behavioral program, whether the behavior is passive (decreased initiation), active (agitation), or somewhere along the continuum. An effective program includes comprehensive staff training, tools that track and monitor behavior and techniques, and consistent multidisciplinary communication (behavior management meetings) to ensure that the individualized behavior plan is effective and goal oriented.[71]

Evaluation of the Individual at a Lower RLA Level

Clients emerging from coma and at the beginning stages of the injury (RLA levels I through III) may exhibit minimal arousal and limited purposeful movements. It may be necessary to evaluate such individuals in short sessions and at different times of the day. A quiet environment with minimal distractions will enhance the client's ability to attend to and follow commands. Evaluation includes assessment of the following:

1. *Level of arousal and cognition:* Can the client visually attend to the speaker and follow commands such as "Open your mouth" and "Squeeze your eyes closed"? Can he or she communicate through verbalizations, gestures, or eye movements? Does he or she demonstrate purposeful movements, such as pulling at vital tubes? How easy or difficult is it to wake the client, and how long can the client stay awake?

2. *Vision:* Is the client able to visually scan or attend to a person, object, or activity? Can the client maintain eye contact?

3. *Sensation:* Does the client respond to external stimulation, such as pain, temperature, and movement of the joints?

4. *Joint ROM:* Has the client lost ROM in certain joints as a result of decorticate or decerebrate posturing, increased tone or spasticity, contractures, or heterotopic ossification?

5. *Motor control:* Does the client exhibit decorticate or decerebrate posturing? Is there an increase in tone and spasticity? Is there decreased tone and hypotonicity? Are deep tendon responses present, diminished, or absent? Does the client exhibit the presence of primitive reflexes? Does the client engage in spontaneous motor movements, such as scratching the face?

6. *Dysphagia:* Does the client handle his or her own secretions, drool, or swallow spontaneously? Does the client demonstrate poor oral motor control? Answers to these questions provide valuable information on whether a swallowing evaluation is indicated.

7. *Emotional and behavioral factors:* Is the client's affect flat or expressive? Are responses such as crying or laughing observed in response to interactions with the rehabilitation team or family members?

Evaluation of lower level individuals with TBI is generally accomplished with tools such as a goniometer, clinical muscle and tone testing, traditional neurological screening, and clinical observations. Many acute TBI rehabilitation facilities have developed their own initial evaluation forms. A variety of scales can be used to establish a baseline and predict recovery. The GCS and RLA scale are common; however, newer cognitive scales are also being used (eg, the JFK-Revised and WHIM).[67] Some clients tend to emerge quickly and move expeditiously through the RLA levels, whereas others (eg, those with anoxia) may demonstrate limited or slow recovery. A subacute program or a rehabilitation center that specializes in slow to recover clients may be necessary. In either case, a rehabilitation program with active therapeutic intervention is necessary to prevent contractures, encourage activity, and facilitate the client's progress through the rehabilitative process.

In the case of Marisol, the team decided to address her spasticity and joint contractures first by providing appropriate medical interventions, including blockade of her musculocutaneous nerve to decrease her left UE spasticity. This was followed by casting to reduce her elbow contracture. The team also gave Marisol a comprehensive activity schedule in a multistimulus environment. This schedule involved transferring her out of bed and into a customized wheelchair, in which she would remain 6 to 8 hours a day, getting up into a standing frame daily, and requiring active participation in all therapies 4 hours per day. Her cognitive level was assessed weekly with the JFK-Revised scale, and her ability to follow through with basic mobility and self-care tasks also was assessed.

Intervention for the Individual at a Lower RLA Level

The general aim of intervention for those at RLA levels I through III is to increase the individual's level of response and overall awareness of self and environment. All stimulation should be well structured and broken down into simple steps and commands. Allotting sufficient time for an individual's response is necessary because cognitive processing is often significantly delayed during this phase of recovery. Intervention at this stage can be grouped into six areas: sensory stimulation, bed positioning, casting or splinting, wheelchair positioning, management of dysphasia, and emotional and behavioral management; family and caregiver education also begins. Interventions may occur simultaneously to optimize progress. Each intervention affects and enhances the next. Because clients often respond more to the familiar and routine, it is important to involve close family members and friends in the sessions.

Sensory Stimulation

Intervention for clients emerging from coma should start as soon as they are medically stable. Intervention generally begins in the intensive care unit. At this stage, clients frequently lack responsiveness to pain, touch, sound, or sight. They may exhibit a generalized response to pain that appears reflexive (eg, attempting to pull away from painful stimuli). The goal of intervention is to increase the client's level of awareness by trying to increase arousal with controlled sensory input. **Sensory regulation** increases neurological signals to the reticular activation system, the structure of the brainstem that alerts the brain to important sensory input from the external environment.

Sensory stimulation can be introduced in a variety of ways and methods. Introducing isolated visual, auditory, tactile, olfactory, and gustatory stimulants to the individual may heighten arousal. For example, a flashlight may be used to elicit eye opening and visual tracking. Playing familiar music may facilitate autonomic responses, such as a change in the respiratory rate or changes in blood pressure. Introducing olfactory stimulation through a variety of scents may elicit eye opening or head turning. Gustatory stimulation involves the controlled presentation of taste to the client's lips and tongue using a cotton swab. Such stimulants may include salty, sweet, bitter, and sour tastes. Any response from the client is noted.

OT Practice Notes

The most effective types of sensory stimulants are those that have personal meaning to the client, such as favorite songs or stories. Family members often bring in familiar objects and pictures that can facilitate responses from the client. It is helpful to learn about the client's preinjury history to incorporate familiar items and routines into his or her intervention plan.

Kinesthetic input is incorporated early in the intervention. One of the most effective ways to facilitate volitional movement is by actively guiding movements in a normalized fashion while performing functional activities. The therapist actively helps the client perform simple movements (eg, rolling from side to side) and simple functional activities (eg, wiping the mouth with a washcloth, combing the hair, and applying lotion to the skin). The theoretical aim of functional sensory stimulation is to reactivate highly processed neural pathways that had been established before the injury. Other activities related to functional sensory stimulation include sitting the individual up at the edge of the bed and having the client stand by using a tilt table or a hydraulic standing frame. During all these activities, the therapist observes the client for any changes, such as visual tracking, turning of the head, physical responses, vocalizations, and ability to follow verbal commands.

Wheelchair Positioning

Seating and positioning are important components of treatment in clients at lower RLA levels. Proper positioning in a wheelchair allows these clients to interact with their immediate environment in an upright, midline posture. Proper positioning facilitates head and trunk control so that clients can see and interact with people and objects in the environment. A proper wheelchair seating position helps prevent skin breakdown and joint contractures, facilitate normal muscle tone, inhibit primitive reflexes, increase sitting tolerance, enhance respiration and swallowing function, and promote function (Fig. 34.1).

FIG 34.1 Proper wheelchair seating position.

Effective seating and positioning require a stable base of support at the pelvis, maintenance of the trunk in the midline, and facilitation of the head in an upright, midline position. This position frees the UEs for use and allows the client to visually scan the environment. Once the client has a seating system that encourages and promotes function, therapy sessions can be more effective and beneficial. For example, clients generally find it easier to handle their secretions in this position, so swallowing trials may be safer and more effective.

Marisol required a wheelchair and specific positioning devices when she entered the acute rehabilitation program. Given her motor abilities and deficits, what type of wheelchair setup would you prescribe?

Pelvis

Wheelchair positioning should begin at the pelvis. Poor hip placement adversely alters trunk and head alignment and influences tone in the extremities. Because sling-seat wheelchairs contribute to internal rotation and adduction of the hips, it is important to insert a firm, solid seat (padded with foam and covered by vinyl) to facilitate a neutral to slightly anterior pelvic tilt. A lumbar support may also help maintain the natural curve in the lumbar spine. A wedged seat insert (with the downward slope pointing toward the back of the chair) can be used to facilitate hip flexion and inhibit extensor tone in the hips and LEs. The individual's buttocks should bear weight evenly, with both ischial tuberosities firmly resting on the wheelchair seat. A seat belt angled across the pelvis helps maintain this desired position. Because these clients have spent a significant amount of time in bed, loss of anterior pelvic tilt is present. Before clients are positioned in a wheelchair, significant stretching of the pelvis and trunk often is necessary to achieve neutral **pelvic alignment** and upper trunk extension. These stretches often facilitate upright, symmetric trunk alignment, which may have occurred secondarily to prolonged bed rest and abnormal tone, reflexes, and patterns.

Trunk

The trunk should be positioned after the pelvis because it is the next most proximal body structure. A solid back insert or firm contoured back should be placed behind the client's back to maintain the spine in an erect posture. A back insert contoured to the curves in the spine will maintain the lumbar and thoracic curves. Lateral trunk supports can be used to reduce scoliosis and lateral trunk flexion caused by imbalanced tone of the intrinsic muscles of the back. A chest strap (with easily opened Velcro fasteners) can be used to reduce kyphosis, facilitate shoulder retraction and abduction, and expand the upper part of the chest for proper diaphragmatic breathing and UE use.

Lower Extremities

An abductor wedge placed between the LEs just proximal to the knees may be used to reduce hip adduction and internal rotation. If hip abduction is present, a padded abductor wedge can be placed along the lateral aspect of the thigh to reduce LE abduction. Ideally, the knees should be positioned at 90 degrees, with the heels slightly behind the knees while sitting. Both feet should be maintained securely on the foot plates to provide proprioceptive input and facilitate weight bearing in both heels to normalize tone.

Upper Extremities

The UEs should be positioned with the scapulae in a neutral position (neither elevated nor depressed), the shoulders slightly externally rotated and abducted, the elbows in a neutral position of slight flexion with forearm pronation, and the wrists and digits in a functional position. This position is often difficult to achieve because of severe spasticity and soft tissue contractures of the UEs. A splint or cast may be applied to reduce spasticity and facilitate a functional position of the UEs. Frequently, a lap tray is used to provide support for the UEs and encourage bilateral UE weight bearing and use.

Head

Lower functioning clients with TBI often have little or no active head control. Attaining a neutral-midline head position, which allows optimal visual contact with the environment, is difficult. A dynamic head-positioning device (Fig. 34.2) can be used to maintain neutral head alignment and facilitate head control. A contoured headrest that cradles the head posteriorly and laterally may be used to support the head in a midline position. A forehead strap (fabricated from soft, padded material) may be used to prevent the head from falling forward. Slightly reclining the wheelchair also prevents the client's head from falling forward and facilitates visual interaction with the environment. The client should be reclined 10 to 15 degrees; reclining the client beyond this point reduces weight bearing through the trunk and pelvis and tends to encourage extensor tone, a posterior pelvic tilt, and sacral sitting. If the client has had a portion of the skull removed, a helmet is necessary to protect the brain during all mobility and when getting the client out of bed into a wheelchair.

FIG 34.2 A dynamic head-positioning device maintains neutral head alignment and facilitates head control.

As the client progresses in rehabilitation, wheelchair seating and positioning should be continually reevaluated to better meet his or her specific needs. Devices should be modified gradually or removed as the client begins to control his or her body actively and manipulate more items in the environment. A schedule is necessary to indicate the length of time the client can tolerate being seated in the wheelchair. Keeping the client in a wheelchair longer than can be tolerated may result in fatigue, which can subsequently interfere with active participation in therapy.

Bed Positioning

Proper bed positioning is critical in the early stages of TBI. Because the client tends to spend a lot of time in bed, proper bed positioning is crucial to prevent pressure sores, facilitate normal muscle tone, and prevent loss of pelvis and trunk ROM and mobility. It is often difficult to maintain optimal positioning because of spasticity and abnormal posturing. Other complications that may interfere with proper positioning are casts or splints, intravenous tubes, nasogastric tubes, fractures, and any medical precautions that must be followed while the client is in bed.

If the client exhibits abnormal tone or posturing, a side-lying or semiprone position is preferable. This position assists in normalizing tone and providing sensory input. A supine position may elicit a tonic labyrinthine reflex and extensor tone. A supine position with the head in a lateral position could elicit an asymmetric tonic neck reflex. Clients with TBI generally have bilateral involvement, requiring a program for side-lying on both sides. The traditional bed-positioning techniques used for clients who sustained a cerebrovascular accident may require modification, depending on the extent of bilateral involvement. Pillows, foam wedges, and splints may be incorporated into the bed-positioning program to facilitate normal positions and prevent abnormal postures, such as extreme elbow flexion, head and neck extension, and footdrop deformity.

OT Practice Notes

Because all clients have unique needs, each should be assessed and set up with an ideal positioning program. It often helps to take a photo of the client once positioned and post it to ensure that it can be easily duplicated and carried out by staff and family members.

Splinting and Casting

Splinting or casting may be indicated when (1) spasticity interferes with functional movement and independence in ADLs, (2) joint ROM limitations are present, and (3) soft tissue contractures are possible. Splints have been thought to provide elongation and inhibition by positioning the joint in a static position with the muscles and soft tissues on stretch. Splinting of the elbows, wrists, and hands is often implemented to maintain a functional position at rest and to reduce tone. Serial casting is a more aggressive intervention to increase ROM in the joints when contractures have formed or spasticity is present (or both). Splinting and casting not only reduce contractures and increase ROM, but also prevent skin breakdown. Because clients with TBI often have limited active ROM, the UE joints often assume a position of flexion (particularly when severe finger flexor spasticity has caused the fingers and nails to embed in the palmar surface of the hand), and this may cause moisture, redness, and breakdown of the skin.

A resting functional position or antispasticity splint (Fig. 34.3) is worn when the client is not involved in active movements or functional tasks. Once the splint has been fitted, a wearing schedule must be established for the rehabilitation team and caregivers to follow. A typical splint schedule during the day requires the client to wear the splint for repeated, alternating 2-hour periods (2 hours on, followed by 2 hours off). The client must be monitored frequently for any skin breakdown or tonal changes that may change the initial fit of the splint. The team and caregivers should be trained in proper application and removal of each splint.

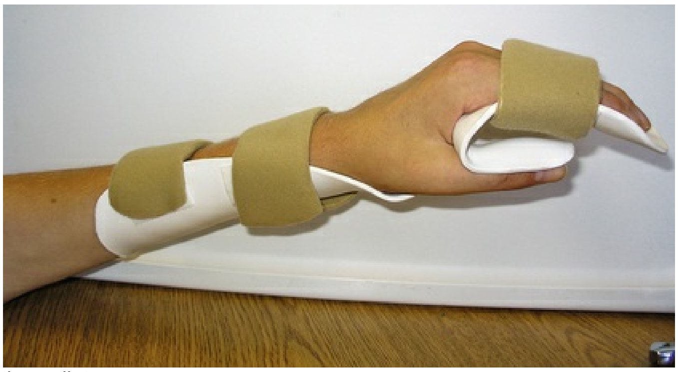

FIG 34.3 Resting splint. (From Cifu DX: *Braddom's physical medicine and rehabilitation*, ed 5, Philadelphia, 2016, Elsevier.)

Other common splints worn at this stage of recovery are cone splints, which are used in the palm of the hand to keep the fingers from digging into the palmar surface. Frequently, rolled cloths are put into the clenched hand; however, because this may facilitate increased spasticity, a hard cone splint is more appropriate. An antispasticity splint (Fig. 34.4) not only positions the hand and wrist in a functional position, but also abducts the fingers to further reduce spasticity. Splints are modified as needed and may eventually be discontinued if the individual's motor control and tone improve.

FIG 34.4 Antispasticity splint. (From Skirven TM, et al: *Rehabilitation of the hand and upper extremity,* ed 6, Philadelphia, 2011, Mosby.)

A serial casting program is indicated when moderate to severe spasticity cannot be managed by splints. The goal of casting is to increase ROM and decrease tone gradually by using a progressive succession of separately fabricated casts, each worn continuously for a period of weeks. Casts are often left on for 5 to 7 days, which places the muscle and tendons on prolonged stretch and reduces tone. Successive casts are designed to increase ROM further until a functional joint range is achieved and maintained. A common difficulty that prevents success with serial casting is skin breakdown. If skin breakdown occurs because of a cast that is worn for several days, the cast must be removed until the skin has healed. While wound healing is occurring, spasticity again increases, and any gain in joint ROM is often lost.

The most common UE casts are the elbow cast, which is used for loss of passive range of motion (PROM) in the elbow flexors, and the wrist-hand cast, which is used for loss of PROM in the wrist and finger flexors. Variations of these casts include elbow dropout, wrist, thumb, hand, and individual finger casts. However, casting of more than one joint at a time often leads to skin breakdown as a result of multiple pressure points. Therefore, casting should be applied to one joint at a time.[30]

Casting is frequently used in conjunction with motor point blocks, nerve blocks, or botulinum toxin injections. Blocks involve the injection of a chemical substance (eg, lidocaine, bupivacaine, phenol) into the nerve or motor point to temporarily inhibit the innervation of spastic muscles. Botulinum toxin is injected directly into the target muscle and works by causing presynaptic blockade of acetylcholine release.

Indications for termination of a casting program include achieving functional ROM or plateauing (eg, the individual has not gained significant improvement in ROM after two consecutive casts). When improvement in ROM has been made and the goal has been achieved, the final cast is cut in half lengthwise, the edges are finished, and the cast is used as a bivalve splint to maintain the functional position. Velcro straps or elastic wrap bandages are used to secure them in place (Fig. 34.5). A wearing schedule is then established for the bivalve splint (cast).

FIG 34.5 Spasticity splint. (From Skirven TM, et al: *Rehabilitation of the hand and upper extremity*, ed 6, Philadelphia, 2011, Mosby.)

Casting is an advanced intervention technique that carries some risk. Competent application of the technique requires knowledge and advanced clinical training.

Marisol had increased spasticity and reduced function in her UEs. What splint or cast (or both) would best suit her needs initially?

Dysphagia

Clients emerging from coma are fed through a nasogastric or gastrointestinal tube. Once the client is alert and more oriented, the physician decides when evaluation for dysphagia is indicated. Dysphagia programs usually begin when the client has moved into the intermediate or advanced levels of rehabilitation (see Chapter 27).

Behavior and Cognition

As clients emerge from coma and become more alert and aware of their surroundings, it is important to track their improvement and attempt to establish a form of communication. In acute rehabilitation, tracking the level of arousal and awareness is important because it demonstrates progress. Several scales and assessments are available, including the WHIM, JFK-Revised, and Orientation Log. These measurement tools document improvements in visual attention, visual tracking, and ability to follow commands.

Establishing a way for the client to communicate wants and needs is of the utmost importance because it helps guide intervention. It also allows the team to more accurately assess the client's cognitive level. A reliable yes/no system should typically be implemented. Examples include eye blinks, eye gaze, head nods, and motor movements, such as thumb up and thumb down. Once a system has been established, communication is possible.

Marisol gained some active movement of her right UE and with guiding was able to use large colored buttons to answer yes or no to questions. The yes and no buttons, which were positioned on the lap tray of her wheelchair, buzzed when Marisol touched them. Thus she was effectively able to answer simple questions, such as, “Do you need to use the bathroom?” and “Are you in pain?”

Family and Caregiver Education

Education of family members and caregivers starts immediately because they are an integral part of the intervention team. Family members often play an essential role in eliciting the client's responses and implementing the sensory regulation program, positioning the client in bed, and contributing to the ROM program. At the earliest stage after injury, therapy may be limited; therefore, setting up a simple intervention plan for the family to implement is important in fostering the client's recovery and maintaining passive joint motion. Family members often feel helpless, and allowing them to be actively involved helps alleviate their feelings of helplessness and focuses their array of emotions.

Later, when the individual is more alert and mobile, family members can be involved in transfers, wheelchair positioning, feeding programs, and ADL retraining. Providing several education materials is helpful for family members. Brain injury education booklets and Internet websites are effective tools in educating clients and family members.

Evaluation of the Individual at an Intermediate or Higher RLA Level

During the intermediate and advanced levels of recovery (RLA levels IV to VIII), the client is alert but often displays confused, agitated, and inappropriate responses. The client may be able to follow simple two- or three-step verbal commands but is easily distracted. Minimal or moderate cues are often necessary to assist clients at an intermediate or a higher level in the performance of ADLs. In general, they can complete most components of the OT evaluation; however, they may require several breaks during the evaluation process because of distractibility or agitation. The evaluation is similar to that for clients in the earlier recovery levels in that physical status, dysphagia, psychosocial and behavioral factors, vision, sensation, and perception are all assessed. However, clients at intermediate or higher levels require more extensive evaluation of ADLs (including driving), work readiness, and ability to reintegrate into the community.

Physical Status

The physical status evaluation includes an assessment of joint ROM, muscular strength, sensation, proprioception, kinesthesia, fine and gross motor control, and total body control (ie, dynamic sitting or standing balance). Limitations in physical status are usually the result of abnormal tone, spasticity, and muscle weakness without abnormal tone, heterotopic ossification, fractures, soft tissue contractures, and peripheral nerve compression. Tools to assess physical status include goniometers, dynamometers, manual muscle testing, and clinical observation.

Dysphagia

The dysphagia assessment may include both clinical (bedside) evaluation and videofluoroscopy. The bedside examination provides the therapist with a variety of information. For example, aspiration can be caused by impulsivity because the client may gulp large portions of food quickly. Pocketing food and drooling may be apparent and are a result of impaired oral motor control. The dysphagia examination can also provide the therapist with information about cognitive status. Does the client appear to understand what to do with the utensils and food items? Is neglect present and causing the client to leave one side of the plate untouched? Does the client know the names of the utensils and food items, or is aphasia suspected?

Performed by a speech pathologist or a trained occupational therapist, videofluoroscopy provides information about the anatomy and physiology of the oral, pharyngeal, and esophageal stages of swallowing. Videofluoroscopy is the primary dysphagia assessment tool that can provide information on the individual's ability to manage liquids and solid foods, particularly during the oral, pharyngeal, and esophageal phases of the swallow. This information is used to design a feeding program, which may require a diet of thick liquids and pureed foods. Swallowing status should be reevaluated as the individual improves in rehabilitation and can progress to thin liquids and solid foods. (See Chapter 27 for more information on dysphagia.)

Improper positioning, behavioral disorders, and cognitive-perceptual impairment have all been implicated as factors contributing to swallowing disorders. Dysphagia intervention must address seating and positioning and cognitive-perceptual distortions. Formal assessments to evaluate dysphagia include the Dysphagia Evaluation Protocol[6] and the Evaluation of Oral Function in Feeding.[74]

Cognition

Cognitive skills are assessed within functional tasks (eg, ADLs, meal preparation, money management, and community skills). Tasks that involve paper and pencil can also provide valuable information, although they are only part of the equation. Assessment of a client's cognition during preparation of a cold meal may include the following skills: (1) following two- or three-step written or spoken directions, (2) correctly sequencing the order of steps, (3) attending to the task with minimal distraction, and (4) displaying good safety and judgment. The therapist may evaluate the client's cognitive status by using any of the following: (1) counting the number of errors and correct responses, (2) assessing the amount of assistance or cueing required (minimal, moderate, or maximal), and (3) determining the percentage of the task that was completed correctly. Assessment of the complexity of the activity (simple versus multistep or basic to complex) and the conditions of the environment (isolated versus multistimulus or quiet to distracting) is also important.

When assessing an individual's cognitive skills, the therapist must consider and document other factors that may affect performance, such as language barriers (eg, the presence of aphasia, a primary language other than English), visual-perceptual deficits, the effects of medication on cognitive level, educational and cultural background, and previous experience with the task. Formal cognitive assessments that may be used with clients with a TBI include the Allen Cognitive Level Test,[2] Loewenstein Occupational Therapy Cognitive Assessment,[54] Rivermead Behavioral Memory Test,[82] Kohlman Evaluation of Living Skills,[47] and Cognitive Assessment of Minnesota.[69]

Vision

Clients with TBI should undergo vision screening. This screening should be completed as early as possible in the rehabilitation process because early detection of visual deficits allows the intervention team to obtain more reliable information about the client's overall health status. For example, diplopia (double vision) or accommodative dysfunction (inability to adjust focus for changes in distance) will probably influence the results of the neuropsychology or speech-language pathology assessments.

Vision screening is a tool that allows therapists to identify potential deficits in vision. Although therapists cannot diagnose conditions of vision dysfunction, they can determine whether an individual passes or fails a visual screening based on standard criteria. The screening is a means of determining which clients require referral to an optometrist or ophthalmologist for a complete evaluation and intervention. A comprehensive vision intervention program is designed by an optometrist and implemented by an occupational therapist or vision therapist. A visual history questionnaire also should be completed. The questionnaire should contain an ophthalmologic history, questions about the use of glasses and contact lenses, and questions about the presence of blurred vision, dizziness, headaches, eyestrain, diplopia, and visual field loss.

Common areas evaluated in a vision screening include visual attention, near and distant acuity, ocular movement (eg, pursuits and saccades), convergence, accommodation, ocular alignment, depth perception (stereopsis), and visual field function. Visual dysfunction can also be identified during clinical observation of the individual's performance in functional activities. Tilting the head as a result of a field deficit, closing or covering one eye to reduce blurred vision, and bumping into walls or objects in the environment because of a field deficit or unilateral neglect are all easily observed behaviors indicative of visual dysfunction.

Perceptual Function

Perceptual evaluation should be performed when the therapist has obtained a clear understanding of the individual's cognitive, sensory, motor, and language status because deficits in these areas may skew the client's performance on a perceptual evaluation. Evaluation of visual perception should include right-left discrimination, form constancy, position in space, topographical orientation, and naming of objects. Evaluation of perceptual speech and language function should assess for aphasia and anomia. Evaluation of perceptual motor function should include the functions of ideational praxis, ideomotor praxis, three-dimensional constructional praxis, and body schema perception (including identification of unilateral neglect). Formal perceptual assessments that can be used for adults with TBI include the Hooper Visual Organization Test,[40] Motor-Free Visual Perception Test–Revised,[17] Rivermead Perceptual Assessment Battery,[76] and Loewenstein Occupational Therapy Cognitive Assessment.[54]

Activities of Daily Living

Clients at an intermediate RLA level should be assessed in all basic ADLs (eg, grooming, oral hygiene, bathing, toileting, dressing, functional mobility, and emergency response). Clients at an advanced RLA level should also be assessed in instrumental activities of daily living (IADLs), such as hot and cold meal preparation, money management, community shopping (Fig. 34.6), household maintenance, cleaning and clothing care, safety procedures, medication routine, and work readiness. The therapist will have ample opportunity during assessment to observe cognitive skills, perceptual skills, and behavioral appropriateness.[33] Formal assessments that can be used for clients with TBI to assess ADL skills include the Arnadottir OT-ADL Neurobehavioral Evaluation (A-ONE),[4] Assessment of Motor and Process Skills (AMPS),[24] Functional Independence Measure (FIM),[37] and the Klein-Bell Activities of Daily Living Scale.[46]

FIG 34.6 Community shopping. (Courtesy iStock.com.)

Clients with a history of alcohol abuse require assessment of leisure patterns. An interest history and interest checklist may reveal healthful leisure interests that can replace alcohol use. The combination of leisure skills development and substance abuse rehabilitation will help clients manage time more effectively and thereby refrain from using alcohol after discharge.

Driving

Many states require physicians to report anyone to the Department of Motor Vehicles who has lapses of consciousness, seizure disorders, and cognitive, visual, and perceptual dysfunction caused by TBI. Regulations that apply to clients with such disorders often mandate that the driver's license be revoked until further assessment confirms that the person can drive without posing a safety risk to himself or herself or others. These laws vary from state to state.

Clients with TBI who are at an advanced RLA level and who do not have seizure disorders or severe cognitive deficits must undergo a comprehensive driving evaluation to assess their ability to resume driving. Two types of driving evaluation can be performed: a clinical assessment (evaluation of the individual's visual, cognitive, perceptual, and physical status as these relate to driving) and an on-road assessment. Both types of evaluation are necessary because the client may fail the clinical assessment but pass the on-road assessment by using compensatory strategies. Conversely, the client may perform successfully on the clinical assessment but fail the on-road assessment (see Chapter 11).

Clients with TBI frequently exhibit deficits (eg, visual processing disorders, figure-ground discrimination dysfunction, and impulsivity) that significantly affect their ability to drive safely. Individuals with delayed visual processing hesitate during driving maneuvers and stop in an unsafe manner (eg, in the middle of the road or at a corner) to allow themselves adequate time to process visual information. Those with figure-ground impairments may be unable to identify stop signs and traffic signals at intersections or locate the gearshift near the dashboard. Impulsive individuals may respond aggressively rather than defensively when driving, increasing the risk of accidents. They may use poor judgment when making driving decisions and may be unable to inhibit inappropriate responses. The Elemental Driving Simulator[29] and Driving Assessment System[29] are off-the-road clinical driving assessments that can be used with an on-road assessment to determine a client's ability to resume driving after brain injury.

Occasionally clients have a strong desire to drive but poor insight into whether they have the safety skills to resume driving. Because most rehabilitation centers and out-settings do not have an adaptive driving program and expensive driving simulators, occupational therapists need to use low-tech options to determine driving readiness and educate clients on whether they are safe to drive. There are many commercially available computerized driving assessments and training tools that are easy to download and inexpensive. One option is the Roadwise Review, distributed by the American Automotive Association (AAA).[1] This computer-based tool measures the functional abilities scientifically linked to the risk of crashing in older drivers. Because it assesses useful field of view, visual-perceptual skills, and reaction times, it is an excellent tool that can be used for adults with TBI.

Vocational Rehabilitation

Clients at an advanced RLA level may be evaluated to determine whether they are ready to return to work. It has been well documented that return to work after moderate to severe TBI is generally unsuccessful. The high unemployment rate among individuals with TBI has been attributed to the adverse emotional, behavioral, and neuropsychological changes arising from brain injury. Substance abuse in clients with TBI is another major factor inhibiting the person's ability to return to and maintain employment.[27]

Vocational assessment for clients at an advanced RLA level must involve assessment in the actual work setting because psychometric tests and job simulations in themselves do not accurately determine work potential. The client is often able to compensate in a familiar work setting for deficits that may appear to be significant impairments on a psychometric test. The therapist's vocational evaluation should summarize the individual's interests, strengths, and areas of deficit. The report should conclude with recommendations stating the modifications required, realistic job goals, and a plan for achieving these goals with professional assistance as needed.

Psychosocial Skills

Clients at an advanced RLA level who will be discharged to the home or to a community supportive living residence should also undergo a psychosocial skill evaluation. Such an evaluation should assess role loss, social conduct, interpersonal skills, self-expression, time management, and self-control. In addition, the therapist should assess the client's social support system, ability to form and maintain friendships, and resources for reducing feelings of isolation (eg, TBI support groups). The ability to form and maintain intimate and sexual relationships after TBI will be of paramount concern to single clients who sustained a TBI between the ages of 18 and 30. Childrearing and care of family members will be of concern for clients who are responsible for children and other family members.

Assessment of psychosocial skills in clients with TBI is critical. For 1 or more years after injury, clients with TBI report that their psychosocial deficits significantly diminish life satisfaction and are a greater problem than the physical and cognitive deficits combined. Psychosocial impairment is often neglected in the rehabilitation setting, which prioritizes intervention for acute physical, cognitive, and perceptual deficits. Psychosocial difficulties are more apparent after discharge, when the individual has left the structured and safe setting of the rehabilitation hospital to reenter the community. It is important to address psychosocial difficulties before the individual is discharged. Psychosocial assessment tools that can be used for these clients include the Assessment of Communication and Interaction Skills,[70] Occupational Role History,[25] and Role Checklist.[61]

Marisol received skilled OT intervention throughout a 3-month in-client rehabilitation stay, followed by 6 weeks in a day treatment program. Marisol participated in a multifaceted spasticity reduction program and **neuromuscular reeducation**, which improved ROM and functional use of her right UE. As her ROM and selective movement improved, Marisol learned how to feed, dress, and bathe herself with minimal assistance. As Marisol's head and trunk control improved, she was able to participate in all aspects of bed mobility and transfers. Daily guided self-care tasks were a critical part of her morning schedule. Performing meaningful, routine tasks allowed Marisol to work on her basic cognitive abilities. Spontaneous neurological recovery, cognitive reeducation, and memory strategies improved Marisol's ability to plan, organize, and sequence her ADLs and recall her daily therapy schedule, with occasional verbal cues. Marisol was referred to an out-client OT program after discharge from the day treatment program.

Intervention for the Individual at an Intermediate or Higher RLA Level

Intervention for individuals at an intermediate or higher RLA level (IV through VIII) involves two primary approaches: the rehabilitative model and the compensatory model. The **rehabilitative model** is supported by the theory of **neuroplasticity**, which holds that the brain can repair itself or reorganize its neural pathways to allow relearning of functions lost as a result of neural damage sustained in the accident. The **compensatory model** holds that repair of damaged brain tissue either has occurred to its fullest extent or cannot occur, with the individual being left unable to perform lost functions without external assistance. Tools used in the compensatory model are adaptive equipment, environmental modification, and compensatory strategies that allow the client to perform ADLs. It is valuable to approach intervention using both the rehabilitative and compensatory approaches by addressing neuromuscular impairment, cognitive deficits, perceptual deficits, vision dysfunction, and behavioral disorders. In general, a rehabilitative approach is used in the acute stage of TBI recovery until the client has plateaued or progress has slowed, at which time a compensatory approach is attempted.

Neuromuscular Impairments

As with clients at lower RLA levels, clients at intermediate or advanced levels can have numerous types of neuromuscular impairment. Spasticity, rigidity, soft tissue contractures, primitive reflexes, diminished or lost postural reactions, muscular weakness, and impaired sensation affect the ability to perform activities independently and with normal control (see Table 34.3). The prerequisites for normal movement include normal postural tone, balanced integration of flexor control (reciprocal innervation), normal proximal stability, and the ability to implement selective movement patterns.

The common principles of intervention for neuromuscular impairment are to facilitate control of muscle groups, progressing proximally to distally; encourage symmetric posture; facilitate integration of both sides of the body into activities; encourage bilateral weight bearing; and introduce a normal sensory experience. Effective rehabilitation techniques for such individuals include neurodevelopmental treatment (NDT), proprioceptive neuromuscular facilitation (PNF), myofascial release, and some physical agent modalities (see Chapters 29 and 31). These clinical interventions require education beyond the entry level and must be either incorporated into or followed by a meaningful functional activity that requires the same movement. The following brief overview of principles is merely an introduction and cannot substitute for training in the specific techniques.

Intervention for impaired neuromuscular control should begin at the pelvis because positioning of the pelvis affects the motor control of all other body parts. A variety of approaches may be used to normalize pelvic positioning. For example, clients with TBI commonly have a posterior pelvic tilt. To move the client to a more functional erect pelvic position, a therapist trained in NDT might use anterior pelvic tilt mobilization. A therapist with a different approach might use a bed sheet behind the pelvis to lift and rotate the pelvis forward over the heads of the femurs. In either case, the client would be directed to raise the head and sit up tall.

The trunk is positioned after the pelvis. Proper positioning of the trunk frees the UEs for functional activities. Major principles include (1) facilitating trunk alignment, (2) stimulating reciprocal trunk muscle activity, (3) encouraging the individual to shift weight out of a stable posture into all directions (bending forward, bending backward, reaching to each side while laterally flexing the trunk), and (4) helping the individual move the lower part of the trunk on a stable upper trunk or move the upper trunk on a stable lower trunk. Once trunk control improves, intervention should progress to the UEs.

Competent practitioners may apply rehabilitative techniques in a variety of ways. A client with soft tissue contractures or spasticity in a particular muscle group may benefit from NDT mobilization and inhibitory techniques for the agonistic muscle group. A client with low tone or weak muscles (without spasticity) may benefit from NDT, PNF, and physical agent modalities. Kinesiotaping can assist in providing stability to weak muscle groups. Neuromuscular electrical stimulation can effectively stimulate UE muscle groups, including the triceps, pronators, supinators, and wrist and finger extensors, to enhance muscle strength, increase sensory awareness, and assist in motor learning and coordination.[14]

Many clients at an advanced RLA level have fairly intact motor control and are able to ambulate independently and use both UEs in functional activities. However, close observation reveals subtle trunk and extremity deficits related to coordination and speed of movement. The intervention for trunk control focuses on developing full isolated movements of the trunk and extremities, good dynamic standing balance for all activities (including reaching and bending to high and low surfaces), and the ability to shift weight naturally from one LE to the other during activities. UE intervention programs are designed to increase scapular stability and improve fine motor control. A goal of intervention is to improve the client's speed while maintaining good coordination and minimizing compensatory strategies (Fig. 34.7).

FIG 34.7 Use of both hands during meal preparation.

Ataxia

Ataxia is a common motor dysfunction that occurs primarily as a result of damage to the cerebellum or to the neural pathways leading to and from the cerebellum. Ataxia develops early in the acute stage of recovery and may remain permanently. It is a clinical problem for which rehabilitation methods are generally ineffective. More often, therapists train the client to use compensatory strategies to control the effects of ataxia. For example, weighting body parts and using resistive activities often improve control during the performance of tasks but show inconsistent carryover of muscular control when the resistance is removed.

When applying weights to clients, the therapist must identify at which joint (or joints) the tremor originates. Applying weights to clients' wrists when the tremor emerges from the trunk and shoulders is ineffective. Weighted eating utensils and cups are also used as compensatory aids to reduce the effects of ataxia on the UEs; however, these assistive devices are limited in their effectiveness.

Cognition

Intervention designed to enhance cognitive skills should be implemented through functional ADLs and IADLs. A common impairment in cognition is concrete thinking, in which the individual is likely to have difficulty with abstract concepts. Activities that require generalization of skills from one task to another are difficult for clients with TBI. It is best to engage these clients in activities they need to participate in in everyday life. For example, if the client will return to a community environment in which it is necessary to use public transportation, interpreting bus schedules is a meaningful and relevant activity that addresses many critical cognitive skills, including problem solving, planning, organization, concentration, tolerance of frustration, sequencing, money management, and categorization. Another way to address the aforementioned cognitive skills is by planning a trip to the hardware store to purchase supplies necessary to install a handheld showerhead.

Clients at an advanced level of recovery who demonstrate high-level cognitive skills often display subtle cognitive deficits in the areas of organization, planning, sequencing, and short-term memory.

OT Practice Notes

Activities such as establishing a monthly budget to live independently and negotiating the community public transportation system to pay a utility bill provide a context for cognitive retraining to address subtle cognitive deficits. Activities should be challenging, age appropriate, and relevant to the individual's real-life needs. Compensatory strategies may include the use of a schedule, memory book, electronic handheld device, monthly budget chart, and simplified maps of the client's community. For optimal results, the system chosen must take into account the client's familiarity with and motivation to use the given strategy. For example, a client may have used a high-tech cell phone as a day planner before the injury and may also prefer to use this system after the injury.

Generally, neuropsychologists and cognitive educators have implemented the use of computers in cognitive retraining. However, use of computer programs has not been shown to generalize to the cognitive skills needed to improve performance in IADLs.[60] Computers can be used in therapy if they are meaningful in the client's daily life; the therapist should address the client's specific computer needs. For example, by simplifying tool bars and menus and programming step-by-step written directions that appear on the screen, therapists may reprogram a client's home computer to make it less complicated to use. Software programs that do not represent functional activities should be avoided.

Since computers in the home are now commonplace and Americans with disabilities are likely to benefit from the use of accessible technology, it is important to introduce computer use into intervention sessions as a therapeutic modality.[53a] Not only can occupational therapists set up a computer using the built-in accessibility options and utilities, they also can provide specialty assistive technology products (eg, voice recognition, alternative keyboards, and trackballs) to allow clients to access and use a computer successfully.[32] Computer access not only facilitates cognitive retraining opportunities, but also can serve as a source of communication and can address visual, perceptual, and motor deficits.

Vision

Intervention alternatives for clients with TBI and visual dysfunction include the use of corrective lenses, occlusion (eg, patching one eye), prism lenses, vision exercises, environmental adaptations, and corrective surgery. An optometrist or ophthalmologist can evaluate the client's vision and prescribe glasses to address any accommodative dysfunction caused by brain injury. However, the glasses should not be prescribed until the client has passed the subacute phase of rehabilitation because an accommodative dysfunction that appears in the acute stage of brain injury may improve during the recovery process.

A common technique for eliminating double vision (diplopia) is patching, or occlusion. The client wears a patch over one eye to block the image seen by that eye and eliminate diplopia. Patching is a temporary compensatory strategy. An optometrist may prescribe prism glasses or binasal occluders for clients with consistent diplopia resulting from permanent oculomotor nerve damage. The prisms assist the eyes in fusing images. Prism glasses are not effective for those with significant lateral strabismus or exotropia (outward eye turn). Binasal occluders encourage the malaligned eye to fixate centrally. Prism glasses and binasal occluders are used with vision exercises. The goal of this intervention is to reduce the diplopia and eventually eliminate the need for prisms or occluders.

Vision exercises consist of a series of activities that (1) maximize residual vision, (2) enhance impaired vision skills (the rehabilitative approach), (3) increase the client's awareness of his or her visual deficits, and (4) help the client learn compensatory strategies. Intervention progresses from monocular to binocular vision and follows a developmental progression (supine to sitting to standing). Exercises initially address basic skills, such as visual attention, pursuits, and saccades, and may progress to more difficult skills, such as fusion and stereopsis. These vision exercises are based on the rehabilitative model, which holds that impaired visual skills can improve with training.

Environmental adaptations for visual deficits are based on the compensatory model. Compensatory strategies for visual deficits include using a colored border along one side of a page to facilitate reading. A colored strip of tape along one side of a plate or meal tray to promote self-feeding is one option. Use of large objects, such as a clock with bold numbers or a telephone with enlarged buttons, is another compensatory technique. Using contrasting colors to highlight controls and knobs (eg, marking TV/VCR remote control buttons with fluorescent paint) may be helpful. Increasing lighting in an environment and using textures as cues (eg, placing textured tape on a banister by the bottom step to alert the individual that the bottom step is coming and thereby reduce falls) may be used for clients with low vision. The latter compensatory strategy is also valuable for clients with vertical gaze paralysis who can look neither up nor down. Those who have lost pupil constriction should wear sunglasses whenever they are in bright light.

Corrective surgery performed by an ophthalmologist may be indicated to align the eyes and eliminate double vision; however, the individual must wait at least a year after the injury to allow any improvement that may occur naturally in the course of recovery.

Perception

Treatment of perceptual deficits involves both rehabilitative and compensatory intervention. For example, impairment of figure-ground perception might be treated using a rehabilitative approach through the repeated practice of locating objects against a similar background (eg, finding a white shirt on a bed with white sheets or finding a spoon in a drawer of similar stainless steel utensils). Using a compensatory approach, the therapist would help the client arrange the kitchen drawers so that utensils are categorized (perhaps color coded) and distinctly divided to facilitate identification.

Aphasia (a perceptual speech disorder) can also be treated by both rehabilitative and compensatory approaches. Expressive aphasia may be treated through a rehabilitation approach by using repeated conversation exercises in which clients are given feedback about their incorrect spoken words and challenged to express the words they meant to verbalize. If the client has not made significant gains in expressive speech through use of the rehabilitative approach, the compensatory approach should be used to help the client articulate his or her needs to caregivers. For example, a chart with letters, words, or pictures (or a combination of the three) of important items in the client's environment can be used to help the client identify needs such as eating, toileting, and medications. Such a chart may be used along with rehabilitative approaches.

Through a rehabilitative approach, apraxia can be treated by helping the client perform specific tasks (eg, brushing the hair) hand over hand (ie, the therapist's hands guide the client's hands during brushing). The rehabilitative approach holds that through repeated hand-over-hand exercise, the client's brain can repair the neural pathways that mediate specific motor patterns, such as those needed for brushing the hair, or can reorganize pathways so that different, undamaged areas of the brain can establish new pathways for specific motor patterns. In a compensatory approach, the client may brush the hair by following steps through the visual interpretation of sequentially depicted (pictures) or listed (words) on a poster or note card.

Neglect syndrome (a disorder of body schema) can also be addressed by using rehabilitative and compensatory strategies. Severe neglect syndromes tend to decline as a natural part of the recovery process. However, some neglect syndromes may continue into the post-acute rehabilitation stage. With a rehabilitative approach, the client is encouraged to use the neglected extremity for all ADLs. The client's room may be rearranged to encourage interaction with the neglected part of the environment (eg, placing the television or standing bed tray on the left side of the room if the client has left-sided neglect). A compensatory model is used when the client has not demonstrated significant improvement in attending to the neglected side of the body or environment. The meal tray may be placed within the client's field of vision to maximize success. A colored border may be placed on the left side of book pages to cue the individual to scan the entire line while reading.

Behavioral Management

The types of intervention strategies used to reduce or eliminate problem behavior may be divided into two categories: environmental and interactive. **Environmental interventions** alter objects or other environmental features to facilitate appropriate behavior, inhibit unwanted behavior, and maintain individual safety. Agitated clients should be placed in a quiet, isolated room without a roommate. All extraneous stimuli (eg, radios and televisions) should be removed. Similarly, therapy is provided in a private, quiet room away from other people and extraneous stimuli.

An agitated client who demonstrates severe behavioral problems may require one-to-one care. The client is assigned a rehabilitation aide who remains with the client throughout the day (including during therapy) to monitor and regulate his or her behavior. The rehabilitation aide may wear an alarm bracelet that signals staff when the client attempts to wander away from the appropriate floor or out of the building. Walkie-talkies, pagers, and wander guards may be used with those who are at risk of eloping. One walkie-talkie or pager remains in the nursing station; the other is held by the therapist or staff member who is providing one-to-one care to the client. If the client begins to act aggressively or attempts to elope, the rehabilitation aide can alert the staff that assistance is needed.

Interactive interventions are the approaches staff members and caregivers use to interact with the client. The entire team should implement these interventions in a consistent way. Consistent implementation includes speaking in a calm and concise manner and deliberately refraining from detailed explanations that will only increase the client's confusion and frustration. For safety's sake, therapists should also keep the door open when working with the client at the bedside and should always maintain awareness of the individual in relation to self.

A client in the post-acute stages of rehabilitation who continues to exhibit behavioral problems should be placed in a behavioral management program. Such a program should allow the client to experience the natural consequences of inappropriate behavior (eg, losing community recreational privileges) in an effort to encourage more appropriate responses. Drug therapy may be used for those who do not make significant improvements in their behavior and who present a safety risk to themselves and others.

Dysphagia and Self-Feeding

Intervention strategies for dysphagia follow the same guidelines as for other neurological impairments; however, intervention may be more complex for these clients because of bilateral neurological involvement, cognitive and behavioral issues, and severe neuromuscular impairments.[5,6] A self-feeding program may begin in a quiet area, such as the client's room. Eating is then advanced to more social situations, such as the hospital dining room. Common pieces of adaptive equipment, such as a rocker knife, plate guard, and nonspill mug, may be used if the client demonstrates diminished strength, coordination, or perceptual deficits. If the client displays decreased attention, introducing one piece of adaptive equipment at a time may help. Clients with heightened impulsivity may benefit from the strategy of placing the fork down after each bite to ensure that they completely chew and swallow before initiating the next bite. Depending on the client's level of dysphagia (ie, preoral, oral, pharyngeal, or esophageal), a diet of thick liquids or pureed foods may be indicated until the client makes progress toward recovery.

Functional Mobility

Mobility training can be subdivided into bed mobility, transfer training, wheelchair mobility, functional ambulation during performance of ADLs, and community mobility. The NDT principles of bilateral extremity use, equal weight bearing, and **tone normalization** are used in intervention strategies that address functional mobility. The rehabilitation model based on the principles of NDT and PNF should be used for intermediate-level clients with TBI in the acute and subacute stages of rehabilitation. Allowing a client with loss of function to use compensatory strategies, such as grabbing a bed rail with one hand and rolling or standing on one leg to transfer, may appear to enable the client to function more independently earlier. However, use of such strategies diminishes the client's ability to perform activities with a bilateral UE pattern at a later point. In time, unilateral performance of activities results in hemiplegic postures, contractures, and abnormal gait deviations. Compensatory strategies should be used only in the later stages of recovery and when the client has not been able to demonstrate significant improvement in functional mobility skills and thus must learn compensatory strategies to enhance the ability to live independently in the community.

Bed Mobility

An intermediate-level client with TBI may require training in bed mobility skills, including (1) scooting up and down in bed, (2) rolling, (3) bridging, and (4) moving from a supine position to and from sitting and standing positions.

Wheelchair Management

Wheelchair management includes the ability to manage wheelchair parts (eg, removing footrests and locking brakes) and propelling the wheelchair both indoors and outdoors on a variety of surfaces (eg, low-pile carpeting, sidewalks, and ramps). Customized wheelchairs may be ordered for a client who is in the post-acute stage of rehabilitation and continues to exhibit neuromuscular impairment that requires the use of a wheelchair for long-term mobility needs. A custom wheelchair provides a seating and positioning system that contours the client's body for comfort and skin protection, includes adaptive supports for proper pelvic and trunk alignment, and offers a seating position that enhances the client's ability to interact with the environment. Clients who cannot propel or control a manual wheelchair may require an electric wheelchair for independent home or community mobility.

Functional Ambulation

Functional ambulation refers to the ability to walk during functional activities. Physical therapists address gait training, whereas occupational therapists facilitate the carryover of ambulation skills into ADLs. Ambulation during performance of ADLs often requires the integrated use of UEs and LEs to carry and manipulate objects (eg, carrying a plate to a table, holding a book bag or purse, sweeping with a broom or vacuum cleaner, and carrying an infant). Functional ambulation also requires the ability to negotiate an ambulatory device (eg, straight or quad cane and walker) with one or both UEs during performance of ADLs. This is a high-level activity that requires eye-hand coordination and the integration of total body movements. Compensatory aids to improve the client's ability to negotiate an ambulatory device while performing ADLs include walker bags and baskets, wheeled carts (to provide balance and support during transport of items such as plates to a table), canes with built-in reachers, pouch belts (to hold keys, wallet, and memory books), and an apron during meal preparation (also see Chapter 10).

Community Travel

For clients who will be discharged to home or a community supportive living arrangement, the ability to negotiate their environment must be considered. Negotiating uneven sidewalks and curb cutouts, and correctly interpreting traffic light signals and the direction and speed of oncoming traffic, are important skills to practice for safe and independent community mobility. Functional ambulation in the community requires the client to respond and initiate actions quickly; for example, to cross the street after the light turns green and before it turns red. Clients must perceive depth and spatial relationships (to correctly judge the distance and speed of oncoming and turning traffic) and visually identify and avoid environmental hazards that could cause falls (eg, potholes and cracks in the sidewalk). Power mobile scooters or power wheelchairs are often recommended for clients who need long-distance mobility in the community but who fatigue easily or are unable to walk independently. Use of a power mobile scooter or power wheelchair requires good static sitting balance and the ability to quickly integrate UE hand control and cognitive decisions about the environment. Practicing with clients during the wheelchair evaluation is crucial to determining whether they are able to safely propel a power system in the community.

Transfers

All transfers, whether from bed to chair, from wheelchair to toilet, or from lying in bed to sitting on the edge of the bed, need to be performed in a safe manner. Individuals with TBI commonly have memory deficits and limited carryover of information; therefore, transfer training should be consistent (in technique and sequence) among all staff members treating the client. It is preferable that transfers for intermediate- and advanced-level clients be practiced while moving to both the right and the left sides of the body. Without such practice, clients who become proficient in a transfer toward the uninvolved side (in the hospital) may be dismayed to find that the home setting or public restroom requires transfers toward the opposite side. Additionally, teaching clients to transfer to both sides provides weight bearing on both LEs, the use of bilateral trunk muscles, and bilateral sensory input.

Family members and caregivers should be trained in proper transferring techniques (including proper body mechanics) by a therapist before transferring the individual alone. The decision on when to begin caregiver training depends on the client's functional level and ability to cooperate, the discharge date, and the caregiver's physical and cognitive abilities.

Home Management

As the client's skills and independence in self-care, dressing, self-feeding, and functional mobility increase, intervention is expanded to include home management skills in preparation for discharge to the community. Home management skills include meal preparation, laundry, cleaning, money management (eg, balancing a checkbook, paying bills, and budgeting), home repairs (eg, changing a washer in a leaking faucet), and community shopping (making a shopping list, locating the correct items in the store, and paying the correct amount of money at the cash register). Examples of high-level activities include planning a monthly budget, organizing a file cabinet, ordering from a catalog or the Internet, and filing income taxes. These are skills that adults need to live independently in the community and are thus relevant for most clients with TBI.

The degree to which clients participate in home management activities varies. For example, some prepare only simple meals using a microwave oven. For those who must prepare meals to live independently in the community but who are not interested in cooking, the goal is to help them safely prepare simple hot and cold meals at home. Some clients perform no household cleaning activities other than making their bed and doing the laundry. Common sense dictates that therapeutic interventions first address the activities that the client performed before the injury.

As in all other areas of intervention, home management skills are graded to accommodate the client's functional level. Beginning meal preparation tasks may involve making a cold sandwich, whereas beginning money management skills may involve learning to perform basic cash transactions. As clients progress in home management skills, the meal preparation task may be upgraded to preparing a two-item hot meal using a stovetop, oven, or microwave oven. Money management skills may be upgraded to writing checks and balancing a checkbook. As the client continues to gain skills, activities requiring higher level demands are performed until the client reaches the desired goals.

Child care, if appropriate, must not be overlooked as an area of intervention. Family involvement is critical if a mother or father is to return effectively to his or her role as a spouse and parent. Sensory overload and its resultant agitation in a parent with TBI are a commonly reported problem for families. OT sessions should gradually reintroduce parents to their role of caring for their children. Some hospitals have a family suite in which family members can practice ADLs and interpersonal skills with the client on weekends in preparation for discharge. This allows family members to gain a greater awareness of their loved one's impairments and need for assistance. It also makes the transition from hospital to home less stressful for both clients and family members.

The occupational therapist can also assist parents with TBI in the adaptation of strollers, cribs, and child care equipment to make handling of such items easier. Safely bathing or carrying a baby, preparing a meal while simultaneously caring for children, and one-handed diapering and dressing techniques are all examples of areas that could be addressed by OT services.

Community Reintegration

Clients who will be discharged from the acute rehabilitation hospital to home or to a post-acute residential supportive living arrangement should receive training to facilitate the transition from the hospital to the community. Clients who achieve a maximal level of independence in the protected and structured environment of the rehabilitation hospital may find that community reintegration holds even greater challenges. Community trips, in which an advanced-level client with TBI is accompanied by the occupational therapist (and perhaps a family member) to practice IADLs in the natural environment, should be implemented to provide the client with the opportunity to rebuild daily life skills. Depositing or withdrawing money from the bank or ATM, using the public transportation system, planning a shopping list, and purchasing items at the grocery or hardware store are activities that can facilitate initiation of the client's reentry into the community. Having the client perform ADLs in the community setting also allows the therapist to observe the client's ability to interact successfully or otherwise with the environment. The client is provided a chance to receive valuable feedback from others in the community about his or her behavior.

Some clients are discharged from the acute rehabilitation center to a transitional living center. Transitional living centers are designed to develop daily life skills by providing the client an opportunity to temporarily live in a community group setting with 24-hour staff supervision and assistance. The goal of transitional living centers is to facilitate progression from supervised living to greater independence in community living. The client is usually discharged from the transitional living center to a relative's home or to a residential supportive living facility that provides various levels of living arrangements (eg, community apartments and shared community group homes). Because long-term residential community facilities for people with TBI are expensive and not covered by most insurance companies, many are discharged home, where they receive continued intervention in out-rehabilitation or in day treatment programs that provide community, work, and school reentry training.

Psychosocial Skills

One or more years after their injury, individuals with TBI commonly report that psychosocial impairment is the greatest obstacle to rebuilding a meaningful lifestyle. Many report feeling a deep sense of isolation and loneliness. Loss of roles such as partner or spouse, worker or student, independent home maintainer, friend, and community member often leaves individuals feeling as though they have lost their identity. The goal of the occupational therapist, particularly in post-acute TBI centers (eg, day treatment programs, out-rehabilitation, transitional living sites, and long-term community supportive living arrangements), is to help rebuild desired occupational and social roles. This involves a three-step process: (1) identifying the desired roles that were lost as a result of TBI, (2) identifying activities that would support the desired roles, and (3) identifying rites of passage that were either lost or never transitioned through as a result of the TBI. Rites of passage are socially recognized events that mark the transition from one life stage to another. Common rites of passage in Western society include obtaining a driver's license, graduating from secondary school or obtaining a higher education degree, securing full-time employment, living independently in the community, dating, marrying, and parenting.

Once the desired occupational and social roles, activities, and rites of passage have been identified, the therapist facilitates the client's use of adaptation, compensatory strategies, and integration of new learning. The therapist will also help the client enhance or regain interpersonal skills, self-expression, social appropriateness, time management, and self-control. Such psychosocial skills are critical if the client is to reenter the community; that is, to live in a neighborhood setting, hold a job, perform volunteer work in the community, and participate in desired recreational opportunities along with other adult community members.

Group intervention is beneficial because it enables the client to meet others experiencing the same life concerns (thereby reducing feelings of isolation). Groups can offer exposure to peer reactions, which is particularly helpful if the client exhibits socially inappropriate behavior. Groups may also facilitate problem solving by providing the opportunity to speak with others who have successfully dealt with the same or similar problems. Participants who have been in the group longer can become peer mentors to new group members. The opportunity to help others—that is, to share one's experience of having a brain injury with others who can benefit from that knowledge—has been shown to enhance an individual's life satisfaction, feelings of competence, and sense of usefulness. Many states have state associations for brain injury that provide support groups for individuals with TBI.

Substance Use

If the client's preinjury history includes substance use, he or she should receive drug and rehabilitation services specifically designed for individuals with TBI. Clients with a history of substance use may not display any signs of a desire to return to substance use while in the structured and protective environment of the subacute rehabilitation facility. Substance use may become a problem only after the client is discharged to the home, a community-supported living arrangement, or any residential situation in which long periods may be spent alone and unsupervised. Drug rehabilitation services are critical for clients with a substance abuse history because return to substance use after brain injury has been closely implicated in the occurrence of a second TBI.

Discharge Planning

Planning for discharge from OT services begins at the initial evaluation and continues until the last day of intervention. Components of discharge planning include a home safety evaluation (if the client will be discharged home), equipment evaluation and ordering, family and caregiver education, recommendations for a driver's training program (if indicated), and recommendations for a successful return to school or vocational retraining and work skills.

Home Safety

If the client is to be discharged home, the therapist should visit the home (or transitional living setting) to recommend modifications for increased safety. For example, clients with balance difficulties should have grab bars in the shower stall. Increased lighting should be provided as necessary for clients with visual deficits because low lighting has been linked to falls. Recommendations should also be made regarding the client's ability to handle sharp items (eg, knives or glass items that could shatter easily), use the stove, and remember to turn off the faucet and other appliances. The temperature for the hot water system should be set at 120°F or lower to prevent scalding.

Anything the client could trip over (eg, throw rugs, appliance cords, furniture legs, objects placed on steps) should be removed. If feasible, nonslip flooring should be added to slippery surfaces (eg, bathroom and kitchen tiles). If a wheelchair is indicated, the therapist should recommend modifications to doorways and bathroom spaces and should suggest replacement of high-pile carpeting with tile, wood, or other surfaces that can be easily traversed by a wheelchair.

Additionally, family members and caregivers should be educated in the appropriate steps to follow during a seizure, should understand how to evacuate the individual in case of emergency, and should practice methods by which to transfer the individual safely. Caregivers should be able to identify unsafe activities in which their loved one should not participate, and they should know the length of time the person can be safely left alone, if that is possible at all.

Equipment Evaluation and Ordering

If a client will be discharged from the acute rehabilitation facility, an evaluation of the equipment needed in the next setting is required. This may necessitate reevaluation of the client's equipment needs because many of the adaptive devices that were valuable in the beginning and intermediate stages of rehabilitation may be discarded as the client improves. For example, a tub bench or shower chair may have been needed initially because of dynamic standing balance difficulties. The client may have progressed sufficiently during the course of rehabilitation to stand in the shower while using only a grab bar. Because clients with TBI may demonstrate improvements over the course of many months, a rental wheelchair may be considered.

Family and Caregiver Education

Family members and caregivers should be involved in the client's rehabilitation from the beginning of treatment and should be considered members of the intervention team. Education of caregivers in such activities as transfers, wheelchair mobility, ADLs, bed positioning, splint schedules, use of equipment, ROM exercises, and self-feeding techniques facilitates follow-through with the skills the client has learned in the rehabilitation hospital. Individual safety is of primary importance for caregiver education. The caregiver should be trained in implementation of the home program (in either written or videotape form). Home programs may include the areas listed previously, in addition to specific activities for the improvement of cognition, vision, perception, and motor control.

Recommendations for Driver's Training

If the client passes the clinical driver's evaluation, the OT may recommend a specific number of hours of driver's training. An occupational therapist or a driving instructor who has experience working with individuals with TBI (see Chapter 11) should implement the driver's training.

Recommendations for Vocational Training and Work Skills

If indicated, an OT may make recommendations for vocational training if the client is discharged to a day treatment program, an out-rehabilitation center, or a transitional living site. Vocational training is an extended process that requires the involvement of an occupational therapist and possibly a vocational counselor. The client's eventual return to work may require the assistance of a job coach. The success of a client's return to work depends highly on the environment to which he or she is returning and the supportiveness of the environment. These are all aspects that must be considered when a client's potential is evaluated.

Summary

Treatment of adults with TBI is challenging and requires flexibility, stamina, and creativity. Behavioral and psychosocial deficits greatly influence recovery. Substance abuse, a possible contributing factor, must be assessed and addressed. Most clients have a multitude of problems requiring intervention. Coordination of evaluation and goal setting with the interdisciplinary team (including the client and family) is assumed. Intervention should be individualized and oriented toward functional outcomes that are meaningful to the client. An effective transition from acute care to intermediate care and then to the community requires the therapist to plan thoughtfully and communicate clearly. For some people with TBI, recovery and adjustment are lifelong challenges; for this reason, and because the needs of these individuals continue to evolve, providing resources throughout the continuum is essential for an ongoing productive outcome.

Review Questions

1. What are two important measurable landmarks of recovery from TBI?
2. Name five types of neuromuscular impairment that may be present in a client with TBI.
3. Describe the types of care settings available for clients with TBI in the acute, subacute, and post-acute stages of rehabilitation.
4. Describe the psychosocial deficits that may be present in a client with TBI.
5. List two components of a behavioral management program.
6. Name three standard assessments for individuals with TBI and describe the performance components and areas they assess.
7. List four visual skills that are evaluated in a vision screening.
8. Why is it important for a client with TBI to complete an on-road driving assessment?
9. What are the goals of a proper wheelchair positioning program?
10. What are the indications for splinting? For casting?
11. Describe three areas that should be addressed during discharge planning.
12. Why is it important to address substance use in individuals with TBI?

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[a]The author wishes to gratefully acknowledge the contributions by Rochelle Mclaughlin and Jeffrey Englander.

[b]The Rancho Los Amigos Scale of Cognitive Functioning is a means of describing the level of activity of a person with a brain injury. The RLA scale measures the levels of awareness, cognition, behavior, and interaction with the environment.

[a]References 9, 13, 18, 23, 37, and 83.

35

Degenerative Diseases of the Central Nervous System

Winifred Schultz-Krohn, Diane Foti, Carolyn Glogoski

CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Describe the course of amyotrophic lateral sclerosis (ALS).
2. Describe the differences between familial ALS (FALS) and sporadic ALS (SALS).
3. Describe the role of the occupational therapist for a client with ALS.
4. Describe the three subtypes of ALS.
5. Identify the symptoms and incidence of Alzheimer's disease.
6. Describe the pathophysiology of Alzheimer's disease.
7. Describe the overall model of medical management used by primary care providers and other health care professionals.
8. Describe an approach to evaluation used by occupational therapists.
9. Identify stages of disease progression and general treatment interventions associated with stages of dementia.
10. Describe the course and stages of Huntington's disease (HD).
11. Identify current research regarding the etiology of the disease.
12. Describe the medical management of HD.
13. Describe the purpose of occupational therapy for a client with HD.
14. Describe the three typical forms of multiple sclerosis.
15. Describe current research regarding the etiology of the disease.
16. Describe the symptoms of multiple sclerosis.
17. Describe complications that may occur as a result of the disease.
18. Describe the role of the occupational therapist for the person with multiple sclerosis.
19. Describe the course and stages of Parkinson's disease (PD).
20. Identify current research regarding the etiology of the disease.
21. Describe the medical management of PD.
22. Describe the role of the occupational therapist for a client with PD.

KEY TERMS

Alzheimer's disease
Amyotrophic lateral sclerosis
Bradykinesia
Chorea
Emotional lability
Exacerbation
Fasciculations
Festinating gait
Huntington's disease
Motor neuron disease
Multiple sclerosis
Parkinson's disease
Relapse
Remission
Rigidity
Stereotactic surgery

Case Study

Marguerite

Marguerite is a 35-year-old woman who was diagnosed with multiple sclerosis (MS) when she was 26. Although Marguerite was initially identified as having the relapsing-remitting form of MS, her neurologist recently diagnosed her with the secondary progressive form of MS and referred Marguerite to occupational therapy. Marguerite now uses an ankle-foot orthosis (AFO) on her right lower extremity when walking and has diminished sensation and dexterity in her nondominant left hand.

An occupational profile revealed the following background information about Marguerite. She is married and has two boys, ages 8 and 6. Both children participate in soccer and swimming on a weekly basis. Her husband travels every month for his job as a sales manager at an insurance company. Marguerite is a special education teacher in an elementary school and works full time, although she was unable to work during relapses. She cares for her 69-year-old mother, who has been diagnosed with Alzheimer's disease. Her mother lives alone in her own apartment in the same city. Although Marguerite has two sisters, neither lives within driving distance; Marguerite has the primary responsibility of caring for her mother and her children.

Marguerite was asked to identify what areas of occupational performance were problematic or successful. She quickly replied that being a chauffeur for her children, a manager of her mother's medical care, and a housekeeper for her family were problematic. She felt as though she was constantly juggling schedules; recently, her children's swimming class changed to a different day, causing a big change in the schedule. Although she wants her children to have the opportunity to pursue sports, Marguerite finds it difficult to supply snacks every month for these extracurricular activities, an obligation that each participant's mother is expected to fulfill. Her husband does try to help with household chores when he is home, but he works long hours and does not have time to shop for the family's groceries. Marguerite is also responsible for arranging all of her mother's medical appointments; shopping for her mother, who no longer drives; and visiting her mother daily. Marguerite reports that she often feels so tired after teaching all day and running all of her errands that she has trouble making dinner when she returns home.

Marguerite was most comfortable with her work situation and reported that many of her colleagues had offered to help with various tasks such as playground duty or monitoring the students during lunchtime. This allowed Marguerite to have a brief break during the day to rest.

Critical Thinking Questions

1. What evaluations would you perform to collect additional data to develop an intervention plan?
2. Where would you start your intervention plan, considering Marguerite's report of her occupational profile?
3. How would the change in Marguerite's diagnosis from the relapsing-remitting form to the secondary progressive form of MS affect her current occupational roles?
4. How would the strategies you select for Marguerite be applied to other clients who have degenerative neurologic disorders?

Introduction

This chapter addresses the impact of degenerative neurologic disorders on a person's occupational performance and outlines the role of occupational therapy (OT) in providing services to clients with these disorders. The specific disorders discussed in this chapter are amyotrophic lateral sclerosis (ALS), Alzheimer's disease (AD), Huntington's disease (HD), multiple sclerosis (MS), and Parkinson's disease (PD).

In degenerative neurologic disorders, the disease progresses and an individual's occupational performance is often increasingly compromised. Occupational therapy aims to help the client compensate and adapt as function declines secondary to the disease process. Environmental adaptations and modifications are often necessary to maintain functional skills for as long as possible.

Degenerative neurologic diseases may occur because of structural or neurochemical changes within the central nervous system (CNS).[70] In the disorders discussed in this section, the client's CNS usually functions normally during childhood and adolescence. After these years, the client experiences signs and symptoms indicating that CNS functions are deteriorating. The progressive nature of the disorder varies from person to person. Some clients have a rapid decline in function, whereas others maintain functional skills for many years.

The decline in function may compromise the individual's sense of self-efficacy in performing various tasks.[190] No longer is the individual able to perform personal or instrumental activities of daily life at the same level of independence. Dependence on others can alter the client's concept of self-worth and self-control. The OT practitioner serves an important role in reframing the client's sense of self even though functional independence may be deteriorating. A man with PD who is unable to dress independently may now direct a personal care attendant (PCA) or home health aide (HHA) to perform these tasks. A woman with MS who was previously responsible for household finances may need to instruct a member of the family to complete these activities.

The disorders discussed in this chapter are most often diagnosed during adult or later adult life, after habits, routines, and patterns of independent behavior are well established. A client may encounter a significant change in social relationships and interactions secondary to a decline in functional abilities. The OT practitioner must consider the ways in which progressive loss of function affects the client's social and occupational roles, whether those roles are as husband, wife, parent, adult child, worker, sibling, or friend. OT must address the needs of the client within the context of his or her social, physical, and cultural environment.

OT intervention aims to support the client's ability to function within his or her environment. The rate at which the client's symptoms progress influences the intervention plan. A client who displays a progressive loss of fine motor skills over 20 years has a much different profile than a client who loses all upper extremity function within 2 years. Use of adaptive equipment must be carefully weighed against the rate of deteriorating skills.

The OT practitioner must be knowledgeable about support services and respite care available to clients with a degenerative neurologic disorder. A PD support group may provide the necessary social support for both the person with this disorder and the individual's family. MS support groups may offer clients information regarding new intervention methods available, along with the opportunity to share life experiences.

An OT intervention plan should address not only the physical limitations associated with various disorders but also their cognitive, social, and emotional implications. Many individuals with neurodegenerative disorders have concomitant depression. Depression can be a reaction to the loss of function associated with some disorders or the primary symptom of other disorders. Occupational therapists should regularly screen for depressive features. An instrument such as the Beck Depression Inventory can effectively evaluate this component.[23,24] In addition to the evaluation of depression in clients with neurodegenerative disorders, cognitive abilities should be evaluated. Clients may have concomitant cognitive problems because of the destruction of neurologic structures, and these deficits can have a dramatic effect on intervention. Brief assessments such as the Mini Mental State Examination (MMSE)[66] or the Cognistat[146] can be used to determine cognitive abilities and establish a baseline of performance.

In most cases, the occupational therapist is a member of a team providing services to the individual with a degenerative neurologic disorder.[93] As a team member, the occupational therapist must consider the roles other professionals and family members play in the client's life and incorporate this knowledge into the intervention plan. OT practitioners provide a unique and needed service to individuals with degenerative neurologic disorders. A client who is able to engage in meaningful occupations despite deteriorating skills reflects the significant contribution of OT.

Three case studies are presented to illustrate the similarities and differences among clients faced with degenerative neurologic disorders. The first case concerns a woman, Marguerite, who has MS. That case is presented at the beginning of the chapter. The second case concerns a man, Marcus, who has ALS, and is presented at the beginning of Section 1 on ALS to serve as a frame of reference for the chapter content. The third case concerns a man, Carl, with PD and is presented at the end of the chapter to serve as a review. The cases should prompt clinical reasoning and decision making as you read this chapter.

Section 1 Amyotrophic Lateral Sclerosis

Diane Foti

Case Study

Marcus

Marcus is a 61-year-old man diagnosed with ALS. He is married and has two grown adult children. He works as the supervisor at an automotive parts outlet store that is a small local family business. He was planning to retire in 6 months when he turns 62. He shares all of the household chores with his wife, Sandy, who also works full time. He loves to garden, goes to church, reads, and plays harmonica.

About 6 months prior to his diagnosis he noticed that he was having difficulties sustaining his grasp on tools and was often dropping things at work. He also reported he was having a harder time lifting boxes off of shelves taller than shoulder height. He fell two times, once at work tripping on a step and once in the garden. His primary doctor noticed the fasciculations in his forearms and calves along with slight atrophy of the intrinsics of his hands. He was referred to a neurologist who made the definitive diagnosis of ALS. The neurologist referred Marcus to occupational therapy (OT) and physical therapy (PT) in the outpatient department. The OT referral was for evaluation and treatment of activities of daily living (ADLs) with a specific focus on Marcus' desire to keep working for at least 6 additional months. The PT referral was for an ankle-foot orthosis and gait evaluation.

The OT evaluation included learning which occupations were the most important and most problematic for Marcus. This allowed the OT to collaborate and prioritize goals with him. She asked Marcus to describe his understanding of his condition. Marcus said he was not sure if the neurologist's diagnosis was correct so he was seeking a second opinion. Either way, he decided it would not hurt to come to his OT and PT appointments. He stated the doctor told him he would get weaker but he thought if he just exercised enough he could improve his hand, shoulder, and leg weakness and prevent it from getting worse.

Along with a discussion of Marcus' work, family, and home environments, the OT assessed his motor and sensory skills and completed a cognitive screening. The OT presented the cognitive screening as a tool to help her determine how he best learns. The cognitive screening was within normal limits without any evidence of impaired short-term memory, spatial deficits, attention deficits, or problem-solving issues.

The OT practitioner found he had intrinsic weakness bilaterally but was right-handed. He had a weak key pinch. His gross grasp strength was 3+/5. He was able to pick up small coins but could not manipulate them in his hands. He also had 4/5 shoulder flexion strength. The therapist also noted hip and ankle dorsiflexion weakness. When he got up from a chair he used his hands to push off and at time shuffled his feet.

Marcus reported that most of his socialization beyond his family occurred at work with his buddies. He had known some of them for 20 years. He went to church regularly but did not socialize there. He stated church was a personal quiet introspective time, not a time to socialize.

Marcus and his wife live in a two-story house with a half-bath downstairs and his bedroom upstairs. There are two steps to enter and exit the house. He has lived in this house for 15 years. One of his sons and a daughter-in-law live down the street with their two children.

Marcus' daily routine includes having coffee in the garden or in the sunroom and dropping off his two grandchildren at school on his way to work. Typically he came home from work and would either take a walk with his wife and dog or work in the garden. On the weekends Marcus goes for long walks with his wife and spends time playing harmonica.

Functional deficits noted during the initial evaluation are as follows:

- Home: ADLs/ instrumental activities of daily living (IADLs)

- Difficulty fastening buttons and zippers

- Difficulty with handwriting
- Increased effort to get off of the toilet, chair, couch
- Difficulty handling tools for repairs at home

- Leisure

- Difficulty shoveling dirt
- Difficulty getting off the ground when weeding
- Fatigues rapidly when playing harmonica

- Work

- Dropping coins when ringing up a purchase
- Difficulty carrying boxes greater than 15 pounds and walking
- Extreme fatigue at the end of the day and needs to take a nap when he gets home

OT interventions during the initial evaluation included the following:

- Prioritizing goals with Marcus
- Instruction in energy-conservation principles in all occupations
- Hand splint option of using a custom-made short opponens splint to improve key pinch
- General hand strengthening with soft Theraputty with instruction not to overdue the repetitions
- Instruction in compensatory strategies for sit to stand
- Resources for bathroom equipment including a shower seat, low/small-diameter grab bars (to function as long as possible with progression of the disease), shower hose, rubber mat, and rationale for implementing equipment as energy-conservation technique and fall prevention
- Recommendations for easy-to-don clothing and instruction in use of a button hook
- Education on Americans with Disabilities Act (ADA) and work accommodations
- The future need for a home evaluation or lengthy discussion about potential access issues in his home
- Discussing frequency of follow-up appointments and alternative methods of communicating via the secure healthcare message system
- Education on the scope of OT and how the OT practitioner will work with Marcus throughout the course of the ALS to make ongoing adaptations to the activities he feels are important

The therapist continued to work with Marcus and his family throughout the course of his disease. The frequency of services depended on his current needs. Marcus and his wife frequently communicated with the OT via e-mails asking about different adaptive equipment and ideas to remain functional. He eventually was followed by an occupational therapist who worked for Home Health and Hospice. At that time Marcus used a power wheelchair full time with a chin switch, a Hoyer lift for transfers, and was dependent with all ADLs and IADLs except using an adapted phone and tablet. He had a percutaneous endoscopic gastrostomy (PEG) feeding tube. Marcus entered the hospice program approximately 2 years after initial diagnosis. His goals at that time were to be more comfortable, continue to use his tablet to e-mail friends at work, see his grandchildren's pictures on Facebook, and do online grocery shopping for the family.

Critical Thinking Questions

1. What evaluations would you perform to collect additional data for developing an intervention plan? What events would indicate a need for reevaluations?

2. Where would you start your intervention plan in light of Marcus' report of his occupational concerns?

3. The early and late stages of ALS are briefly described in the case study. What types of participation and performance skill deficits will likely arise during the middle stage of ALS?

4. When would you begin to include Marcus' family in treatment?

The role of the occupational therapist when working with an individual diagnosed with ALS (such as Marcus in the case study) is to focus on the occupations most important to the individual and on the adaptation methods he will need to apply as his performance skills decline.[7] Occupations that occupational therapists focus on are as diverse as the individuals' personal interests, goals, and priorities. The novice should not assume that basic ADLs are a priority but should listen to what motivates, drives, and frustrates the client and family. The therapist will have the opportunity to use the expanse of OT skills through the evaluation process and treatment interventions, which may include ADL/IADL adaptation; hand splinting; adaptive equipment; cognitive assessment and strategies; psychosocial assessment; environmental modifications for work, home, and leisure; and wheelchair seating and positioning. Most critical is to listen to the client and family about their needs and make those a priority. The personal context of the individual will significantly influence the choices an individual makes regarding home modification and choice of power versus manual wheelchair mobility. For example, a person with limited financial means may choose to not make significant home modifications. Diagnosis and progression of disease are described in terms of the loss of performance skills, whereas Box 35.1 describes the OT interventions in relation to both occupation and performance skills as identified in the Occupational Therapy Practice Framework.[7]

Box 35.1

People With Cognitive Dysfunction Benefit From the Following Approaches

- Use simpler tools for communication than you would use for patients who do not have cognitive deficits.

- Use simpler and more straightforward language and communicate clearly and directly.

- Supervise eating more closely. Patients with frontal lobe abnormalities and poor swallowing ability may have difficulty following medical advice to limit solid foods, or they may place too much food in their mouth.

- Assess patients' ability to make decisions by talking with them and the caretaker because patients with neurologic disorders are faced with complicated medical, financial, and sometimes legal issues.

- Even patients with subthreshold cognitive deficits who do not meet the criteria for dementia may lack the ability to make sound judgments about their care. Poor insight is common, so caregiver involvement may be appropriate.
- Supervise walking. Patients with cognitive deficits often have a loss of impulse control and may make poor decisions about where to walk, how far to walk, or when to use equipment such as a walker.
- Remind caregivers and family to avoid taking the person's behavior personally.
- Help them understand that there is a physiological cause for the behavior.
- Encourage the caregiver and the family to build an atmosphere of comfort and love with a calm and orderly environment.

Modified from ALS Association: *ALS, cognitive impairment (CI) and frontotemporal lobar dementia (FTLD): a professional's guide,* 2005, 27001 Agoura Road, Suite 250, Calabasas Hills, CA 91301-5104. Phone: (800) 782-4747. Website: alsinfo@alsa-national.org / www.alsa.org.

The term **amyotrophic lateral sclerosis** (ALS) is used to identify a group of progressive, degenerative neuromuscular diseases. The underlying neurologic process involves destruction of motor neurons within the spinal cord, brainstem, and motor cortex.[196] Affected individuals exhibit a combination of both upper motor neuron (UMN) and lower motor neuron (LMN) deficits at some point in the progression of the disease.

In the United States, ALS is also known as Lou Gehrig's disease.[25] The term **motor neuron disease** refers to a group of diseases that includes ALS, progressive bulbar palsy, progressive spinal muscular atrophy, primary lateral sclerosis, and an inherited form, spinal musculature atrophy.[102,140] Table 35.1 describes each of these distinct subtypes of ALS. The classic forms of ALS are presented in this section. The National ALS Registry identified the prevalence or number of people living with ALS at any one time to be about 4 people out of every 100,000 in the United States.[205]

TABLE 35.1

Clinical Subtypes of Amyotrophic Lateral Sclerosis

Name	Area of Destruction	Symptoms
Progressive bulbar palsy (PBP; bulbar form)	Corticobulbar tracts and brainstem motor	Dysarthria, dysphagia, facial and tongue weakness, nuclei involved and wasting
Progressive spinal muscular atrophy	Lower motor neurons in the spinal cord	Marked muscle wasting of the limbs, trunk, (PMA or PSMA) (LMN form) and sometimes the brainstem and/or the bulbar muscles
Primary lateral sclerosis (PLS; UMN form)*	Destruction of the cortical motor neurons; progressive spastic paraparesis may involve both corticospinal and corticobulbar regions.	Progressive spastic paraparesis

*The World Federation of Neurology Classification of spinal muscular atrophy and other disorders of the motor neurons does not identify primary lateral sclerosis (PLS) as a subtype of amyotrophic lateral sclerosis (ALS).[25] This author is including PLS in the list in recognition of the many other articles and books that recognize it as a subtype of ALS.

From Belsh JM, Schiffman PL, editors: *ALS diagnosis and management for the clinician*, Armonk, NY, 1996, Futura Publishing; Guberman A: *An introduction to clinical neurology, pathophysiology, diagnosis, and treatment*, Boston, 1994, Little, Brown.

ALS incidence increases after age 40, with cases peaking among those in their 60s and 70s. There is a higher incidence in males than females. Some studies have shown an increased incidence of ALS in veterans of World War II, the Korean War, the Vietnam War, and the Gulf wars. An approximate twofold risk of ALS was reported for veterans of the 1990–1991 Persian Gulf War and for all U.S. veterans.[83,218]

Two primary forms of ALS are recognized: sporadic and familial. Sporadic ALS makes up about 90% to 95% of ALS cases. Between 5% and 10% of individuals with ALS are found to have a family history of the disease. There is no difference in the symptoms or course of the disease for clients with the familial and sporadic types.

The diagnosis is primarily determined by clinical symptoms, electrophysiological exam, and ruling out other neurologic disorders. Criteria established by the World Federation of Neurology and more recently revised by Costa and colleagues state that it is critical for the diagnosis to determine both upper and lower motor neuron involvement with progressive weakness and to exclude all alternative diagnoses.[47] Definite ALS occurs when motor neurons from three or four of the following regions are involved: bulbar (jaw, face, palate, larynx, and tongue); cervical (neck, arm, hand, and diaphragm); thoracic (back and abdomen); and lumbosacral (back, abdomen, leg, and foot). The presence of upper and lower motor neuron involvement but intact bowel and bladder, the absence of sensory changes, and a normal spinal x-ray all support a positive diagnosis for ALS.[196]

Pathophysiology

The etiology of ALS has not been established. Multiple theories have been proposed as the cause of the motor neuron destruction, including gene mutation, metabolic disorders of glutamate insufficiency, metal toxicity, autoimmune factors, and viral infection.[196]

Clinical Picture

The symptoms of ALS vary, depending on the initial area of motor neuron destruction. An individual with ALS typically has a focal weakness beginning in the arm, leg, or bulbar muscles. The individual may trip or drop things as in the case of Marcus and may have slurred speech, abnormal fatigue, shortness of breath, and **emotional lability**, which is uncontrollable periods of laughing or crying. As the disease progresses, marked muscle atrophy, weight loss, spasticity, muscle cramping, and **fasciculations** (i.e., twitching of the muscle fascicles at rest) ensue (Fig. 35.1). To better understand the condition, the OT practitioner may want to research videos that show fasciculation. This will improve the OT practitioner skills when assessing function and reporting symptoms and deficits to the physician. Performance areas may be affected as the individual has greater difficulty with walking, dressing, fine motor activities, and swallowing. In the end stages the individual may elect to use complex, life-prolonging interventions such as tube feedings and a ventilator for respiration. ALS is a rapidly progressive disease, with the majority dying of respiratory failure in 2 to 5 years after the onset of symptoms if no tracheostomy and ventilation are performed. Approximately 10% of the population will live 10 to 20 years or longer.[141] As ALS progresses, the disorder does not affect a person's eye function, bowel and bladder function, or sensory function.

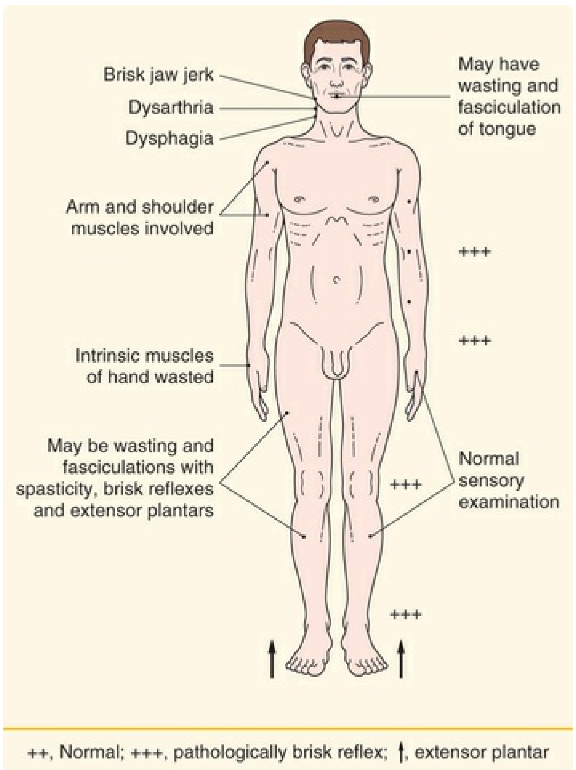

FIG 35.1 Clinical findings in a patient with classic amyotrophic lateral sclerosis with a mixture of upper and lower motor neuron signs. (From Yogarajah M: *Crash course in neurology*, ed 4 (updated), Edinburgh, 2015, Mosby.)

Research has found that mild to moderate cognitive changes occur in 50% of the population with ALS and as much as 20% of the population has dementia.[126] Specific cognitive deficits have been identified, such as frontal temporal lobe dysfunction and disorders of executive function.[183] Executive function impairment includes reasoning, judgment, sequencing, ordering, inferring, regulating emotions, planning, retrieval inefficiency, and a person's ability to have insight into his or her behaviors. A clinician or family member may observe repetition of questions, actions, or phrases; getting stuck on an idea; and an overly emotional response to a situation. Risk factors for developing cognitive problems, behavior changes, or a full-fledged dementia syndrome may include older age, bulbar onset ALS, a reduction in functional vital capacity (FVC), and a family history of dementia.[169]

The prognosis is difficult to predict. Generally, individuals with early bulbar involvement have a poorer prognosis.[196] A more positive prognosis is usually associated with the following factors: younger age at onset; onset involving LMNs located in the spinal cord; deficits in either UMNs or LMNs, not a combination of both areas; absent or slow changes in respiratory function; fewer fasciculations; and a longer time from the onset of symptoms to diagnosis.

The loss of function with ALS is more rapid, without episodes of remission or plateauing as may be seen with individuals diagnosed with multiple sclerosis (MS). A person with ALS must cope with a fatal disease, whereas a person with MS or Parkinson's must cope with a chronically disabling condition.

Medical Management

The American Academy of Neurology has established practice parameters and standards to address major management issues for persons with ALS. An OT practitioner working with this population should be familiar with the standards to better understand the approaches and rationale for intervention. The parameters cover the following topics: how to inform the client of the diagnosis, when to consider noninvasive and invasive ventilator support, evaluation of dysphagia and intervention with a feeding tube, management of saliva and pain, and use of hospice services.[127] Symptoms such as muscle cramping, excessive saliva, depression, lability, and pain are managed with medication. The client's respiratory status should be reevaluated frequently to determine when noninvasive and invasive ventilator support is necessary. Swallowing function should also be evaluated frequently to prevent aspiration and to determine when and whether a feeding tube should be placed.

The Food and Drug Administration approved the drug riluzole (Rilutek) in 1995. Riluzole, an antiglutamate, was the first drug used specifically to alter the course of the disease by prolonging survival. Researchers believe that the success of riluzole indicates that an excess of glutamate leads to the death of motor neurons.[155] Research has shown that riluzole prolongs the life of clients with ALS by at least a few months.[127] Although additional medications may be used to manage symptoms, there is no cure for ALS and no medication to reverse the course of the disease.[155]

Many clinical trials have been funded for research on extending survival, slowing the decline associated with the disease, and assessing and treating the resulting deficits. A comprehensive list of current studies can be found on the National Institutes of Health, clinicaltrials.gov, and the alsconsortium.org websites.

Occupational Therapy Evaluation and Intervention

It is essential to work with the client and family throughout progression of the disease as client factors and performance skills become impaired. The case study of Marcus presents OT intervention for a newly diagnosed individual at the end stage, but there are many more opportunities for the client to benefit from occupational therapy in the middle stage of ALS (Table 35.2). The client factors, including cultural, social, and spiritual values, must be understood because these factors will influence ongoing decisions about personal care and life support. When working with Marcus, the OT practitioner should recognize that his work site is his primary social networking opportunity and that he has a consistent role as a grandfather driving his grandchildren to school.

TABLE 35.2

Amyotrophic Lateral Sclerosis Interventions

Patient Characteristics	Interventions With Focus on Performance Areas of Occupation	Interventions With Focus on Client Factors
Phase I (Independent)		
Stage I Mild weakness Clumsiness Ambulatory Independent with ADLs	Continue normal activities or increase activities if client is sedentary to prevent disuse atrophy and prevent depression. Integrate energy conservation into daily activities, work, and leisure. Provide opportunity for individual to voice concerns (provide psychological support as needed).	Begin range-of-motion program (e.g., stretching, yoga, tai chi). Add strengthening program of gentle resistance exercise to all musculature, using caution to prevent overwork fatigue.
Stage II Moderate, selective weakness Slightly decreased independence in ADLs; for example, difficulty climbing stairs, difficulty raising arms, difficulty buttoning clothing	Assess self-care, work, and leisure skills impaired by loss of function; if patient continues to work, focus on how to adapt tasks with current deficits; assist with balance between work, home, and leisure activities; include significant others in treatment. Use adaptive equipment to facilitate ADLs (e.g., button hook, reacher, built-up utensils, shower seat, grab bar). Integrate hand orthotic use into daily activities. Perform baseline dysphagia evaluation; reevaluate throughout each stage of the disease.	Continue stretching to avoid contractures. Continue cautious strengthening of muscles with MMT grades above F+ (3+). Monitor for overwork fatigue. Consider orthotic support (e.g., AFOs, wrist or thumb splints—short opponens splint).
Stage III Severe, selective weakness in ankles, wrists, and hands Moderately decreased independence in ADLs Tendency to become easily fatigued with long-distance ambulation Slightly increased respiratory effort	Prescribe manual or power wheelchair with modifications to eventually allow recline or tilt posture with headrest, elevating leg rests, adequate trunk and arm support. Help patient prioritize activities and provide work simplification. Reassess for adaptive equipment needs (universal cuff to eat). Assess and adapt use of communication devices (e.g., regular phone to cordless or speaker phone; pen and paper to computer with adapted typing aid). Provide support if there is loss of employment or other activities; explore alternative activities. Begin discussing need for home modification, such as installing ramps or moving the bedroom to the lowest floor. Provide education regarding the types of bathroom equipment available for energy conservation and safety.	Keep patient physically independent as long as possible through pleasurable activities and walking. Encourage deep breathing exercises, chest stretching, and postural draining if needed.
Phase Ii (Partially Independent)		
Stage IV Hanging-arm syndrome with shoulder pain and sometimes edema in the hand Wheelchair dependent Severe lower extremity weakness (with or without spasticity) Able to perform some ADLs, but fatigues easily	Evaluate need for arm slings, overhead slings, mobile arm supports for eating, typing, page turning. Prescribe power wheelchair if the patient wants to be independent with mobility; controls must be adaptable from hand to other mode of control. Evaluate need for assistive technology such as environmental control systems, voice-activated computer; augmentative communication device. Help the patient prioritize activities, and consider negotiating roles with significant others. Reinforce the need for home modifications. Reinforce the need for shower seat or transfer tub bench and shower hose. Assist with patient's ability to participate in closure activities, such as writing letters or making tapes for children, completing a life history, and writing a log on household management for family.	If arm supports are not used, provide arm troughs or wheelchair lap tray for wheelchair positioning; wrist cock-up splints for full resting; hand splints may be needed for positioning. Provide pain and spasm management through the following: Heat, massage as indicated to control spasm and pain Anti-edema measures Active assisted or passive range-of-motion exercises to the weak joints; caution to support and rotate shoulder during abduction and joint accessory motions Isometric contractions of all musculature to tolerance
Stage V Severe lower extremity weakness Moderate to severe upper extremity weakness Wheelchair dependent Increasingly dependent in ADLs At risk for skin breakdown caused by poor mobility	Instruct family in methods to assist patient with self-care, especially bathing, dressing, and toileting; aim to minimize caregiver's burden and stress. Family training to learn proper transfer, positioning principles, and turning techniques. Instruct in use of mechanical lift if needed for transfers out of bed (patients in slings require head support). Adapt and select essential control devices for telephone, stereo, television, electric hospital bed controls for independent use. Adapt wheelchair for respiratory unit if needed to allow for continued community access.	Instruct family and patient in skin inspection techniques. Instruct in use of electric hospital bed and antipressure device. Adapt wheelchair for respiratory unit if needed; reassess adequacy of wheelchair cushion for pressure relief.
Phase Iii (Dependent)		
Stage VI Dependent, with all positioning in bed or wheelchair Completely dependent in ADLs Extreme fatigue	Eating: Evaluate dysphagia, and recommend appropriate diet; therapist may recommend tube feedings if patient is at high risk for aspiration; recommend suction machine for handling secretions and preventing aspiration. Augmentative speech devices may be recommended, in addition to speech therapy.	Continue with passive-range-of-motion exercises for all joints Provide sensory stimulation with massage and skin care.

Modified from Yase Y, Tsubaki T, editors: *Amyotrophic lateral sclerosis: recent advances in research and treatment*, Amsterdam, 1988, Elsevier Science. In Umphred DA, editor: *Neurological rehabilitation*, ed 3, St. Louis, 1995, Mosby.

The client and family members must regularly update decisions about care. Decisions range from when or whether a wheelchair or adaptive eating device should be used to whether the client should undergo a tracheostomy, choose tube feeding, or use of a ventilator. The entire health care team should provide psychosocial support regarding decisions about the extent of life support and medical intervention, with the physician and client having the primary responsibility. As the occupational therapist works with Marcus considering ADL adaptation and home modification, opportunities will arise for the OT practitioner to discuss how much intervention the client wants and what type. Several studies have shown that caregivers and patients have different needs and perceptions of quality of life. It may be beneficial for patients and caregivers to have time for education and support separately to meet their individual needs.[29,154]

Initial and ongoing OT assessment is essential to educate the client about ways to adapt functional activities as the disease progresses. As Marcus declines in physical function and relies more on caregivers, the emphasis is on caregiver training. Education is needed for nursing staff and physicians to understand the role of the occupational therapist in the treatment of clients with ALS.

Steady disintegration in the ability to speak, swallow, move, and perform activities of daily living (ADLs) makes it easy to overlook the presence of some common signs of cognitive or behavioral dysfunction, such as poor insight and deficits in planning.[2] Multiple cognitive domains may be affected in persons with ALS, including psychomotor speed, fluency, language, visual memory, immediate verbal memory, and executive function.[169]

With impaired executive function, a person with ALS may have difficulty handling the visual, auditory, and other sensory data required for complex decision making.[155,183] These cognitive and behavioral issues are pertinent when considering teaching strategies and the need for caregiver counseling and support.

Role of the Occupational Therapist

ALS progresses rapidly, with ongoing deterioration in physical status and possibly cognitive deficits. The intervention plan should focus on the client's participation in occupational performance because the client's functional status changes frequently and intervention focused on physical performance is limited. As the client's function declines, there is a greater need for environmental support through providing durable medical equipment, modifying the home, and providing adaptive equipment. Some studies have shown that exercise, including passive range of motion and light resistive exercise, improves an individual's function and reduces spasticity. Daily range of motion to reduce spasticity and prevent contractures is important during the middle to late stages of the disease.[11] Depending on the client's level of understanding, life support choices, and acceptance of the disease, the OT intervention may initially focus on structuring the client's environment to support independence, and in middle to later stages attention may shift to caregiver training and adaptation to ADLs with assistance. Some clients with ALS may choose to have the maximum environmental and life support available to extend life. In this case, the occupational therapist may provide periodic reevaluations to determine the client's need for adapting self-care, work, and leisure activities. Other clients may request that no extraordinary life support be used, in which case the occupational therapist would assume a supportive role, perhaps helping these clients create a memory book to give to their loved ones. Table 35.2 provides a list of the functional deficits at various stages of the disease and interventions that may be required. When referring to this table, the OT practitioner must remember that each client's clinical picture is unique and that symptoms may appear in a different sequence than the table indicates. For example, a client with early-onset bulbar signs will require earlier intervention regarding swallowing assessment and communication devices; another client may not need a wheelchair until the very late stages. The ALS Association website (www.alsa.org) provides practical solutions for ADLs and a variety of resources that address many of the problems that this population faces, and it is an invaluable resource for practitioners, patients, and families.

Individuals and their families require an interdisciplinary approach to the rapid changes in function, complex psychosocial factors, and quality-of-life issues associated with ALS. The impact of the disease on the client's quality of life has been examined frequently. One study indicated that those who were less distressed and less depressed[39] and had a more positive attitude lived longer.[86] Fatigue and depression have been associated with a poor quality of life for an individual with ALS.[118] Research has found that level of disability was not directly correlated with degree of anxiety and depression.[39] Hecht and colleagues found that social withdrawal correlated with levels of disability; based on the results of this investigation, the authors recommended that mobility be improved with power wheelchairs and public transportation to prevent social withdrawal.[86] Studies have also examined the impact of hope, spirituality, and religion as a means of coping with the disease.

OT Practice Note

Formulation of an occupational profile during the occupational therapy evaluation can promote better understanding of the client's outlook and help determine the most appropriate interventions to improve quality of life with this rapidly progressing disease.

Section 1 Summary

The Marcus case study demonstrates how ALS symptoms manifest and the impact on occupations and client factors. As ALS progresses rapidly, OT reassessment and interventions are needed throughout the process. OT aims to maximize the client's function by providing interventions and periodic reassessment to compensate for declining motor function through modification of the environment, occupations, and tasks and by helping the client and family achieve their client-centered goals.

Section 2 Alzheimer's Disease

Carolyn Glogoski With Winifred Schultz-Krohn

Dementia is the general word used for a group of symptoms caused by serious disorders of the brain. Memory loss and other related problems in language, perception, thinking, and judgment interfere with learning, communicating, relating, and even caring for self. Dementia is not just one disease but includes a number of diseases (e.g., vascular dementia, Lewy body dementia, frontotemporal dementia). The most common form of dementia is **Alzheimer's disease** (AD), especially in persons over 65 years of age.

Alzheimer's disease (AD) is considered a primary dementia as it does not result from other diseases. Secondary dementia is a word that may be used to refer to symptoms of dementia that are associated with other physical diseases (Parkinson's and Huntington's disease, amyotrophic lateral sclerosis, multiple sclerosis) and are discussed elsewhere in this chapter. AD, unlike the other neurologic disorders discussed in this chapter, is formally classified as a mental disorder by the American Psychiatric Association.[10] The exact cause of AD is still unknown, although one pathological change that has been identified is the accumulation of amyloid-beta 42 (AB42) plaques in the central nervous system.[186,202] It is not known why the plaques trigger the degenerative impact on the nervous system, and to date it is not clear what promotes the quick onset of these plaques that are one cause of AD. Because of the damage to brain cells and irreversible cognitive decline, the disease results in impaired higher mental processes, altered behavior, and disturbances in mood. The disorder progresses gradually, producing multiple cognitive deficits, a significant decline from previous levels of functioning, and noticeable impairment in social and occupational functioning is seen over the course of time. Effects on the motor and sensory systems are not apparent until later in the disease process.

Dementia is a significant healthcare problem because of the increasing number of individuals who are living longer, the higher incidence of dementia among older persons, the very high cost of supervised care, and the extensive use of medical resources.[206] Medicare spends almost three times as much money on persons with AD and other dementias than on beneficiaries without AD.[4,5] Early recognition of cognitive decline by physicians, occupational therapists, and all other healthcare professionals is critical.[58] Slower progression of the disease, greater understanding of functional decline, improved quality of life, and time to prepare for the future for older adults and their families could be an outcome of early recognition. The AD diagnosis is often overlooked or mistaken for other disorders, especially in the early stages.

OT Practice Note

Occupational therapists have an essential role in helping the client with AD enjoy life and remain as self-sufficient as possible and in supporting families and caregivers over the course of this difficult disease.

Incidence

Alzheimer's disease accounts for more than two-thirds of the cases of dementia, and the incidence increases dramatically as people age.[4,5,38,202] It is estimated that close to 13% of adults 65 years of age and older have AD. The disease affects more than 5 million people in the United States, and 4.9 million are persons over 65 years of age. Age is the strongest primary risk factor. The incidence of AD more than doubles every 5 years after age 65. It is estimated that 40% to 50% of the population of old-old (85+ years) adults have AD. Many more Americans are surviving into their 80s and 90s because of advances in medical technology. In a study of 97-year-olds 61% of the population had some form of dementia.[99] As the population of old-old adults continues to grow, the number of persons with AD is also expected to grow. Family history and genetics are other risk factors for AD.[204] Two general forms of AD are reported and primarily determined by the age of onset of the disease: early onset, which is diagnosed before the age of 65, and late onset, diagnosed after the age of 65.[35] The early-onset form is seen in only 10% of AD cases, and the far more common form of AD is the late-onset type. Early-onset, familial forms of AD are linked to genetic "mutations of the amyloid precursor protein (APP), and/or presenilin-1 and 2 (PS-1, PS-2) genes."[202] Although this genetic link has been identified, even for early-onset familial forms of AD, the genetic marker is only present in approximately 5% of individuals with early-onset AD (EOAD).[35] Late-onset AD has been linked to the apolipoprotein E-4 (APOE-4) allele on chromosome 19, but it should be noted that this allele has also been found in older persons who do not have AD.[137] It is generally agreed that although genetic factors pose some risk in late-onset AD, risk factors may be more influenced by the interactive effects of diet, lifestyle, and environment affecting each person differently.[187] Previous head trauma is a well-established risk factor for AD; other factors that increase risk include diabetes mellitus, APOE gene variation, current smoking, and depression. There is limited evidence for increased risk associated with the use of estrogens and nonsteroidal anti-inflammatory drugs. There is inconsistent evidence for risk factors associated with heart disease, high blood pressure, and obesity. Researchers are also exploring the effects of certain inhaled anesthetics, lead exposure, and timing in the use of hormone replacement therapy postmenopause.[137-139]

Although the incidence of dementia is growing rapidly, it does not occur in all older adults. Many older adults experience a normal slowing of information processing, called age-related cognitive decline. They do not develop clinically significant cognitive deficits.[112] (APA, 2013).

A portion of the older adult population will develop mild cognitive impairment (MCI), a condition that involves problems with memory, language, or other essential cognitive functions that is serious enough to be noticeable to others and to show up on tests, but this impairment is not severe enough to interfere with daily life.[138] Some, but not all, persons with MCI go on to develop AD. A study by Driscoll and colleagues found that persons with MCI showed brain atrophy, but the group who went on to develop AD showed a pattern of atrophy in the region of the sides of the brain in the temporal lobes.[57] A term sometimes used by laypersons to talk about older adults with memory loss or cognitive impairments is *senility*. Senility is not a medical term. The use of the word *senility* perpetuates stereotypical impressions that progressive cognitive decline occurs in normal aging. Such ideas prevent early recognition and accurate diagnosis of dementia.

Pathophysiology

AD is the result of degenerative changes in the CNS. Neuroanatomic (structural) and neurochemical changes occur in genetically or environmentally susceptible brains. Many neurons die, stop functioning, or lose their connections with other neurons. Disruptions of communication, metabolism, and neuron repair occur. The result of these changes is progressive and diffuse neuronal loss in the cerebral cortex and the hippocampus.[137,188] Three noticeable pathologic changes have been found through microscopic examination of brain tissue after death. These changes include accumulation of amyloid in the space between neurons, increased neuritic plaques, and neurofibrillary tangles, with loss of neurons and synapses. Early AD is associated with decreased cholinergic markers in areas of the brain where there is also increased distribution of plaques and tangles. Many of the changes in the brains of persons with AD can be seen only at autopsy, although neuroimaging techniques (e.g., computed tomography [CT], magnetic resonance imaging [MRI], and positron emission tomography [PET]) provide further diagnostic information such as enlarged ventricles (Fig. 35.2). Degenerative changes in the brain involve several processes that affect neurotransmission and result in neuronal death.[188]

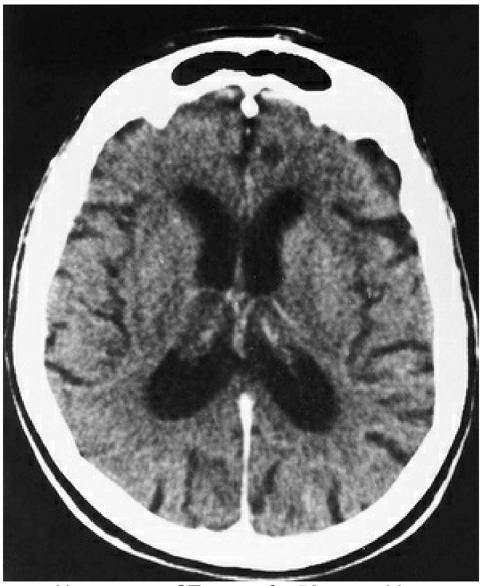

FIG 35.2 Alzheimer's disease. Noncontrast CT scan of a 56-year-old woman with progressive dementia shows generalized enlargement of ventricular system and sulci. (From Eisenberg RL: *Comprehensive radiographic pathology*, ed 6, St. Louis, 2016, Elsevier.)

Studies suggest that the sequence of disease events with AD involve amyloid deposits in the earliest stages that are not yet associated with actual cognitive impairment.[129,137,201] Then, later there is an accumulation of abnormal tau causing loss of synapses, neurons, and brain volume. An inflammatory process causes the tau proteins in the cortical and limbic neurons to undergo microtubular dysfunction, preventing the neurons from sending nutrients and hormones along the axons. The paired filaments of these intracellular proteins actually become cross-linked in an abnormal metabolic process. These filaments form neurofibrillary tangles that eventually lead to neuron death as the neuron-transport system collapses. Neurofibrillary tangles are also seen in the temporal areas and to a lesser degree in the parietal association areas. Neuritic plaques are large, extraneuronal bodies consisting of accumulated B-amyloid and neuronal debris—small axons and dendrites. Distribution of neuronal plaques predominates in the temporal and parietal areas in early AD. This material degenerates, taking up cellular space. Extracellular accumulation of too much insoluble B-amyloid into neuritic plaques contributes to neuron degeneration. When neurons lose their connections, they cannot function and eventually die. The neuron degeneration and death spreads through the brain, connections between other neurons break down, and affected regions begin to shrink in a process called brain atrophy. By the final stage of AD, damage is widespread, and brain tissue has shrunk significantly.

Clinical Picture

Initially, the presentation of Alzheimer's disease may seem puzzling, as it can affect different people in different ways.[4] The most prominent symptom is the progressive inability to remember new information. The Alzheimer's Association has compiled a checklist “Know the 10 Signs,” an Early Detection Matters education campaign that assists older adults and their families with early recognition and contact with their primary care physician.[3] Symptoms and patterns of behavior in AD are often described in terms of stages, but it is important to recognize that it can be difficult to place a person with Alzheimer's in a specific stage, as stages may overlap. The simplest description of staging, useful for caregivers and consumers, defines the progression of AD in terms of a three-point stage scale using early, middle, and late stages.[76] A more clinically and diagnostically complex scale, such as the seven-point Global Deterioration Scale (GDS),[176,177] is used in research or modified for diagnostic purposes and often used as part of an assessment battery. It is important to realize that no two people will progress at the same rate or show the same pattern of symptoms with AD despite the GDS staging framework.

The primary symptom of AD is impairment in recent memory that worsens with time and includes at least one other cognitive deficit such as apraxia, aphasia, agnosia, or impaired executive function, according to the American Psychiatric Association.[10] Memory impairment involves increased difficulty learning new information and recalling information after more than a few minutes.[137,195] Over time, the ability to learn deteriorates further and the ability to recall old memories also declines. Symptoms such as speech and language problems, impaired recognition of previously familiar objects, and impaired ability to perform planned motor movement are more variable and may not be seen in all persons with AD. The expression of symptoms depends on the areas of the brain most affected by the disease. Executive function (the ability to initiate, plan, organize, safely implement, and judge and monitor performance) inevitably deteriorates as AD progresses. Visuospatial dysfunction is common. Mood and behavioral changes are often observed in the early stages of AD, with personality shifts and the development of depression, anxiety, and increased irritability. Later in the course of the disease, troubling behavioral problems such as agitation, psychosis (i.e., delusions and hallucinations), aggression, and wandering can emerge.[4,5,137,138] Motor performance areas such as gait and balance may become impaired, and sensory changes usually arise in the middle to later stages in the course of AD (Table 35.3). Frequently, delirium and depression complicate the clinical picture. The life expectancy following the diagnosis of AD is typically from 8 to 10 years but can range from 3 to 20 years, with a variable rate of progression.

TABLE 35.3

Progression of Alzheimer's Disease and Intervention Considerations

Client Characteristics	Intervention Using Occupational Performance Patterns and Client Factors	Intervention Using Performance Patterns and Client Factors
Stage I: Very Mild to Mild Cognitive Decline		
Feels loss of control, less spontaneous; may become more anxious and hostile if confronted with losses	Listen to client concerns; collaborate with client in identifying areas that are challenging, and identify associated feelings (depression or anxiety).	Encourage physical exercise and wellness behavior.
Mild problems with memory and less initiative; difficulty with word choice, attention, and comprehension; repetition sometimes necessary; conversation more superficial; mild problems with gnosis or praxis	Begin training the caregiver to serve as a case manager.[21]	Help client and caregiver establish a daily routine, and post it in a central place.
Seems socially and physically intact except to intimates; decline in job performance	Provide educational and other resources for disease information, support and relaxation, support groups, or activities for both client and caregiver.	Use environmental aids such as calendars, appointment books, adhesive notes, and notebooks to enhance memory and reinforce engagement in occupation.
	Identify roles, activity frequency, and configuration; encourage continuation of or increase in enjoyable activities by keeping a log and planning enjoyable activity daily or weekly[203]; use activity or task as a focus in socialization.	Identify appropriate environments, or adapt for activities that are currently challenging.
	Explore meaning of occupations and occupational role changes with client and caregiver.	In teaching new tasks, use auditory, visual, and kinesthetic input, and provide supportive or positive feedback; grade activity for success to decrease anxiety.
	Identify needs, preferences, and goals of the caregiver. Discuss driving skills, and plan for future evaluation and restrictions.	During communication training, rehearse with client how to use “I” statements and assertively express self and needs in response to changed ability and the feelings aroused.
		Educate and train caregiver in how to empower client to keep active and facilitate initiation of tasks.
Stage II: Mild to Moderate Decline (Problems From Stage I Are Exacerbated)		
Use of denial, labile moods, anxious or hostile at times; excessive passivity and withdrawal in challenging situations; possible development of paranoia	Emphasize to caregiver the importance of environment in managing dementia at home.[46]	Maintain routines and design environmental support (e.g., lists, posters, and pictures) and level of assistance for cues to remember daily routine and important events
Moderate memory loss, with some gaps in personal history and recent or current events; decreased concentration; possible tendency to lose valued objects; difficulty with complex information and problem solving; difficulty learning new tasks; visuospatial deficits more apparent	Analyze and adapt meaningful leisure, home management, and other productive activities so as to allow the client to safely participate and exert initiation, independence, and control.	Avoid tasks involving new learning; help to simplify surroundings and tasks; make objects accessible, establish expectations for object use, simplify instructions, and clarify the meaning of “success.”

Need for supervision slowly increases; decreased sociability; moderate impairment in IADLs that are complicated and mild impairment in some ADLs (e.g., finances, shopping, medications, community mobility, cooking complex meals); no longer employed; complicated hobbies dropped	Identify needs, and design ways to adapt and grade activity by simplifying complex tasks; train the caregiver to provide cognitive support (verbally) with the client on IADLs and some ADLs.[21]	Help caregiver interpret behavioral problems by understanding source of frustration and the effects of memory loss on behavior.
	Encourage scrutiny of family structure and resources to respond to increasing need for supervision; consider outside resource (e.g., day care, legal planning, friendly visitor volunteer, public transportation for the disabled).	Maintain socialization, and structure opportunities in which others initiate socialization to ensure satisfying relationships in group activity and other social activities.
		Use reality orientation activities, photo albums, and pictures around the home as a reminder of the past, past competence, and opportunities for socializing.
		Encourage stretching, walking, and other balance activities.
Stage III: Moderate to Moderately Severe Decline in Cognition (Problems From Stage II Are Exacerbated—Difficulties Involving Physical Status)		
Reduced affect, increased apathy; sleep disturbances; repetitive behaviors; hostile behavior, paranoia, delusions, agitation and violence possible if client becomes overwhelmed	Maintain involvement in meaningful activity and reactivate alternative roles; identify and design tasks in home management activity; client can assist caregiver with design of productive activity related to former work role.[113,114,210]	In managing problem behaviors (e.g., assaultive behavior), teach caregivers to identify problem, understand and consider possible precipitants for the behavior (e.g., feelings; antecedent events; who, where, when; medical problem or task; environment; or communication problem), and adapt own behavior or change the environment.[40,53,225]
Progressive memory loss of well-known material; some past history retained; client unaware of most recent events; disorientation to time and place and sometimes extended family; progressively impaired concentration; deficits in communication severe; apraxia and agnosia more evident	Help caregiver problem-solve and recognize degree of need for initiation, verbal cues, physical assistance, and ADLs; provide time orientation; simplify environment.	It is essential to maintain consistent daily routines as means of facilitating participation in overlearned tasks, maintain function, and continue to define the self.[40]
Slowed response, impaired visual and functional spatial orientation	Support socialization at home and with family or in structured settings outside of the home.	Teach family that overlearned tasks are possible but require safe environment; overall, tasks take longer, need to be simplified, and require setup and grading to comprise two steps or less.
Unable to perform most IADLs; in ADLs, assistance eventually needed with toileting, hygiene, eating, and dressing; beginning signs of urinary and fecal incontinence; wandering behavior	Ensure safety in the home and other environments by making adaptations suited to level of client functioning (e.g., alarms, restricted use of heating devices and sharps, cabinet latches, ID bracelet, visual cues for item location, and visual camouflaging).[41,68,92,191]	Make further environmental adaptations to compensate for perceptual deficits and ensure safe mobility.
		Rehearse and review names of family and others, using pictures.
		Encourage standby or assisted ambulation, stretching, and exercise on a regular basis.
		In new environments, cue and assist client in navigation, and provide more light and pictorial representations to cue.
Stage IV: Severe Cognitive Decline and Moderate to Severe Physical Decline		
Memory impairment severe; may forget family member's name but still recognize familiar people; can become confused even in familiar surroundings	For ADLs (hygiene, feeding), instruct caregivers (family or nursing assistants) regarding need for simple communication, one-step commands, step-by-step verbal cues, and physical guidance.	Encourage caregiver to use respite programs and maintain recreation and leisure activity for himself or herself.
Gait and balance disturbances; difficulty negotiating environmental barriers; generalized motoric slowing	Encourage continued socialization by family; socialization depends on initiation of conversation by others and may not consistently include a response from the client.	Encourage assisted ambulation methods until client is no longer able to use them.
Often unable to communicate except by grunting or saying single word; psychomotor skills deteriorate until unable to walk; incontinent of both urine and feces; unable to eat; often becomes necessary to place client in nursing home at this time	Use dysphagia techniques to promote swallowing, prevent choking, and encourage eating.	Maintain proper positioning in bed and wheelchair; instruct family in skin inspection.
	Instruct family in transfer techniques.	Provide controlled sensory stimulation involving sound, touch, vision, and olfaction to maintain contact with reality.
		Begin program of active and assisted and passive ROM exercises.

Adapted from Baum C: Addressing the needs of the cognitively impaired elderly from a family policy perspective, *Am J Occup Ther* 45:594, 1991; Morscheck P: An overview of Alzheimer's disease and long term care, *Pride J Long-Term Health Care* 3:4, 1984; Glickstein J: *Therapeutic interventions in Alzheimer's disease*, Gaithersburg, MD, 1997, Aspen; Gwyther L, Matteson M: Care for the caregivers, *J Gerontol Nurs* 9, 1983.

Deterioration in the individual's functional performance usually occurs in a hierarchical pattern. This pattern of decline consists of initially a gradual progression from mild impairments in work and leisure performance to more moderate difficulties in performing instrumental activities of daily living (IADLs), especially with finances and driving. Eventually, there is a progressive loss of the ability to perform even basic self-care tasks in ADLs. The disability pattern is usually characterized by lower extremity ADL problems (walking) before decline in upper extremity ADL functions.[82,200] The trend in AD is for cognitive deficits to increase and executive function to become more impaired (see Table 35.3). Motivation and perception can influence functional performance but may not be routinely considered in individuals with AD.[68,112]

Medical Management

According to Larson,[106] medical management of the individual with AD in primary care settings generally includes several areas. Many aspects of what is termed medical management may also be performed by certain other members of an interdisciplinary health care team, including the nurse, social worker, physical therapist, or occupational therapist. First, there is a need for early recognition and diagnosis of AD.[106] Second, there is the issue of how to intervene on behalf of the person with AD who is living in the community, before institutionalization or more restrictive care becomes necessary. The third area concerns intervention issues as the disease progresses. Last is the role of healthcare providers in recognizing and addressing treatment of other conditions that lead to excess disability in the person with AD.

Although dementia is relatively common in persons who are more than 80 years of age, such individuals often are not diagnosed until approximately 2 to 4 years after the onset of dementia symptoms.[105,106,108,124] A comprehensive physical examination, laboratory evaluation, mental status examination, brief neurologic examination, and informant interview are essential in diagnosing AD. It is important to identify and treat medical conditions (e.g., metabolic disturbances, infections, alcohol use, vitamin deficiencies, chronic obstructive pulmonary disease, heart disease, and drug toxicity) that can contribute to comorbidity. MRI, PET, and CT scan results can be useful, but overreliance on these techniques should be avoided because their value is in identifying relatively uncommon, treatable causes of cognitive impairment. A comprehensive and skillful interview with a reliable informant is essential to the evaluation and diagnostic process in order to recognize decline by comparing current changes with past performance. Informant questionnaires, interviews, and screening measures may be performed by many health care professionals other than physicians and are important to the diagnostic process.

The goal of health care providers in the successful management of an individual with dementia, whether in the community or in a semi-institutional or institutional setting, is to "minimize behavior disturbances, maximize function and independence, and foster a safe and secure environment."[195] Increased mortality is associated with dementia.[31,195] Regular health maintenance visits in primary care settings to identify treatable illnesses such as depression, Parkinson's disease, low folate levels, arthritic conditions, urinary tract infections, and other conditions that may exacerbate dementia are important for all older adults, but especially those with AD.[110,188]

Depression and dementia easily may be mistaken for each other, or they may coexist.[195] Careful attention to whether the onset of symptoms has been gradual (dementia) or more recent (depression) is an important diagnostic issue because affective and cognitive symptoms frequently occur together.[175] Cognitive impairments and especially functional performance may improve in individuals with both dementia and depression after they are treated for depression. Delirium (i.e., impairment in attention, alertness, and perception) and dementia frequently coexist as well, especially in hospital settings.[195] Both conditions involve global cognitive impairment, but delirium is usually acute in onset, shows fluctuating symptoms, disrupts consciousness and attention, and interferes with sleep. Adverse drug reactions are more common in AD because of the vulnerable, impaired brain.[107] Often, a cause of delirium, such as drug toxicity, is treatable.

Hearing, vision, and other sensory impairments are known to make dementia worse and cause greater strain on the caregiver.[213,214] Falls with hip fractures are 5 to 10 times more common in persons with AD than in normal persons of the same age and often result in earlier institutionalization for the individual and the need for higher levels of care.[32] Unsafe mobility quickly becomes an overwhelming burden for caregivers, especially those who are aged.

According to Small and colleagues,[195] pharmacotherapy for the treatment of individuals with AD should be assessed carefully and justified at regular intervals. Although OT practitioners do not prescribe medications, knowledge of pharmacotherapy for individuals with AD is useful when providing OT intervention.[37] Cholinesterase inhibitors such as tacrine and donepezil may improve cognition and functional performance, at least in the short term. Promising research is under way in this area. Other agents that may improve cognitive function include estrogen, nonsteroidal antiinflammatory agents, ginkgo biloba, and vitamin E.[185] Evidence about the benefits of these agents is inconclusive. Antidepressant medications, especially selective serotonin reuptake inhibitors (SSRIs), are often prescribed.[195] However, some of the tricyclic antidepressants (e.g., amitriptyline, imipramine, and clomipramine) and monoamine oxidase inhibitors (MAOIs) can have troublesome side effects in older adults. Atypical antipsychotics such as clozapine, risperidone, and olanzapine may be used to reduce agitation and psychosis.[120,195] Benzodiazepines are prescribed for treating anxiety and infrequent agitation but have been found to be less effective than antipsychotics when the symptoms are severe.[195]

Role of the Occupational Therapist

Most individuals with AD live in the community, alone, or with family and friends, rather than in institutions. A predominant feature of AD is significant and progressive deterioration of function from previous levels of performance because of advancing brain atrophy and pathologic tissue changes. Families and significant others connected with persons who have AD become progressively involved as the disease itself progresses. Family and significant others provide increasing oversight and personal assistance.[37,75] Changes in the brain caused by AD result in deficits in client factors, which in turn lead to deterioration in occupational performance skills, occupational performance areas, and major changes in occupational roles. Over time, more structured, supervised living environments are needed. Increased difficulties in performing everyday functions create challenges for the individual with AD and impact the quality of life for the client, family, and caregivers as the disease progresses. Effective OT interventions must be directed at supporting occupational performance for the individual and creating as much quality of life as possible. Intervention should focus on supporting and maintaining capabilities, adapting tasks and environments, and otherwise compensating for declining function in individuals with AD while trying to help them retain as much control as possible over their lives in the least restrictive environment.[8]

Ethical Considerations

Support for the caregiver is a must. Collaboration with and training of the caregiver is essential in the management of clients with dementia. Family members should encounter an open and encouraging environment in which to discuss safety, security, and dependence issues. Legal, financial, and health concerns that require advance directives (e.g., medical and legal), trusts, activity restrictions (e.g., driving, financial matters, and medication management), and contingency and transitional care plans (e.g., day care, residential care, and long-term care) are important in preparation for the inevitable progression of the disease.[106,194]

Behavioral problems can be expected in the client with AD until the terminal or bed-bound stage. Encouragement to use respite care, in-home support services, and support groups is important. Caregivers also need effective strategies for dealing with behavioral disturbances and disruptions in mood. The use of environmental adaptations, therapeutic interpersonal approaches, referral to other disciplines, and resource sharing helps in collaborating with the client's family and handling these problems. Health professionals use education, training, counseling, and support to help caregivers deal with their feelings, manage behaviors, and maintain quality of life for themselves and for the client with AD. Awareness of the multidimensional effects of this illness on the individual, the family, and the society at large is important to promote more effective and efficient care.[170]

Evaluation

An OT screening is often performed before the evaluation. OT services are indicated for individuals who have demonstrated a recent decline in function; whose behaviors pose a safety hazard to family, staff, other residents, or self; or who may experience improved quality of life.[27]

The type of assessment and the depth of the evaluation process used are influenced by the setting, the stage of progression of AD, the reimbursement process, the presence of other medical and mental health disorders, and the cooperation and interest of the caregiver or care staff. An instrument used to detect changes in progression of the disease process is the Alzheimer's Disease Assessment Scale–Cognitive subscale (ADAS-cog).[162] This 11-item instrument has been successfully used to detect decline in cognitive function over the course of time and has good sensitivity. This tool is often part of an interdisciplinary assessment, and the psychologist or the OT practitioner may be involved in administering this instrument.

Much of the OT practitioner's time in community settings and in long-term care is spent helping families and caregivers develop strategies and environmental adaptations to cope with the overwhelming stresses of safely managing a cognitively impaired individual.[21] The consequences of caregiving and the needs of the caregiver can vary greatly, depending on gender, family relationships, culture, and ethnicity. The caregiver's understanding of dementia, reaction to dementia-related behaviors, use of problem-solving skills, use of the environment, use of formal and informal support systems, and decision-making style greatly affect the caregiver's ability to participate in the care plan and treatment of persons with dementia.[19,45,60,111,221] The Activities of Daily Living Inventory is a 23-item inventory that assesses both activities of daily living and instrumental activities of daily living using the caregiver interview.[37] This instrument does not focus on what the individual might be able to do but rather asks for specific information on what the individual with AD actually does in day-to-day life. It has been used as a primary outcome measure in research regarding the efficacy of OT services provided to individuals with AD and their respective caregivers.

Evaluations for individuals who have AD should be comprehensive despite changing reimbursement requirements. Substantial information can be gathered before an interview and intervention session by asking caregivers, family members, and staff informants to complete questionnaires and rating scales. These scales assess occupational performance, functional abilities, and skills using measures such as the Functional Behavior Profile,[22] the Activity Profile,[21] the Caregiver's Strain Questionnaire,[179] the Katz Activities of Daily Living Scale (KADL),[98] and the Instrumental Activities of Daily Living Scale (IADL).[109] Informant rating measures should routinely be followed by an interview either before or during the first visit. The use of a few brief screening instruments for mental status (e.g., the MMSE),[66] depression,[24,222] and anxiety[110] provides baseline data and a wealth of information about factors that are likely to influence performance.

The functional evaluation of an individual with AD depends on the stage of cognitive decline.[8] The American Occupational Therapy Association's statement on services for persons with AD suggests that tasks involving work, home management, driving skills, and safety should be targeted in the early stages of the disease. Driving has been specifically identified as an area where OT practitioners should provide not only ongoing assessment but also intervention.[88] Although the on-road driving assessment is considered the gold standard, standardized off-road assessments are available to determine the safety of drivers who have cognitive impairments. In the later stages, the focus shifts to self-care, mobility, communication, and leisure skills.

The concerns and observations of the caregiver are important, but the therapist's observation of task performance is also necessary. Many of the functional ADL scales developed for use with older adults have targeted physical performance in the assessment process and are not appropriate for persons experiencing cognitive decline.[71] Fortunately, several excellent, standardized measures that determine whether individuals are able to use their cognitive skills to perform tasks in ADLs and IADLs have been developed. The Kitchen Task Assessment (KTA) determines the level of cognitive support a person with AD needs to complete a cooking task successfully. Baum and colleagues created the Executive Function Test (EFT) with standardized administration and scoring.[22] The Allen Cognitive Level (ACL)[1] test determines the quality of problem solving an individual uses while engaged in perceptual motor tasks. Levy[114,115] has written at great length about the use of the ACL for clients with cognitive impairments. Consistent with the Allen theoretical approach, the Cognitive Performance Test (CPT)[2,34] was developed to identify cognitive deficits that are predictive of functional capacity using several ADL and IADL tasks. Another measure, the Assessment of Motor and Process Skills (AMPS),[63] has been used with individuals who have dementia.[63,150] The AMPS measures motor (e.g., posture, mobility, and strength) and process (e.g., attentional, organizational, and adaptive) skills by using task performance in IADLs. The Disability Assessment for Dementia (DAD)[71] uses informant ratings to determine the ability of the individual with AD to complete tasks in both ADLs and IADLs. The DAD also provides information relevant to executive functioning, such as the person's ability to initiate, plan, and execute the activity. Further information regarding the evaluation of cognitive function and ADL performance is given in Chapters 10 and 26. After obtaining through evaluation a good understanding of the disease process and the functional level of the person with AD, the therapist can begin to look at the all-important question of what aspects of the occupational performance context, especially the environment and care provider interactions, must be modified to optimize function of the person with AD.[150]

Intervention Methods

The goals of occupational therapy are to provide services to persons with dementia and their families and caregivers so as to emphasize remaining strengths, maintain physical and mental activity for as long as possible, decrease caregiver stress, and keep the person in the least restrictive setting possible.[9,14,84,96] Though AD is the primary presenting problem, the OT practitioner has to consider the complexities of developing interventions with an older adult who may be experiencing additional sensory losses and numerous medical problems such as arthritis, orthopedic issues, COPD, diabetes, and heart disease in addition to AD.[56,95] Intervention planning takes into account the physical issues associated with aging, co-occurring disorders such as depression and anxiety, the progressive nature of the disorder, the expected decline in function, and the care setting itself. OT interventions for clients with dementia are directed toward maintaining, restoring, or improving functional capacity; promoting participation in occupations that are satisfying and that optimize health and well-being; and easing the burdens of caregiving.[21] The caregivers need to be included as an important member in developing the intervention plan, and OT services may be focused on reducing the caregiver distress and enhancing caregiver coping strategies.[117] A program developed specifically for caregivers focused on the level of stress and dysfunctional coping strategies. When caregivers were supported, the burden of caring for the person with AD was reduced.[117] Gitlin and colleagues instituted a program to improve the overall pleasure of persons living at home with dementia in an effort to decrease the distress of the caregivers who are affected by the behaviors of the persons with AD for whom they were caring.[75a] A program called the Tailored Activity Program (TAP), an occupational therapy service that evaluates the interests and capabilities of persons with dementia, provides customized activities for each individual. TAP then trains their families to use those activities as part of their daily care routines. The methods therapists use in the intervention process include activity analysis, caregiver training, behavior management techniques, environmental modification, use of purposeful activity, and the provision of resources and referrals. Services are provided in many settings, such as home care, adult day care, and semi-institutional or institutional long-term care. The intervention setting and the stage of the illness help frame the focus of intervention, determine the recipients of service, and prescribe the methods used (see Table 35.3).

Section 2 Summary

AD is a neurologic condition characterized by the development of multiple cognitive impairments with a gradual onset. The effect of these impairments is a significant and progressive decline from previous levels of functioning. The course of the disorder is variable, but loss of function generally occurs in a hierarchical pattern, beginning with work and progressing to difficulties with home management, driving, and safety until even basic self-care skills such as dressing, functional mobility, toileting, communication, and feeding are affected.

OT interventions should be directed at enhancing the abilities of the client with AD by continually adapting tasks of daily living and modifying the physical and social environment as the client experiences progressive loss of function. Given many of the current limitations in treatment time imposed by third-party payment, therapists may find it useful to employ some of the self-report and informant report measures identified in this chapter as a means of gathering information more efficiently during the evaluation process. Several standardized measures also have been identified to assist with the assessment of functional performance and the establishment of a baseline of performance. Recommendations for OT treatment of AD have been identified. The focus of intervention must be flexible and depends on an understanding of the particular expression of the disease process in the client, the specific treatment setting, and the needs of the caregiver. Generally, the goals of OT services for persons with dementia are to maintain or enhance function, promote continued participation in meaningful occupation, optimize health and quality of life, and work collaboratively with the caregiver to ease the burden of caregiving.

Section 3 Huntington's Disease

Winifred Schultz-Krohn

Incidence

Huntington's disease (HD) is a fatal, degenerative neurologic disorder that affects 5 to 10 of every 100,000 individuals.[74,160,181] The disorder is transmitted in an autosomal dominant pattern. Each offspring of an affected parent has a 50% chance of having HD. Genetic studies have identified a mutation (cytosine-adenine-guanine [CAG]) on the Huntington gene (HTT) of chromosome 4 as the cause of this disease.[136,160,168,173,181,215] Presymptomatic diagnosis of HD is possible with genetic testing when the family history shows this disease.[158,160] Diagnosis is also made through clinical examination when the family history is unavailable or unknown.

Pathophysiology

The neurologic structure associated with HD is the corpus striatum (Fig. 35.3). Deterioration of the caudate nucleus is more severe and occurs earlier than atrophy of the putamen.[42,156] The corpus striatum plays an important role in motor control, and deterioration in this area contributes to the **chorea** associated with HD. The caudate nucleus is also linked to cognitive and emotional function through connections with the cerebral cortex. Thinning of the gray matter in the caudate and dorsolateral prefrontal cortex have been identified with the progression of HD.[48] A progressive loss of tissue occurs in the frontal cortex, globus pallidus, and thalamus as the disease advances.[160] The degeneration of the corpus striatum results in a decrease in the neurotransmitter gamma-aminobutyric acid (GABA). Additional deficiencies in acetylcholine and substance P, both neurotransmitters, are noted in clients with HD. The triggering mechanism for the neuronal degeneration has not been clearly identified, but it is linked to genetic coding on the HTT chromosome.[173]

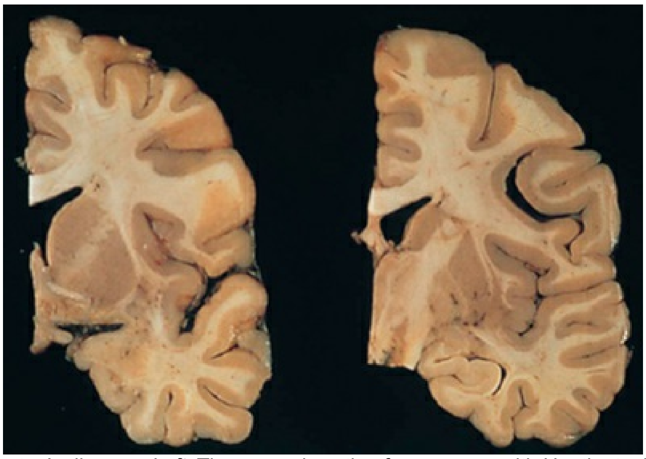

FIG 35.3 Huntington's disease. *Left*, The coronal section from person with Huntington's disease shows atrophy of the caudate, putamen, and globus pallidus. *Right*, Normal coronal section for comparison. (From Perkin GD: *Mosby's color atlas and text of neurology*, St. Louis, 2002, Mosby.)

Clinical Picture

HD is characterized as a progressive disorder involving both voluntary and involuntary movement, in addition to a significant deterioration of cognitive and behavioral abilities.[160,192] A client usually experiences an insidious onset of symptoms in the third to fourth decade of life, but cases have been reported in teenage and younger clients.[220] Clients who are positively identified by genetic testing should be carefully monitored for the first indications of HD symptoms. Not all individuals who have the potential to develop HD, because of family history, elect to undergo genetic testing, and this may negatively affect the time at which first symptoms are identified. The course of progression of HD is often divided into three stages, early, middle, and late, but with the advent of genetic testing, a presymptomatic stage has been added.[216] During the presymptomatic stage, monitoring symptoms is critical, and a decrease in the speed of finger tapping (an item on the Unified Huntington's Disease Rating Scale (UHDRS) may mark the beginning of the early stage of HD. The UHDRS has been used to divide the course of the disease into five stages.[215] The presymptomatic stage is considered stage I. The early stage of the disease process is sometimes referred to as stage II. The middle stage of the disease is stage III, and the late stages, marked by little to no functional capacity, are stages IV and V. The stages refer to specific scores obtained on the UHDRS-Functional Assessment. Regardless of the method used to indicate the stage of the disease, symptoms progress over a 15- to 20-year period, ultimately necessitating long-term care or hospitalization for the client.[160] Death is often the result of secondary causes, such as pneumonia.[158]

The initial symptoms vary but are most often reported as alterations in behavior, changes in cognitive function, and choreiform movements of the hands.[216,220] The early symptoms of cognitive disturbances are most likely related to the degeneration of the caudate nucleus. The client may appear forgetful or display difficulty concentrating. During the early stages of HD, a client may have difficulty maintaining adequate work performance. Family members often identify the initial behavioral changes in the person with HD as increased irritability or depression. Irritability and depression may be attributed inappropriately to the decline in work performance rather than to the disease process.[48] Emotional and behavioral changes are often the earliest symptoms of HD.[17,65] Chorea, seen in clients with HD, consists of rapid, involuntary, irregular movements.[159] During the early stages of HD, chorea is often limited to the hands. A client may mask the initial chorea by engaging in behaviors such as manipulating small objects within the hands. These irregular movements are exacerbated during stressful conditions and decrease during voluntary motor activities in the early stages of HD. Chorea is absent when the client is sleeping. Onset of HD in teenage years is associated more often with early symptoms of **rigidity** than with chorea.[216,220]

Cognitive and emotional abilities progressively deteriorate over the course of the disease.[220] Disturbances in memory and in decision-making skills become more apparent during the middle stages of HD. Establishing and maintaining meaningful habits and routines for the individual who has HD are important ways to support continued participation in occupational pursuits. A client may be able to complete familiar tasks at work or in the home, but if the environment is changed or if additional demands are placed on the individual, task performance is significantly compromised. Further deterioration of cognitive abilities in the person with HD may result in dismissal from employment. The cognitive deficits most frequently associated with HD are problems with mental calculations, the performance of sequential tasks, and memory.[65] Verbal comprehension is often spared until the middle or later stages of the disease, and even then, dysarthria presents as a more significant issue than difficulty in comprehension until the late stages of HD.

Over the course of HD, depression often worsens and suicide is not uncommon.[216,220] Clients with HD are often hospitalized because of various psychiatric problems, including depression, emotional lability, and behavioral outbursts. Although the loss of function may contribute to the client's level of depression, depression is clearly identified as a specific characteristic of HD.[65,135] This affective disorder frequently is treated with various antidepressants. Periods of mania have also been reported in approximately 10% of individuals diagnosed with HD.

As the disease progresses, the chorea becomes more severe and may be observed throughout the entire body, including the face (Fig. 35.4).[160] Disturbances in gait are often observed during the middle stages of the disease, and balance is frequently compromised.[65] The individual with HD may display a wide-based gait pattern and have difficulties walking on uneven terrain. This staggering gait is at times misinterpreted by others in the client's life as evidence of alcoholism.[159] The client also has progressive difficulty with voluntary movements.[160] The performance of voluntary motor tasks is slowed (**bradykinesia**), and the initiation of movement is compromised (akinesia). Although handwriting ability may be spared initially, the client displays increasing difficulties with this task as the disease progresses. Letter size is enlarged, and letter formation, such as slant and shape, is distorted. Saccadic eye movements and ocular pursuits may be slowed at this stage of HD.[158] Slight dysarthria may be noted, which compromises communication.[65] Dysphagia is seen, and the client may choke on various foods. Difficulties may be noted with the coordination of both chewing and breathing while eating.

FIG 35.4 Typical chorea movements in a patient with Huntington's disease. (From Schindelmeiser J: *Neurologie für sprachtherapeuten*, ed 2, München, 2012, Elsevier GmbH, Urban & Fischer.)

In the later stages of HD, choreiform movements may be reduced because of the further deterioration of the corpus striatum and globus pallidus.[160] Hypertonicity and rigidity often replaces the chorea as the disease progresses, and the client experiences a severe reduction in voluntary movements. Severe difficulties in eye movement are common during the final stage of the disease.[158] At this stage, the client often needs significant support from others or resides in a long-term care facility. The client is usually unable to talk, walk, or perform basic ADLs without significant assistance.[136]

Medical Management

Medical management of clients with HD can address symptoms, but no effective course of treatment has been identified to arrest the progression of this disease.[48,171,181] Intervention based on replacing the deficient neurotransmitters has not been effective in changing the course or rate of progression of HD. Tricyclic antidepressants are often used to treat the depression seen in clients with HD, but MAOIs are contraindicated because of possible exacerbation of chorea.[220] Haloperidol may be used to decrease the negative effects of chorea on the performance of functional activities.[160] Haloperidol is prescribed cautiously and only when the chorea significantly compromises a person's daily activities. Tetrabenazine has also been approved as a treatment for chorea.[181] Medical management focuses on three areas: managing symptoms and reducing the burden of the symptoms, maximizing function, and providing education to the client and significant others regarding the course of the disease progression.[135] A team of professionals, including occupational therapists, is advocated when working with a client who has HD.

Investigations have noted how active engagement in activities, through the use of a multidisciplinary team approach, improved function for the client with HD.[48] Occupational therapy services were provided, once every 2 weeks, to clients diagnosed with HD to improve cognitive skills and executive functioning. Clients also participated in home exercises designed to improve overall muscle strength and fine motor skills. Following 9 months of intervention clients had a significant increase in gray matter of the caudate and prefrontal cortex. Significant gains were also noted in learning and memory skills following the 9 months of multidisciplinary intervention services.

A team of various medical professionals is needed to support the individual who has HD and support the family members and significant others in the client's life.[87,97] The perception of the illness experience and coping strategies used by the client who has HD is an important part of the overall medical services provided.[87] Likewise, the significant others in the client's life need support and guidance in developing coping strategies as their loved one experiences progressive deterioration.[97]

Systematic evaluation of a client with HD must be performed at regular intervals to identify the rate of symptom progression and modify intervention strategies. Standardized instruments are available for determining the presence and severity of various symptoms.[91,192] The Unified Huntington's Disease Rating Scale (UHDRS) is an evaluation tool that combines aspects from several instruments into a scale that can be administered within 30 minutes. The UHDRS is often administered by a team. This tool provides an accurate means of determining a change in the areas of "motor function, cognitive function, behavioral abnormalities, and functional capacity."[91] The UHDRS has been used to assess the rate of decline, and it demonstrates good reliability.[103] The occupational therapist should complete additional assessments before an intervention plan is developed. An evaluation would address functional daily living skills; cognitive abilities such as problem solving, motor performance, and strength; and personal interests and values. The occupational therapist must consider the client's role within the family and community and incorporate these data into the intervention plan. An evaluation at both the home and work site would provide needed information that could be modified if necessary.

Role of the Occupational Therapist

The role of the OT practitioner varies depending on the stage of the disease.[93] During the early stages of HD, an occupational therapist should address the cognitive components of memory and concentration. A client may still be employed at this stage. Strategies such as establishment of a daily routine, the use of checklists, and task analysis to break down tasks into manageable steps can be very helpful. These strategies provide the external structure and support to help the person with HD maintain functional abilities at both the workplace and home. Specific OT intervention to help clients develop verbal strategies and problem-solving skills have significantly improved functional abilities for individuals who have HD.[48] A work site evaluation can identify changes that would allow the person with HD to continue working. Modifications may include the use of tools such as organizers, electronic planners, and reminders to prompt an individual to complete regularly occurring tasks in the workplace. Family members should also be instructed in the use of these techniques. Environmental modifications such as providing a quiet workplace and reducing extraneous stimuli will decrease the impact of compromised memory and concentration on performing functional tasks in the workplace. Even during the early stages, work performance may deteriorate and the client may be dismissed due to an inability to meet the job essentials. This increases the stress experienced by the client from a financial perspective and from the loss of a role as a worker.

Psychological issues during this stage of the disease often include anxiety, depression, and irritability.[65,85] A client may express guilt that any of his or her children have a 50% chance of having HD.[159] The diagnosis of HD often is not confirmed until a person is 30 to 40 years old unless genetic testing is completed and confirms HD. The client may already be married and have children by that time. Decisions as to whether to complete predictive genetic testing on children may be a significant stressor for the client with HD and for his or her family members. As mentioned previously, not all individuals elect to be genetically tested, and sporadic presentations of HD do exist where no family member has HD. During this early stage of HD, clients may use denial as a coping strategy even though choreiform movements are present in the hands.[87]

Maintaining social contacts and engaging in purposeful activities are important in designing interventions for clients with HD.[159] Changes in cognitive abilities and unpredictable or exaggerated emotional responses may result in the loss of a job and decreased income for the family, even during this early stage of the disease.[65] This additional stress should also be considered when developing an intervention plan. The OT intervention plan must include community support services for the client with HD. OT services should include providing clients with information regarding support groups, opportunities to engage in community activities, and virtual resources accessible through the Internet. During the early and middle stages of the disease, rehabilitation services focused on cognitive skills, quality of life, physical strength, and endurance have shown positive results for individuals with HD.[208] Occupational therapy services were able to support cognitive as well as physical function.

The motor disturbances during the early stages of HD are usually limited to fine motor coordination problems.[65] The characteristic chorea may be noticed only as a twitching of hands when the client is anxious. OT should provide modifications to diminish the effect of chorea and fine motor incoordination on performance of functional activities.[93] This would include modifications to clothing and selection of clothing that does not require small fasteners such as small buttons, snaps, or hooks. Shoes with Velcro closures or elastic closures are recommended to compensate for diminished fine motor skills. Home modifications should be instituted at this stage to allow the client with HD to become familiar with the changes. Developing the skills of using adaptive equipment or modifications and then converting these skills into habits are critical during the early stage of HD. Typical modifications are the use of cooking and eating utensils with built-up handles, unbreakable dishes, a shower bench or seat with tub safety bars, and sturdy chairs with high backs and armrests. Throw or scatter rugs should be eliminated wherever possible in the home, and walkways should be kept free of clutter. The occupational therapist should establish a home exercise program with the client to address the flexibility and endurance of the entire body.[101] In a randomized control pilot investigation, individuals who were in the middle stage of HD engaged in a regular home exercise program to improve balance, gait, and level of physical activity. After completing 8 weeks of home exercises, substantial improvements were noted in physical abilities, but no significant change in quality of life was seen on the Short Form-36 (SF-36) instrument. The occupational therapist should develop home exercises that can be incorporated into the client's daily routine. As the movement disorder progresses with increased chorea and difficulties with oculomotor control, the client will no longer be safe driving a car and may experience further losses of community mobility. These further losses of independent function and control must be considered within the OT intervention plan. Alternative methods of community mobility must be explored.

As HD progresses, the role of OT changes to meet the client's needs.[93] During the middle stages of HD, further deterioration of cognitive abilities often requires the person to resign from a job. Engagement in purposeful activities is greatly needed at this stage and should be a focus of the OT intervention plan.[85,159] Decision-making and arithmetic skills show further deterioration, and family members may need to arrange for others to handle the client's financial matters.[65,142] Generally, comprehension of verbal information is better preserved than ability to complete sequential tasks during this stage. The occupational therapist should encourage the family to use simple written cues or words to help the family member with HD complete self-care and simple household activities. For example, selecting clothing items for the person with HD and placing the clothes in a highly visible area can prompt the individual to change from pajamas to daytime clothes in the morning. Arranging the bathroom with visual cues, such as putting the toothpaste and toothbrush by the sink, can remind the client to brush his or her teeth in the morning and evening.

During the middle stage of HD, the client may display increasing levels of irritability and depression.[220] Clients with HD may attempt suicide. The OT intervention plan should focus on the client's engagement in purposeful activities, particularly leisure activities.

When selecting craft activities, the therapist should always consider the client's interests but should also strive to ensure that no sharp instruments are required.[85,142] Modification of craft activities allows the client with HD to successfully complete a task with minimal support.[28] Materials often require additional stabilization to compensate for the client's movement disorders, and any tools used in the leisure activity, such as a wood sander and paintbrushes, should have enlarged or built-up handles. New leisure activities can be explored during the middle stage of HD.[198] In one study, clients in the middle stage of HD were provided with the opportunity to engage in gardening activities. A multidisciplinary team designed these activities, and OT figured prominently in the assessment and design of the program. Positive results were noted following the use of this program.[198]

Motor problems become more apparent during the middle stage of HD, necessitating further modifications in daily living tasks.[93,192] The client's compromised balance may require that tasks such as dressing, brushing teeth, shaving, and combing hair be performed while the client is seated. The client may require the use of a walker or wheelchair at this stage. A rollator walker is preferred to a standard walker without wheels. The walker may need to be fitted with forearm supports to provide additional stability when the client is ambulating. When a wheelchair becomes necessary, it should have a firm back and seat; however, additional padding is often required on the armrests because of the client's chorea. Many clients with HD are better able to move the wheelchair with their feet than with their hands. The seat height of the wheelchair should be fitted to allow the client to use his or her feet to move the chair, if possible.

Fatigue is a common issue during the middle stage of HD and can be addressed by taking frequent breaks during the day. Breaks must be scheduled because the person with HD may not readily recognize fatigue. Clothing should have few or no fasteners, and shoes should be sturdy with low heels.[142] Additional adapted equipment that may prove helpful for the client with HD includes shower mitts, an electric razor or chemical hair removal method, covered mugs, and nonslip placemats.[93] The choreic movements may become so severe as to necessitate the use of a bed with railings. Padding should be used on the railings, and additional cushions should be used in the bed.

Because of excessive movements associated with chorea, the client with HD often needs to consume 3000 to 5000 calories per day to maintain weight.[142] Clients with HD display a higher energy expenditure compared to individuals without HD and consequently have issues with weight loss and difficulties maintaining appropriate weight.[211] Smaller, high-calorie meals should be provided five times a day. This schedule may require additional support from family members or a personal care attendant. Dysphagia, poor postural control, and deficient fine motor coordination compromise the client's ability to eat.[93] Positioning during feeding is crucial, and the trunk should be well supported during mealtime. The client with HD should be able to support his or her arms on the table while the feet are stabilized. Feet may be supported on the floor, or the client may wrap the feet around the legs of the chair for additional support. Problems with dysphagia can be addressed with positioning, oral motor exercises, and changes in diet consistency. Soft foods and thickened fluids are preferable to chewy foods, foods with mixed textures, and thin liquids. Nutritional support has been successfully used for clients with HD to maintain appropriate weight.[211] Appropriate body weight is important to maintain overall health for the client with HD.

During the final stages of HD, the client often depends on others for all self-care tasks because of the lack of voluntary motor control.[93,136] In some clients, the chorea may diminish, leading to rigidity. The occupational therapist provides important input on positioning and the use of splints to prevent contractures at this stage. Because of the risk of aspiration, oral feedings are provided by trained personnel; alternatively, the client may receive nutrition through a feeding tube.[142] A combination of oral feedings and tube feedings may be used during this stage.

Although cognitive abilities continue to deteriorate, the level of functional decline is difficult to assess because of dysarthria and the loss of motor control.[65] Dementia is part of the HD profile and must be considered in the development of the intervention plan. For example, a person in the late stage of HD may still recognize family members and enjoy watching television. The occupational therapist should explore the use of various environmental controls to allow the client control of and access to the immediate environment.[16] Providing a touch pad or switch for selecting television channels may prove beneficial for the client.

Behavioral outbursts have been reported in approximately one-third of clients with HD living in long-term care facilities.[136] OT can decrease the frequency of these outbursts by organizing consistent daily schedules and routines for the client with HD.

Section 3 Summary

Although HD is a progressive, degenerative process, OT has much to offer clients with this disease.[85,93,142,159] The diminishing ability to control the environment has been identified as one of the variables contributing to the deterioration of function in clients with HD. Throughout the course of the disease, OT addresses the client's ability to exercise a degree of control over the environment and engage in purposeful activity.

Section 4 Multiple Sclerosis

Diane Foti

Incidence

Multiple sclerosis (MS) is the most common progressive, inflammatory neurologic disease in young adults. Almost 70% of cases show signs and symptoms between the ages of 20 and 40 years of age; however, the disease has been identified in children as young as 3 and adults as old as 67.[174] The prevalence in the United States is approximately 350,000.[33] It is more prevalent in women than in men.[36] The highest prevalence of the disease is in Caucasians of northern European ancestry.

Typically MS has been considered a disease of the white matter, but research now shows there are also lesions in the gray matter structures. Large lesions, known as plaques, are often seen in the spinal cord (50%), optic nerves (25%), brainstem/cerebellum (20%), and periventricular white matter (Fig. 35.5). The myelin is typically damaged in discrete regions of the white matter, with relative preservation of the axons and astrocytic gliosis.[174] Disruption of the myelin sheath has differing effects on axonal conduction, depending on the amount of myelin deterioration or inflammation and the length of the damaged segment.[36] When axons are conducting impulses in a slower manner because of inflammation of the myelin sheath, a person with MS may have intermittent symptoms of sensory distortion, incoordination, visual loss, or weakness. This inflammatory process accounts for the unpredictability of the disease.

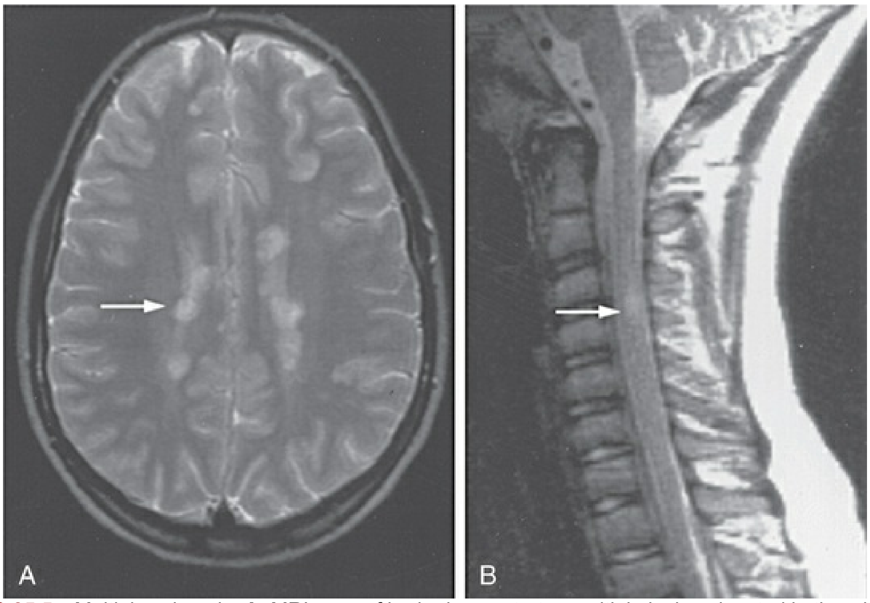

FIG 35.5 Multiple sclerosis. **A,** MRI scan of brain demonstrates multiple lesions located in the white matter characteristic of multiple sclerosis *(arrow)*. **B,** MRI scan of spine indicates a demyelinating plaque of multiple sclerosis in the midcervical region *(arrow)*. (From Kliegman RM, et al, editors: *Nelson textbook of pediatrics,* ed 18, Philadelphia, 2007, Saunders.)

In advanced cases of MS, acute and chronic plaques develop throughout the white matter including the corpus callosum. Axons may be damaged and severed in advanced cases of MS and result in extensive loss of function. MRI may show lesions and changes in brain volume.[26]

Etiology

The specific cause of MS is unknown. Current theories include environmental, immunologic, infectious, and genetic factors. Environment is considered a factor because there is a higher incidence of MS among individuals living farther north of the equator. Studies have shown that 30% to 60% of new clinical attacks of the disease occur after a cold, flu, or common viral illness.

Genetics plays an important factor, as identical twins have a 25% chance of developing the disease, whereas an average person in the United States has a 0.1% chance of developing MS.[144]

Clinical Picture

The symptoms that occur in individuals with MS are related to the area of the CNS affected. These symptoms may include the following:

- Fatigue
- Numbness or weakness in one or more limbs that typically occurs on one side of the body at a time, or the legs and trunk
- Partial or complete loss of vision, usually in one eye at a time, often with pain during eye movement
- Double vision or blurring of vision
- Tingling or pain in parts of the body
- Electric-shock sensations that occur with certain neck movements, especially bending the neck forward
- Tremor, lack of coordination, or unsteady gait
- Slurred speech
- Dizziness
- Problems with bowel and bladder function[123]

Symptoms may temporally worsen when body temperature is elevated but resolve with time. Cognitive deficits are reported to occur in 30% to 70% of persons with MS but do not necessarily correlate with a physical decline.[6,148] Cognitive deficits have been documented in individuals during early stages of the disease.[189] In advanced stages of the disease process, the individual may have varying degrees of paralysis, from total lower extremity paralysis to involvement of the upper extremities, dysarthria, dysphagia, severe visual impairment, ataxia, spasticity, nystagmus, neurogenic bladder, and impaired cognition.

The course of MS is unpredictable. It is marked by episodes of exacerbation and remission.[148] An **exacerbation** may be an episode as minor as fatigue and sensory loss or as extensive as total paralysis of all extremities and loss of bladder control. **Remission** may involve total resolution of the symptoms, slight return of some function with the symptoms remaining, or a short plateau in which no new symptoms occur but the current symptoms remain.

Four patterns seen in MS are (1) relapsing and remitting, (2) secondary progressive, (3) primary progressive, and (4) progressive relapsing.[132] The relapsing and remitting form of MS involves 85% of the MS population and leads to episodes of exacerbation and remission of symptoms that result in a slow, stepwise progression as the deficits accumulate. The secondary progressive course of the disease begins with a pattern of **relapses** and remissions but evolves into the progressive form of the disease given time. Before the introduction of disease-modifying drugs, approximately 50% of clients with relapsing and remitting MS progressed to the secondary progressive form of the disease. Marguerite was first diagnosed with the relapsing remitting form of MS and was later diagnosed with the secondary progressive course of the disease. She is now experiencing sustained diminished fine motor abilities and sensation in her left hand. She also has weakness in one lower extremity, requiring the use of an ankle-foot orthosis and a quad cane.

Though not as common as adult-onset MS, childhood MS does occur and children account for 3% to 10% of the MS population.[72,161] Ninety-five percent of children with MS initially experience a relapsing and remitting course of the disease. Over time, secondary progressive MS will develop in approximately 60% of children.[207]

The primary progressive form of MS (10% of the MS population) is distinguished by a downward course with episodes of exacerbations or remissions. Individuals with this form eventually become nonambulatory and incontinent of urine and may have dysphagia and dysarthria, severely compromised lower extremity function, and varying limitations in upper extremity function. These individuals have difficulty remaining in the workforce and require more assistance with activities of daily living.

The progressive relapsing form of MS is the least common of the four types of MS. This type of MS accounts for approximately 5% of the MS population. These individuals experience a steady worsening of symptoms but with episodes of exacerbations.[212]

Kaufman and colleagues found that individuals with MS typically live 6 years less than those without MS.[97a] Approximately 50% of individuals with MS live for at least 30 years after onset of the disease, and 50% die of complications of MS. Most people with MS will live to experience other changes related to normal aging, which can complicate the clinical picture. Typically, the course of the disease can generally be determined after 5 years of the initial symptoms (Box 35.2).

Box 35.2

Predictors of Poor or Favorable Prognosis at the Onset of Multiple Sclerosis

Predictors of a Poor Prognosis

- Progressive course
- Age at onset >40 years
- Cerebellar involvement
- Polysymptomatic onset
- Male sex

Predictors of a Favorable Prognosis

- Minimal disability 5 years after onset of the disease
- Complete, rapid remission of the initial symptoms
- Age at onset <40 years
- Only 1 symptom during the first year
- Onset with sensory symptom or mild optic neuritis

From Multiple sclerosis and the aging process, Formulary 40(11):S17, 2005. Formulary is a copyright publication of Advanstar Communications, Inc. dba UBM, LLC.

Medical Management

Medical management is dependent on the type of MS. Disease-modifying drugs are used in those with relapsing and remitting MS, and for all forms of the disease anti-inflammatories are used to treat exacerbations.[148] The anti-inflammatory medications, such as prednisone and methylprednisolone, help reduce symptoms and shorten the duration of the exacerbation.[36,132] For the relapsing and remitting form of MS, disease-modifying medications are thought to have an effect in slowing progression of the disease. These medications are available in injectable, oral, and infusible forms. Patients treated with these medications, administered by self-injection, showed a one-third reduction in frequency of exacerbations. Studies regarding the effectiveness of these medications in individuals with the progressive form of the disease are ongoing. The physician and patient determine which is the most appropriate form of treatment. It is important for the occupational therapy practitioner to understand that some individuals experience side effects from the medications, which affect function for a day or so following application.

Medical management primarily focuses on treating the symptoms of the disease. Symptom management includes treatment of spasticity, bladder management, prevention of bladder infection, and management of pain and fatigue. Symptom-specific medications may be prescribed. The OT practitioner can learn more specifically about all of the medications from the MS Society medication site.[144] Spasticity is often managed with medications; unfortunately, this may also worsen the muscle weakness. Bladder management may involve the use of incontinence pads or catheters, along with prevention of bladder infections. Fatigue should be managed with good nutrition, prevention of over-fatigue with energy-conservation methods, regular exercise, establishment of routines for rest and sleep, and control of stress; in addition, several medications are available that may help with fatigue.[133] The ADL evaluation for Marguerite should include questions about bowel and bladder management and how it affects her function at work, at home, and during sleep.

Changes in cognition and mood often occur in persons with MS. Cognitive deficits are reported to occur in 30% to 70% of the MS population but do not necessarily correlate with a physical decline.[6,80,149] The volume of lesions seen on MRI correlates with cognitive decline in the areas of complex attention, processing speed, and verbal memory.[197] One investigation evaluated overall brain atrophy and size of the ventricles in relation to cognitive abilities. The results suggested a relationship between an increase in the size of the third ventricle and a decrease in cognition.[26]

Emotional changes such as depression may also be present. Persons with MS and other chronic conditions experience a higher rate of depression than the general population does.[143] Depression may have different causes and should be assessed by the team. Depression may be caused by a physiological response to the disease process, may be a psychological response to the diagnosis, or might be a side effect of one of the disease-modifying medications. Depression may occur at any stage of the disease process. It should be addressed promptly because it may contribute to fatigue and an inability to cope with challenges and make adaptations as needed.[143] Dementia may develop in individuals who exhibit euphoria and indifference. Dementia occurs in less than 5% of the population with MS.[81]

The most widely accepted tool to measure clinical impairment in a person with MS is the Expanded Disability Status Scale (EDSS).[157] The scale should be completed by a physician because it includes a detailed neurologic examination. The EDSS combines an assessment of neurologic function and a scale to measure a client's ambulatory and functional mobility status. There are limitations with this tool; it does not allow specific assessment of all ADLs and is not sensitive to potential cognitive and sexual deficits in MS.[157] The OT practitioner should be familiar with the EDSS because it is often mentioned in the literature as a baseline for evaluating disability and has been adopted by the International Federation of MS Societies.[94,217] The MS Functional Composite was developed to measure leg function and ambulation, arm and hand function, and cognition.[43,134] It can be used for periodic baseline function and may be more sensitive for use as baseline cognitive evaluation than the EDSS.

Role of the Occupational Therapist

OT practitioners provide services for persons with MS in a number of settings. The type and degree of intervention provided will be determined by the setting, the type of reimbursement, and the client's and caregiver's responses to intervention. Preisnner provides an overview of the OT role for persons with MS. This reference is a starting point for the beginning practitioner.[166]

Evaluation includes an occupational profile to guide the evaluation process. The occupational therapist then selects the necessary instruments to assess occupational performance of ADLs, IADL education, work, play, leisure, and social participation. During the performance of various occupations, the following skills should be evaluated: motor and praxis, sensory-perceptual, emotional regulation, cognitive, and communication skills. This is generally accomplished with a combination of standardized and nonstandardized assessments, through the use of interviews with the family and client, and by observation. The MS Society recommends a number of standardized evaluations appropriate for the OT evaluation.[145] Optimally, a home evaluation should be completed. Because not all settings allow a home evaluation, the occupational therapist should interview the client and caregiver regarding the home environment and potential barriers. Because MS has an unpredictable course, the client may need referral for other resources and will benefit from periodic reevaluation by an occupational therapist.[12] If the client has a cognitive deficit, a family member or significant other should be included in the evaluation process to provide accurate information, if the client allows. It is essential that actual performance evaluations be used for persons with MS because studies have shown that self-report is frequently inaccurate.[79] Having an understanding of the client's cultural, social, and spiritual perspective will provide insight into available support systems and their impact on the client's adaptation to the disability.

Assessment of sensorimotor skills is discussed thoroughly in previous chapters. Because endurance and fatigue are such significant factors, it is important to not rely solely on the results of assessment of a specific client factor. For example, a manual muscle test is not likely to accurately reflect the degree of weakness experienced throughout the day. Observing a client performing a functional activity over a certain period or gathering information about the client's daily activity patterns will provide the clinician with a more accurate evaluation of fatigue.[90] The National Multiple Sclerosis Society recommends use of the Modified Fatigue Scale (MFS) or the Fatigue Questionnaire to understand specific problems resulting from fatigue.[133] In Marguerite's case, the MFS assessment may help determine the impact of fatigue on her daily activities.

When evaluating a client's activity patterns, the OT practitioner should also ask about sleep patterns. Disrupted sleep patterns sometimes contribute to fatigue in the MS population. The information can be shared with the client's physician so that appropriate intervention can be undertaken either medically or with counseling to address the habits and routines that may contribute to the client's disrupted sleep.[15] Marguerite's OT practitioner may ask whether toileting issues disrupt sleep also.

MS may also affect visual abilities, and compromises may be noted in visual tracking, scanning, and acuity. An objective evaluation will help determine the type of deficits, when the deficits occur, and more specifically how they affect ADLs and IADLs.

Perceptual processing and cognitive status should be reassessed periodically. The data gathered will help identify specific deficits and their potential impact on functional activities so that the OT practitioner can incorporate this information into family training.[147] Cognitive deficits vary from a slight decrease in short-term memory and attention span to poor orientation and severely impaired short-term memory. The literature is mixed on the relationship between cognitive deficits and the degree of physical deficits.[50] Assumptions should not be made regarding the presence or absence of cognitive deficits based on physical deficits or abilities or on an individual's basic social skills. A person with significant physical deficits may have fewer cognitive deficits than an ambulatory person with MS. The client's perceptual and cognitive deficits are factors that must be considered when deciding whether the client needs close, constant supervision or can stay home alone. Various standardized cognitive and perceptual assessments are included in previous chapters of this text. Basso developed a screening tool for cognitive dysfunction in individuals with MS. Basso's tool was found to be both sensitive to functional impairment and cost-effective.[20] Occupational therapists or practitioners in other disciplines can use this tool when evaluating a person with MS for cognitive deficits. ADLs may be evaluated with a check-off list, a standardized evaluation such as the Assessment of Motor and Process Skills,[54] or other standardized assessments for ADLs.[13]

Marguerite's occupational therapist should consider completing a cognitive screening or, as appropriate, a full cognitive evaluation. Compensation for mild cognitive deficits may contribute to fatigue. If the results of the cognitive screen indicate deficits, Marguerite may also benefit from a full cognitive assessment administered by a psychologist or neuropsychologist to help her better understand deficits and obtain a baseline of her current cognitive abilities. These assessments could help Marguerite receive disability benefits if her MS deficits progress to the point where she is unable to work. The OT practitioner should also teach compensatory strategies for cognitive deficits along with how fatigue may contribute to cognitive difficulties.

Evaluation of the cultural, social, and physical environment is important to consider with each client. MS is usually identified during the phase of life in which a person is raising a family and developing a career, as was seen with Marguerite. Because the disease is unpredictable and fluctuating, it leads to disruptions in normal daily activities and in family life. These disruptions create stress for the spouse or partner, children, and other family members. The occupational therapist must determine the type of support the client can expect from family members. The therapist may recommend that Marguerite begin to teach her teenage children to help prepare dinner as an energy-conservation technique.

The occupational performance assessment should include listening to the client and family members describe performance patterns to identify the activity demands, typical daily habits, routines, and roles. Assessment and treatment should also focus on the client's engagement in the occupations and the impact on his or her life, sense of self-identity, and sense of competency.[116]

Evaluating and treating the client at different times during the day will often reflect different levels of fatigue. Understanding the performance patterns of rest periods; quality and amount of sleep; exercise patterns; intensity of activity (activity demands) during various times of the day, week, or month; and the time of the day when activities are most challenging is critical in developing treatment planning strategies. Understanding the performance patterns may help the OT practitioner understand how the side effects of the disease-modifying medications affect activity and also how to encourage integrating use of the medication into daily routines while managing side effects.

Ethical Considerations

Consider the following situation: a client, with multiple sclerosis, is able to drive the car but has cognitive deficits that are exacerbated by fatigue in the afternoon. Because the client has discontinued work, the family members do not want to take away driving privileges as well. However, by continuing to drive, the client places himself and others at risk for injury. The occupational therapist may need to educate the family about the deficits by providing examples of the ways in which cognition is evaluated and by discussing the ways in which cognitive deficits affect driving and other daily activities. The occupational therapist is responsible for reporting the driving risk to the client's physician.

Emotional and behavioral issues vary depending on the premorbid personality, progression of the disease, coping skills, and social environment of the person with MS. Cognitive deficits and denial of the progressive nature of the disease may lead to behavior that places the client at risk and makes management difficult. If family members do not understand or recognize the client's behavioral problems, further complications may arise when the behavior is not restricted or modified by the family. Other emotional and cognitive issues include a client who is depressed or labile, has poor memory, refuses assistance from outside caregivers, or uses poor judgment regarding safety with medications and transfers. Each client demonstrates a unique set of behavioral issues and requires individual evaluation and an intervention approach that encompasses the client and caregivers.

Goal Setting and Intervention

For a client with a progressive disease such as MS, goal setting focuses on the client's need to adapt as the disability progresses and during the relapse phases. Goal setting should be client centered and client driven, and it should be short term with follow-up provided.[12] Families often need to negotiate role changes to accommodate the person with MS who may not be able to participate consistently in a previously established family role. For example, with Marguerite's family, her husband may consider taking over the job of grocery shopping. Marguerite and her children can add items to an electronic phone application that allows her husband to have a comprehensive grocery list**.** Hwang and colleagues found that support from family and friends helped clients adjust to the diagnosis, maintain their health, and participate in productive and social activities.[92a] The client's ability to adapt depends on the family's and client's acknowledgment of deficits and willingness to consider alternatives. OT intervention may include (1) problem-solving compensatory strategies, (2) fatigue management group treatment intervention,[62,223,224] (3) role delegation, and (4) the use of adaptive equipment to compensate for motor, sensory, endurance, cognitive, and visual deficits. The National Multiple Sclerosis Society has developed guidelines and recommendations for care at home that address many ADL issues requiring OT treatment. These guidelines are by no means all-encompassing regarding interventions for ADLs and IADLs but provide a solid starting point to problem-solve with the patient and family.[147] For specific techniques related to the individual's deficits, see Chapter 10.

Marguerite may be referred to an OT group designed for persons who have MS to learn fatigue management techniques.[122] The fatigue management group intervention may involve analyzing daily and weekly routines to identify activities that can be eliminated, modified, or delegated. Marguerite may be asked to set short-term realistic goals. She may consider grocery shopping online or delegating this task to her husband. Marguerite will need to evaluate the number of activities in which her teenagers participate and the possibility of carpooling so her teenage children can participate in various activities. She may need adaptive equipment for activities that require bilateral strength and dexterity because of the loss of sensation and dexterity in her left hand. Because Marguerite is receptive to potential home modifications she and her husband can work with the OT practitioner to determine the most important immediate changes and future changes that may be needed. Long-term changes and home modifications should be discussed in light of her MS diagnosis being changed from relapsing-remitting to secondary progressive.

The benefits of an exercise program should be discussed with clients who have MS. An individual may already have an exercise program recommended by a physical therapist, and coordination would be important so that the client is able to engage in a manageable exercise program. The OT role may involve helping clients with fatigue management issues to fit the exercise program into their usual routine. It has long been thought that exercise will exacerbate and worsen symptoms, but recent studies report benefits such as improved quality of life, reduced fatigue, and improved ambulation from a regular exercise program.[130,151,219] Fatigue management recommendations should include assessment of the client's typical exercise routine.

As a method of learning coping strategies, Marguerite may benefit from attending a cognitive behavioral therapy (CBT) support group. Evidence shows that participation in CBT may help with depression, which is common among individuals with MS.[224,225]

Section 4 Summary

Because MS affects each person in a unique way, individual evaluation is essential to determine the client's deficits and strengths. Individuals with MS may range from being ambulatory with limited symptoms, primarily fatigue and energy management issues, to partially limited in mobility and hand function, to the need for full-time wheelchair use and assistance with ADLs. Working with clients who have MS requires the practitioner to use expertise in evaluation and intervention from all areas of occupational performance. A comprehensive evaluation will include status of ADL/IADL, sensorimotor, visual-perceptual, and cognitive and depression screens. The social, cultural, and physical environment must also be considered. Because Marguerite's occupational profile indicates many areas are affected by her MS symptoms, the therapist may ask her to prioritize them. If her husband is present he may also prioritize the issues he sees as most problematic.

With a pattern of relapses and remissions over the course of the disease process, development of an OT intervention plan is particularly challenging. The OT practitioner should know the client's specific type of MS diagnosis, as this will drive the clinical interventions. If the client has relapsing and remitting and is currently experiencing an exacerbation/relapse, minimal changes to the home environment may be made, as the client is expected to improve. If an individual has progressive MS or secondary progressive MS, the OT practitioner may strongly recommend more extensive home modifications such as a roll-in shower. Because the client may expect return of function, he or she may deny deficits and refuse to adapt to a change in status; this attitude can create safety problems. The OT practitioner focuses on assessing the current level of functioning and the best methods for the client to adapt to current changes in status.[125] The occupational therapist may also assist the family in making long-range, realistic plans. For example, if the family is planning to remodel the bathroom, the therapist may encourage consideration of a roll-in shower and not just a standard shower stall with a shower seat.

As with the other progressive neurologic conditions, working with clients who have MS requires a multidisciplinary approach. In addition to the occupational therapist, a physician, physical therapist, registered nurse, social worker, and psychologist may be involved as team members. Because the social environment may create complex and difficult problems, good communication among all team members is needed to ensure that the team goals are congruous. The occupational therapist has a unique perspective to offer the team regarding the client's strengths and weaknesses when cognitive, perceptual, psychosocial, and motor abilities are assessed and treated in a functional context.

Section 5 Parkinson's Disease

Winifred Schultz-Krohn

Incidence

Parkinson's disease (PD) is one of the most common adult-onset, degenerative neurologic disorders,[55] second only to Alzheimer's disease.[193] Three classic symptoms are associated with PD: tremor, rigidity, and bradykinesia. The incidence rate for PD varies greatly, from 10 to more than 400 per 100,000.[226] Prevalence increases with age, and the disease affects 1.4% of the population over the age of 55,[52] but approximately 3% of all PD cases are initially recognized in individuals younger than 50 years of age.[193] Approximately 10% to 30% of clients with PD report first-degree relatives who also have PD. Gender differences have been noted; the prevalence of PD in men between the ages of 55 and 74 is slightly higher than in women of the same age. After the age of 74, women show a slightly greater prevalence of PD than do men. Diagnosis is most often made after the age of 60.

The etiology for PD has not been definitively established.[18,78] Previous literature referred to familial and sporadic forms of PD, but those distinctions are being revised in light of current genetic research. Although a positive family history has been established as a risk factor for PD, a single predictive genetic marker has not been absolutely identified. To date, mutations have been found in several genes that are associated with Parkinson's disease and include alpha-synuclein, parkin, ubiquitin carboxyl terminal hydrolase, SCA2, and DJ-1.[193] These mutations have been found to have a role in abnormal protein processing in cells.[18] Current genetic work has identified a gene mutation in familial PD, and this genetic mutation has also been identified in clients with sporadic PD, providing further evidence of a genetic determination for this disease process.[193]

Previously, environmental factors were considered as a possible cause of PD.[78] The possibility of an exogenous agent's producing PD gained considerable recognition when narcotic addicts began using 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine (MPTP). After using MPTP, many addicts quickly exhibited parkinsonism that "strictly mimics the clinical and anatomical features of Parkinson's disease."[78] Although environmental factors have not been completely eliminated as contributing factors in the etiology of PD, these appear to play less of a role when compared to various genetic mutations.

Pathophysiology

The neurologic structure associated with PD is the substantia nigra, specifically the pars compacta portion.[153] The pars compacta receives input from other basal ganglia nuclei and appears to serve as a modulator of striatal activity.[160] The substantia nigra nuclei undergo significant deterioration as the disease progresses. The significant reduction in the dopaminergic neurons in the substantia nigra pars compacta produces a decrease in activity within the basal ganglia and an overall "reduction in spontaneous movement."[160] The substantia nigra serves as one of the major output nuclei for the basal ganglia to other structures.[156] In addition to the loss of dopaminergic neurons, intracytoplasmic inclusions are found on postmortem examination within the substantia nigra.[153] These intracytoplasmic inclusions are also known as Lewy bodies.[59] Although the greatest amount of neurodegeneration is found in the pars compacta substantia nigra, destruction of other neurologic structures has been reported.[153] Deterioration is also seen in the remainder of the substantia nigra, locus ceruleus, nucleus basalis, and hypothalamus.

Clinical Picture

PD is characterized as a slowly progressive, degenerative movement disorder.[160] The diagnosis of PD is usually made after the age of 55. Although PD is not considered fatal, the degeneration of various neurologic structures severely compromises performance of functional tasks. A person diagnosed with PD may live an additional 20 to 30 years, with a progressive loss of motor function that eventually requires specialized care.[59] A person with PD has an increased risk for developing pneumonia, which may be fatal.

PD is characterized by dysfunction in both voluntary and involuntary movements.[160] A classic triad of symptoms includes tremor, rigidity, and a voluntary movement disorder (Fig. 35.6). By the time these "motor symptoms are clinically recognized, 60% of the dopaminergic" cells of the substantia nigra have deteriorated.[193] The disturbances in voluntary movement are identified as difficulty initiating movement (akinesia) and slowness in maintaining movement (bradykinesia). The bradykinesia and akinesia are often the most disabling motor symptoms for the client with PD.[51] The delay in initiating movement patterns and the slowness in executing the motion compromise functional tasks such as driving, dressing, and eating.

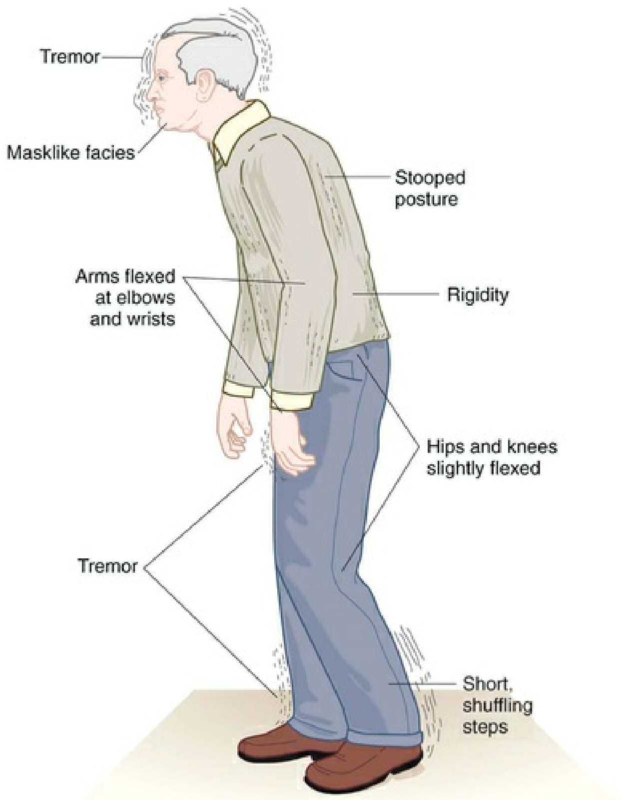

FIG 35.6 Symptoms and signs of Parkinson's disease. (From Hopper T: *Mosby's pharmacy technician: principles and practice*, ed 3, St. Louis, 2012, Saunders.)

In addition to the slowness of movement, rigidity is a characteristic of PD. Rigidity is the stiffness within a muscle that impedes smooth movement. This stiffness occurs in both directions for each plane of motion at a specific joint.[167] The characteristic resting tremor with a rate between 4 and 5 Hz is a disturbance of involuntary movement.[128] This tremor often diminishes with activity, but in some clients the tremor persists during performance of functional activities.

Additional symptoms of PD are disturbances in gait and postural reactions and masked face with decreased facial expressions, and emotional disturbances including depression and psychosis.[77,160] Deterioration in gait is seen throughout the course of the disease.[182] Initially, gait may be fairly normal, but as the disease progresses, changes in stride length and speed of gait are apparent. The characteristic **festinating gait** is often seen; as the client walks, the stride length decreases in length and the speed slightly increases, creating a shuffling effect. A reduced arm swing during ambulation is evident, and trunk rotation is markedly decreased during walking. Another motor disturbance associated with gait is the phenomenon of "freezing."[73] Freezing occurs when the person ceases to move, often after attempting to initiate, maintain, or alter a movement pattern. During gait, freezing may be seen as the client attempts to change directions or approach a narrow hallway or stairs. As the client attempts to alter the trajectory of walking to turn to enter another room, he or she may cease moving. Freezing can also be seen during other motor tasks, such as writing, brushing teeth, and speaking.

Postural abnormalities associated with PD include a flexed, stooped posture with the head positioned forward.[131] The client tends to stand with flexion at the knees and hips. In addition to the stooped posture, balance reactions are compromised.[165] Righting and equilibrium reactions are markedly reduced in effectiveness, and the person with PD may experience frequent falls.

Approximately 50% of individuals with diagnosed PD exhibit depression,[165] which is not merely reactive to the severity of symptoms or the chronic nature of the disease.[59] The depression seen in individuals with PD appears to be related to a serotonergic deficit, which is similar to that in clients without PD who have depression. Complicating the feature of depression is a decrease in facial expressiveness caused by akinesia.[165] This decrease in spontaneous facial expressions, or so-called masked face, is characteristic of clients with PD. Initially, decreased facial expressions are seen unilaterally, but as the disease progresses, spontaneous expression decreases on both sides of the face.[59] Individuals with PD may also self-limit social interaction because they are embarrassed by their decreased facial expressions and movement disorders. Psychosis is also a common complication for clients with PD, and they may experience hallucinations and delusions.[77] These disturbances compromise cognitive abilities and often limit functional skills.

Mental status is fairly normal throughout the early stages of PD, but visual-spatial perception is often compromised.[165] Higher-order cognitive disorders are common in clients with PD. Clients with PD often have difficulty shifting attention among various stimuli. Processing simultaneous information is often difficult for the individual with PD, and tasks that require a sequential process are somewhat easier to perform. Driving a car presents a particular challenge because it necessitates the processing of multiple forms of information in a simultaneous manner. Some self-care tasks, such as brushing teeth, have a clear sequence that can be followed; these activities can be performed with less demand on cognitive functioning. Although dementia is seldom seen in clients with an earlier-onset form of PD, approximately one-third of people over 70 years old who have PD display dementia.

Additional symptoms associated with PD include autonomic dysfunction, dysphagia, and dysarthria.[165] A client with PD may have bowel and bladder problems, with reduced intestinal motility producing constipation. Clients often report an increase in the frequency and urgency of urination. Clients also frequently complain of orthostatic hypotension, but syncope is rare.[59] Clients with PD occasionally report periods of sweating and abnormal tolerance of heat and cold.[165] Because speech volume is often decreased, persons with PD often seem to whisper. Articulation is imprecise, and speech is monotone. Dysphagia tends to occur in the later stages of PD, and clients may be at risk for choking and aspiration pneumonia resulting from the dysphagia.

The course of the disease varies from person to person, but the first clinical symptom identified is typically a unilateral resting tremor in the hand.[128] Hoehn and Yahr[89] established a scale identifying the progression of symptoms in PD. A client at stage I exhibits unilateral involvement, typically a hand tremor, but no impairment of functional abilities is reported. A client is able to complete personal ADLs and IADLs, but performance often requires additional effort and energy. Depending on job demands, a client with PD at stage I is often employed but may require modifications to the work site. During this stage the client's handwriting may become very small, with letters that are cramped together.[59] This change in handwriting is referred to as micrographia. The client may also complain of muscle cramping when required to write for extended periods. Slight rigidity may be seen when the client is asked to rapidly open and close the involved hand.

Stage II denotes a progression of symptoms and the development of bilateral motor disturbances.[89] Although the course of PD is variable, this stage is usually seen 1 to 2 years after initial diagnosis. Even though tremors or rigidity may be noted bilaterally, the client can still perform ADL skills. Performance of IADL skills may require modification because of motor difficulties. Work, depending on the job requirements, often requires additional modifications, and the client may require several rest breaks during the day. The client should make decisions at this point regarding the benefits of remaining employed relative to the energy expenditures. Posture becomes slightly stooped, with flexion at the knees and hips. The person with stage II PD is still able to ambulate independently.

As PD progresses to stage III, the client experiences delayed righting and equilibrium reactions. Balance is impaired; the client has difficulty performing daily tasks that require standing, such as showering and meal preparation. Employment may be difficult because of its energy demands. Safety in walking is a concern because of the client's reduced balance, and home modifications are necessary at this stage. A person with stage IV PD has significant deficits in completing daily living tasks. The client is still able to ambulate at this stage, but motor control is severely compromised and negatively affects dressing, feeding, and hygiene skills. Stage V is the final stage of PD. The client is typically confined to a wheelchair or bed and depends on others for most self-care activities. The rate of progression through these stages varies from person to person, but PD is a slowly progressive disorder.

The extent of PD symptoms in individual clients has been measured using the Unified Parkinson's Disease Rating Scale.[61] This scale evaluates a client's motor skills, functional status, and extent of disability. Motor skills are evaluated by a trained observer.[178] The functional status and extent of disability are measured through a client interview that includes items addressing ADL skills and cognitive and emotional factors.[119] This instrument has been used for research and clinical practice to measure the effectiveness of various interventions in reducing PD symptoms (Table 35.4).

TABLE 35.4

Progression of Symptoms in Parkinson's Disease

Stage	Symptoms	OT Management
1	Unilateral tremor, micrographia, poor endurance for previous occupations, fatigue	Work evaluation if client is employed; work simplification for work and home settings; develop the habit of taking frequent rest breaks; use of utensils with enlarged handles
2	Bilateral motor disturbances, mild rigidity reported, difficulties with simultaneous tasks, difficulties with executive function	Energy conservation techniques related to ADLs; develop a daily flexibility exercises focused on trunk rotation; driving assessment and alternatives for community mobility, use of task analysis to structure sequential tasks
3	Balance problems with delayed reactions, difficulties with skilled sequential tasks	Environmental modifications in the home including raised toilet seats, chairs with arm rests, removal of throw rugs; use of visual cues and supports for sequential tasks
4	Fine motor control severely compromised, oral motor deficits	Modifications to support participation in self-care tasks, changes in food textures
5	Client severely compromised in regard to motor skills, dependent with ADLs	Use of environmental controls to allow access to environment

Medical Management

The most frequently used medical management strategy for PD is the provision of a dopamine agonist to make up for the depletion of dopamine caused by the destruction of the substantia nigra.[55,184] Levodopa is the medication most commonly used in the treatment of PD.[163] This oral medication is actually a precursor to dopamine because dopamine is too large to cross the blood-brain barrier. Levodopa provides substantial relief from tremors and rigidity during the initial stages of PD. After approximately 5 to 10 years of chronic use of levodopa, motor side effects are reported.[165] Those most often reported are dyskinesias and motor fluctuations. This "on-off" phenomenon is related to the levodopa dosage. A decrease in tremors and rigidity occurs during the "on" period after administration of levodopa, but the client may also experience various dyskinesias, such as abnormal movements of the limbs. As the dosage of levodopa wears off, the motor symptoms, specifically tremors and rigidity, associated with PD return.

Timing of the medication and the periods of "on-off" are important considerations in planning the client's daily activities. Even though abnormal movements are observed during the "on" period, the client has greater freedom of movement to complete functional activities.

As PD progresses, control of various motor symptoms through the use of levodopa becomes less effective.[165] Surgical intervention, known as **stereotactic surgery**, has been used. In this surgery, specific lesions are made in neurological structures to decrease the severity of PD symptoms. Stereotactic surgery of the globus pallidus internus has been used to decrease the severity of motor symptoms associated with PD and thus reduce the needed dosage of levodopa.[100,152] This surgical procedure is known as a pallidotomy. Pallidotomies have also been shown to reduce the dyskinesias associated with long-term use of levodopa.[165] Stereotactic surgery has also been used to create lesions in portions of the thalamus to reduce tremor and rigidity associated with PD.[104]

Neural transplantation has been used selectively for clients with PD.[30] This process involves harvesting fetal mesencephalic neural tissue and then transplanting this tissue into the basal ganglia of clients with PD.[44] The results of fetal brain transplants have been varied. In some clients, the tremors and rigidity were substantially reduced, but other clients experienced dyskinesias following the transplanted tissue.[164] The best success for this procedure has been reported when bilateral implants are placed in the putamen from multiple fetuses. The transplanted fetal tissue produces dopamine and thereby reduces the debilitating symptoms of progressive PD. Clients must continue to use levodopa but at a reduced dosage.

Role of the Occupational Therapist

Occupational therapy services vary depending on the client's stage of PD. Typically an OT program would provide compensatory strategies, client and family education, environmental and task modifications, and community involvement. Although OT services have been shown to be beneficial, there are still inconsistent referrals to provide OT services to those who have PD.[172] In a multisite randomized control trial, Sturkenboom and colleagues provided 10 weeks of occupational therapy for 124 clients diagnosed with PD.[201a] A control group of 67 clients with PD served as the comparison for the investigation. The Canadian Occupational Performance Measure (COPM) was used as both the assessment and outcome measure for this investigation. Following the 10 weeks of intervention, those who received OT services had significant improvements when compared to the control group for "self-perceived performance on prioritised activities." This multisite investigation provided strong evidence of the effectiveness of OT services in fostering functional, self-identified activities.

During the initial stages of the disease, the occupational therapist should develop an occupational profile with the client and significant others to establish intervention priorities.[180] Clients have expressed the desire to retain a sense of self and normalcy within their family, even in the face of deteriorating abilities. The focus of intervention is developing the habits and routines to foster participation in desired occupations as the disease process progresses. Educating the client and significant others regarding the course of the disease is an important step in this process, one that aids in the selection of occupations. For example, the case study at the end of this section introduces Carl. He identified traveling and painting as important occupations, and interventions were designed to help him continue participating in these occupations as the disease progressed.

During the early stages of the disease, the client and family should be informed of community resources and support groups. In one study, clients with PD were found to be far more dependent on others for personal care and household activities than were same-age peers without PD.[209] This dependence can place additional stress on the family. Involvement in a community-based group may provide the support needed to accommodate the changes in family roles and interaction.[180]

Even during the early stages of the disease process, clients with PD have difficulties with executive functioning.[67] An investigation by Foster and Hershey compared clients who had PD, but no dementia, with age-matched controls on several assessments of executive functioning. Clients with PD included in this investigation were in stage I or II. Clients with PD performed significantly worse on working memory and executive functioning compared to age-matched controls. Furthermore, lower executive functioning "was associated with reduced activity after controlling for motor dysfunction and depressive symptoms." The authors urge occupational therapists to assess executive functioning even during the early stages of PD and develop strategies to support client participation in desired occupations.

Modification of household items may decrease the impact of tremors during the initial stage of the disease process. Built-up handles for eating and writing utensils should be introduced during the initial stages of PD. Handwriting often becomes small and difficult to read during the initial stage of PD. Time management techniques should be introduced at this stage. Paying bills, signing forms, or doing other written work should be completed soon after taking levodopa, using utensils with built-up handles. Even though tremors are not severe during the early stages of PD, clothing fasteners should be modified. The use of slip-on shoes or Velcro closures for clothing should be considered at this time. Although a client may be able to fasten clothing during this stage of PD, the occupational therapist must consider the amount of energy and time needed to perform such a task.

In addition to the modification of specific tasks, household changes should be made at this time. Loose rugs should be removed from floors and furniture placed close to the wall to decrease obstacles. Chairs should have armrests to allow the client to push up from the chair to stand. Although balance is not significantly compromised during the early stages of PD, the family and client should become familiar with the new arrangement of furniture before this becomes a necessity. Bath and toilet railings and a raised toilet seat should be provided within the home. Because fatigue is a common complaint, clients should develop the habit of taking frequent breaks during the day. Modifying the household setting early in the course of PD allows the client and family members to adjust to changes and incorporate these changes into daily routines before they become a necessity.

A work evaluation should be performed during the early stage of the disease process to assess safety risks, potential hazards, and work simplification techniques that could be used. An ergonomic assessment of the work site and modifications to the tools would be appropriate. In the case of Carl, computer modifications were considered. A client may have the option of reducing the number of work hours, but that decision may reduce medical benefits. These decisions and available options are part of the OT intervention process during the early stage of the disease.

During the initial stage of PD, the occupational therapist should establish a daily exercise program addressing full range of motion.[199] It is preferable to have a client with PD perform a short exercise program for 5 to 10 minutes daily rather than a longer program three times a week. Exercises should include alternating movements from various planes, as many clients with PD display difficulties with smooth shifting of movements.[121] Postural flexibility exercises should be included in the program, with specific attention given to trunk extension. The most common postural change noted with the progression of PD is a stooped posture. In addition to the flexibility exercises, occupational therapists should instruct clients in the use of relaxation techniques and controlled breathing. Inhaling slowly through the nose and exhaling through pursed lips two or three times in succession, combined with improved postural alignment, can promote relaxation.

As the disease progresses, additional exercises can improve gait.[204] Rhythmic auditory stimulation in the form of music with an accentuated initial beat has been found to significantly improve stride length and speed in clients with PD. Dancing can also enhance gait patterns, in addition to providing a social environment for the client with PD. As akinesia becomes more apparent, the client with PD should be instructed to use a rocking motion to begin movement activities. Rocking forward and backward a few times while seated can produce the momentum needed to rise from a chair.

As a person with PD progresses to the middle stages of the disease, the client experiences further deterioration of motor skills, particularly the execution of skilled sequential movements.[49] These types of movements are needed to complete personal care and household tasks. Curra and associates[49] found that external cues improved the speed and sequential performance of novel motor tasks. The occupational therapist should suggest modifying activities to include visual cues, verbal prompts, and rehearsal of movements. These strategies increase a client's ability to perform personal care and household activities.

During the middle stages of PD, clients may have decreased oral motor control.[165] Dysphagia and drooling may embarrass them and further restrict social engagements. The occupational therapist should encourage oral motor exercises and provide education regarding food selection. Food consistencies can be altered to improve the client's ability to eat.

The ability to complete personal care tasks has been identified as a critical variable in a client's perception of quality of life.[64] Although progressive movement problems are characteristic of PD, the occupational therapist can minimize the impact the movement disorder has on functional activities. Tremors have less effect on the completion of personal care tasks than compensations for postural instability.[69] The use of group OT sessions has been demonstrated to be effective in reducing the impact of postural instability in clients with PD. An additional benefit of these group sessions is the reported improvement in the perception of quality of life in clients attending the sessions.

Access to community mobility and support programs should be included in the OT intervention plan during the middle stages of PD. A client with PD is often dependent on others for transportation. The use of community mobility services can decrease the client's dependence on family members for shopping and errands.

During the last stages of PD, movement disorders and rigidity may eliminate the client's ability to perform personal care tasks such as dressing and grooming.[89] Depression caused by the decreased ability to perform these tasks can significantly compromise a person's quality of life.[64] OT services should be provided to further modify the home environment for access and control. The use of environmental control units, such as a switch-operated television or radio, can be helpful. The switch plate should be activated with only light touch. Voice- or sound-activated environmental control units may not be as useful because of decreased vocal volume and poor articulation control during speech production. The client's ability to control the immediate environment can compensate for the losses experienced during the final stages of PD. The client may no longer be able to dress himself or herself, but through the use of various switches the client can select preferred television or radio programs, control room lighting, and operate a computer by using minimal motor action.

Section 5 Summary

Although PD is a progressive, neurodegenerative disorder, OT has much to offer the client with this disease.[64,69] The diminishing ability to perform personal care activities and engage in self-selected tasks has been identified as one of the variables contributing to depression and the decreased quality of life in clients with PD. Throughout the progressive course of PD, OT addresses the ability of the client to engage in meaningful activities. The client's wishes and family circumstances are incorporated into the OT intervention plan at every stage of the disease process.

Case Study

Carl

Carl is a 62-year-old college professor diagnosed with PD at the age of 57. He is married and lives in a small one-story home with his wife. He has two adult children, who live in another state. Carl reports that he enjoys traveling, reading, painting, and attending concerts.

Carl recently considered taking early retirement because of the increase in tremors in both of his hands, which made correcting papers difficult. He also reports some problems with endurance as a result of stiffness. Carl indicates that he is no longer able to paint because of the tremors in his hands. He also reports that he is unsure whether he should continue driving because of these tremors.

Results of the OT evaluation indicate that Carl is cooperative and motivated for therapy. Although he does not indicate that he is depressed, his wife reports features of depression, such as a decreased interest in going to concerts and planning summer vacations to see their adult children and grandchildren. His wife also reports that Carl seems depressed about his possible early retirement and loss of status as a college professor.

Carl is able to complete most personal ADLs independently but has difficulties stepping into and out of the tub and shower. His wife reports that she is afraid he will fall and that she often assists him in getting into and out of the shower. Carl also has difficulty tying his tie and buttoning his shirt. Tremors are noted bilaterally in his hands, and slight rigidity is present during passive range of motion (PROM). Dynamic balance is slightly compromised on uneven surfaces and stairs.

Carl has been taking Sinemet (levodopa and carbidopa medication) for the past 3 years to decrease the rigidity and tremors. He does not report any dyskinesias.

When asked about his personal goals, Carl replies, “I guess I'll have more time to read now.”

OT was initiated to accomplish the following:

1. Improve ADL performance

a. Instruct in use of a buttonhook

b. Make suggestions regarding clothing modifications such as clip-on ties and slip-on shoes

c. Instruct in use of momentum to initiate movement, such as rocking back and forth to rise from a chair

2. Modify home environment

a. Remove throw rugs and obstacles in walkways

b. Provide a tub seat and shower extension hose

c. Provide a raised toilet seat

d. Provide a cushion on dining room chairs

3. Assess work setting for modifications

a. Assess for computer access

b. Instruct in energy conservation, urging him to take frequent breaks and schedule activities during “on” phase of medications

4. Investigate leisure pursuits

a. Provide modifications to his easel, using forearm supports to allow him to continue to paint

b. Provide information regarding community-based Parkinson's disease support groups

5. Instruct in a daily active range-of-motion exercise program

a. Trunk extension and rotation exercises

b. Bilateral upper extremity exercise

c. Use of music during exercise program

Carl responded well to OT intervention. Although he was able to complete the academic school year, he decided to retire afterward. He stopped driving, but his wife began to drive them to concerts and art exhibits. He was able to complete personal ADLs safely with the use of adapted equipment and home modifications. He resumed painting during the “on” periods of his medications schedule, using the forearm supports attached to an angled table. He attended a Parkinson's support group two times a week and began to socialize with members from that group. Carl reported that the daily exercises seemed to decrease his stiffness, and he and his wife took frequent strolls in the park when weather permitted. He and his wife also joined a book club.

Review Questions

1. What are the symptoms of ALS at onset?
2. What is the underlying neurological process in ALS?
3. What bodily functions remain intact throughout the disease process?
4. What is the prognosis for ALS? Given this prognosis, what is the goal of the occupational therapist?
5. What are the symptoms of ALS at each stage of the disease?
6. What interventions are appropriate at each stage of ALS?
7. What are the initial symptoms of AD?
8. What underlying degenerative neurological process is associated with AD?
9. What changes in symptoms occur over the course of AD?
10. How do the changes in symptoms affect occupational performance in clients with AD?
11. What is the prognosis for a client with AD?
12. What OT interventions are appropriate for the client at each stage of AD?
13. What environmental modifications should be made to accommodate the client with AD?
14. What are the symptoms of MS at onset?
15. What is the underlying neurologic process in MS?
16. What are the three typical patterns of MS? How do they differ?
17. What symptoms of MS are managed with medication? What are the side effects of medication management?
18. How is medication management in the relapsing and remitting form of MS different than in the other forms of MS?
19. What does the OT evaluation include for the person with MS?
20. Why is it important to include the family in the evaluation and treatment process for the client with MS?
21. What are the initial symptoms of HD?
22. What underlying degenerative neurologic process is associated with HD?
23. What changes in symptoms occur over the course of the disease?
24. How do the changes in symptoms affect occupational performance?
25. What is the prognosis for a client with HD?
26. What OT interventions are appropriate for the client with HD at the various stages of the disease?
27. What environmental modifications should be made to accommodate the client with HD?
28. What are the initial symptoms of PD?
29. What underlying degenerative neurological process is associated with PD?
30. What changes in symptoms occur over the course of the disease?
31. How do the changes in symptoms affect occupational performance?
32. What is the prognosis for a client with PD?
33. What OT interventions are appropriate for the client with PD?
34. How does the medication schedule of levodopa affect a client's daily routine?
35. What environmental modifications should be made to accommodate the client with PD?

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Resources

Amyotrophic Lateral Sclerosis Association

http://www.alsa.org

Brunel University, Centre for the Study of Health and Illness

www.brunel.ac.uk/about/acad/sssl/ssslresearch/centres/cshi/

International Journal of MS Care

www.mscare.org/journal/

MS Watch

www.mswatch.com

National Multiple Sclerosis Society

www.nmssociety.org

36

Spinal Cord Injury

Jennifer Bashar, Carole Adler Hughes

CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Understand the difference between a complete and an incomplete spinal cord injury and the classification system used to describe such levels of injury.
2. Recognize and identify the various spinal cord injury syndromes.
3. Briefly describe the medical and surgical management of the individual who has experienced a traumatic spinal cord injury.
4. Identify some of the complications that can limit optimal functional potential.
5. Describe the changes in sexual functioning in males and females after a spinal cord injury.
6. Identify the specific assessment areas that must be considered before developing intervention objectives.
7. Analyze the critical issues to consider when developing intervention objectives during the acute, post-acute, and outpatient phases of the rehabilitation process.
8. Identify the functional outcomes, including equipment considerations and personal and home care needs that can be reached at each level of complete injury under optimal circumstances.
9. Describe some of the special considerations that arise for a spinal cord injury in the pediatric population.

0. Analyze how the effects of a spinal cord injury accelerate the normal aging process, and explain how functional status may change.

KEY TERMS

Autonomic dysreflexia (AD)
Durable medical equipment provider
Heterotopic ossification (HO)
Paraplegia
Pressure ulcer
Quadriplegia
Spasticity
Tetraplegia

Acknowledgment

Jennifer Bashar would like to acknowledge Carole Adler's contributions to the success of this chapter throughout the first seven editions of this book. Her dedication to occupational therapy for evaluation and treatment of individuals with spinal cord injury educated and inspired generations of occupational therapists to provide cutting-edge treatments of the highest quality. It is an honor to contribute with her to the eighth edition.

Threaded Case Study

Jack, Part 1

Jack is a 23-year-old Caucasian male who sustained a C6 complete (AIS A) spinal cord injury (SCI) as a result of a motor vehicle accident. He works full-time in a bank and is studying to get a degree in business administration. He lives alone in a two-story house that he recently purchased and plans to renovate. His mother and stepfather live in the same city, and both work full-time.

Jack was initially airlifted from the accident site to a trauma hospital, where he underwent a posterior spinal fusion from C5-T1. While in the intensive care unit he was referred to and evaluated by occupational therapy (OT). OT services provided during the acute stage focused on addressing Jack's physical needs (providing range of motion and positioning devices to protect joint integrity and prevent skin breakdown) and environmental needs (nurse call light, television control, phone access). Spinal injury education with Jack and his family was initiated.

Upon transfer to the inpatient rehabilitation unit a comprehensive OT evaluation was conducted. Jack's occupational profile and history were obtained, in addition to a comprehensive evaluation of his strength, sensation, cognition, and vision. His specific manual muscle test revealed 3+ (Fair+) to 4 (Good) strength in deltoids, biceps, and radial wrist extensors and 2− (Poor−) strength in triceps. Sensory examination was intact to the C6 dermatome. He initially required assistance for all aspects of his activities of daily living (ADLs), including bed and wheelchair mobility. Jack's goals included being able to feed himself, get dressed by himself, be strong enough to push a manual wheelchair, live in his house again, and return to school to complete his degree.

Throughout this chapter, consider the short- and long-term consequences of Jack's injury to his ability to successfully engage and participate in his life contexts. Keep in mind the effects of his SCI on client factors, performance skills and patterns, and the relationship of activity demands to the selection of optimal equipment to enhance mobility and other areas of occupation.

Critical Thinking Questions

1. Considering Jack's level of SCI, what expectations would there be for functional recovery, and what interventions would the therapist provide to maximize his independence in performance of ADLs and instrumental activities of daily living (IADLs)?

2. What durable medical equipment and adaptive equipment will maximize efficiency in his mobility and ADLs?

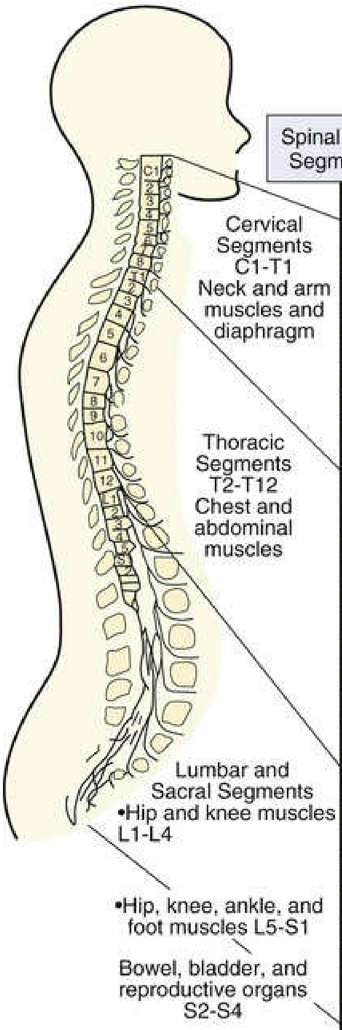
3. How will the therapist approach OT interventions and realistic expectations regarding his specific goals of achieving independence in self-care, returning to school, living independently, and other important lifestyle options?

A spinal cord injury is a catastrophic and life-changing event that is defined as an injury to the spinal cord or spinal nerve roots that results in temporary or permanent change in an individual's motor, sensory, and/or autonomic function. According to the National Spinal Cord Injury Statistical Center (2015), there are approximately 276,000 people in the United States living with an SCI, and an estimated 12,500 new cases occur each year.[41] An SCI can be the result of a traumatic or nontraumatic event. Motor vehicle accidents are the most common cause of a traumatic SCI, followed by accidental falls, acts of violence (e.g., gunshot and stab wounds), sports accidents, and diving accidents. The average age at onset has risen from 29 years old in the 1970s to 42 years old since 2011; approximately 80% of SCIs occur among males.[41] Non–traumatic spinal cord dysfunction may be a result of multiple sclerosis, degenerative central nervous system diseases, tumors, vascular disease, inflammatory disease, spinal stenosis, myelomeningocele, or hydrosyringomyelia.[23] Although some of the intervention principles discussed may apply to the nontraumatic spinal cord conditions, this chapter will focus primarily on rehabilitation of the individual with a traumatic SCI.

Results of A Spinal Cord Injury

SCI results in tetraplegia (also known as **quadriplegia**) or paraplegia. **Tetraplegia** is paralysis caused by a cervical injury and involves any degree of paralysis of the four limbs and trunk musculature. There may be partial upper extremity (UE) function, depending on the level of the cervical lesion. **Paraplegia** is paralysis caused by a thoracic, lumbar, or sacral injury and involves any degree of paralysis of the lower extremities (LEs) with involvement of the trunk, legs, feet and toes, depending on the level of the lesion.[37,38]

The extent of neurological damage depends on the location and severity of the injury (Fig. 36.1). The neurological level of injury is determined by the International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI). A neurological exam is completed by a trained medical professional that involves testing of key muscles and sensory points (Fig. 36.2).[6] SCIs are referred to in terms of the regions (*C*, cervical; *T*, thoracic; *L*, lumbar; and *S*, sacral) of the spinal cord in which they occur and the numerical order of the neurological segments. The neurological level given is the most caudal segment of the cord where sensation is intact and muscle strength is at least 3/5. The results of the ISNCSCI exam also determine whether the injury is complete or incomplete and its classification on the ASIA Impairment Scale (AIS), which was established by the American Spinal Injury Association (ASIA).



Functional Activities

Spinal Cord Segments	EATING	DRESSING	GROOMING	TOILETING	BATHING	MEAL PREPARATION	DRIVING	PUBLIC TRANSPORTATION	WHEELCHAIR TRANSFERS	STANDING/ AMBULATION	COMMUNICATIONS	VOCATIONAL	SEXUAL FUNCTIONING	
C-1	★	★	★	★	★	★		★	★		★	★★	★★	Tetraplegia
C-2	★	★	★	★	★	★		★	★		★	★★	★★	
C-3	★	★	★	★	★	★		★	★		★	★★	★★	
C-4	★	★	★	★	★	★		★	★		★	★★	★★	
C-5	★	★	★	★	★	★	★	★	★		★	★★	★★	
C-6	★	★	√	★	★	★	★	★	★		√	★★	★★	
C-7	√	√	√	★	★	√	★	★	√		√	★★	★★	
C-8	√	√	√	√	√	√	★	★	√	★	√	★★	★★	
T-1	√	√	√	√	√	√	★	★	√	★	√	★★	★★	
T-2	√	√	√	√	√	√	★	★	√	★	√	★★	★★	Paraplegia
T-3	√	√	√	√	√	√	★	★	√	★	√	★★	★★	
T-4	√	√	√	√	√	√	★	★	√	★	√	★★	★★	
T-5	√	√	√	√	√	√	★	★	√	★	√	★★	★★	
T-5	√	√	√	√	√	√	★	★	√	★	√	★★	★★	
T-7	√	√	√	√	√	√	★	★	√	★	√	★★	★★	
T-8	√	√	√	√	√	√	★	★	√	★	√	★★	★★	
T-9	√	√	√	√	√	√	★	★	√	★	√	★★	★★	
T-10	√	√	√	√	√	√	★	★	√	★	√	★★	★★	
T-11	√	√	√	√	√	√	★	★	√	★	√	★★	★★	
T-12	√	√	√	√	√	√	★	★	√	★	√	★★	★★	
L-1	√	√	√	√	√	√	★	★	√	★	√	★★	★★	
L-2	√	√	√	√	√	√	★	★	√	★	√	★★	★★	
L-3	√	√	√	√	√	√	★	★	√	★	√	★★	★★	
L-4	√	√	√	√	√	√	★	√	√	★	√	★★	★★	
L-5	√	√	√	√	√	√	★	√	√	★	√	★★	★★	
S-1	√	√	√	√	√	√	★	√	√	√	√	★★	★★	
S-2	√	√	√	√	√	√	√	√	√	√	√	★★	★★	
S-3	√	√	√	√	√	√	√	√	√	√	√	★★	★★	
S-4	√	√	√	√	√	√	√	√	√	√	√	★★	★★	

√	Normal or near normal function or performance
★	Requires some type of attendant assistance and/or specialized equipment
★★	Participation possible but options and alternatives need to be discussed
	Not practical/probable for this injury level

FIG 36.1 Spinal cord levels and functions affected by spinal cord injury (SCI). (From Monahan FD, et al, editors: *Phipps' medical-surgical nursing health and illness perspectives,* ed 8, St Louis, 2007, Mosby.)

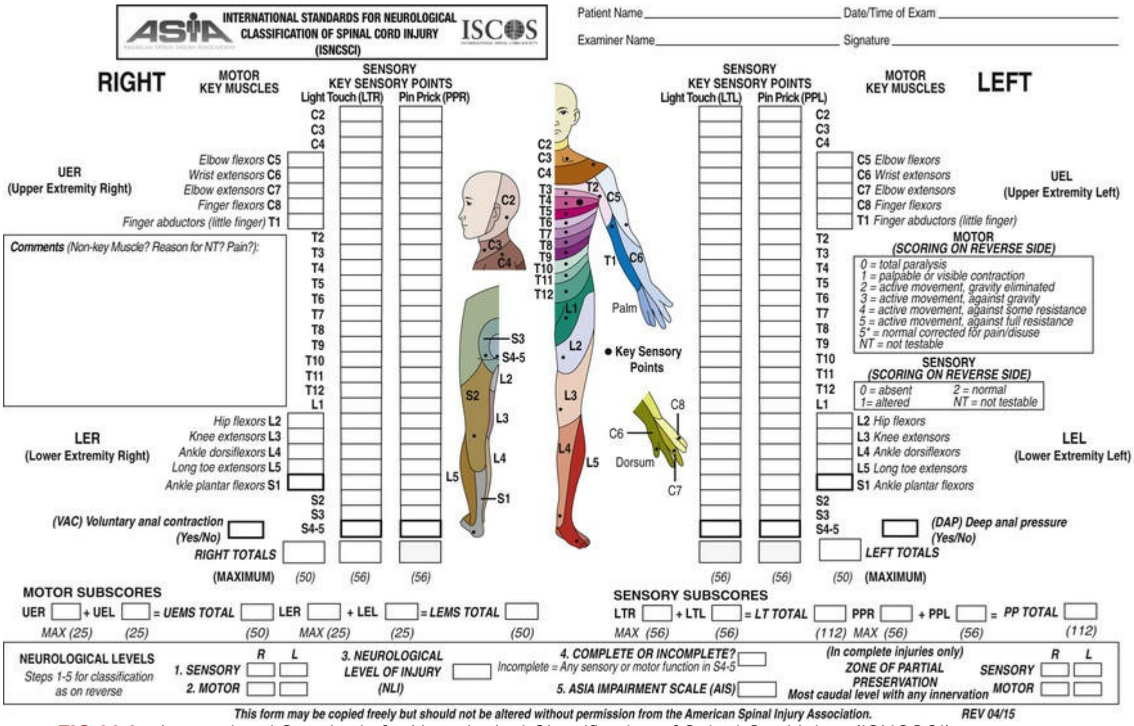


FIG 36.2 International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI). (From American Spinal Injury Association: *International standards for neurological classification of spinal cord injury*, Atlanta, 2008, The Association.)

Complete Versus Incomplete Neurological Classification

The difference between a complete and an incomplete injury is whether the individual has voluntary motor control or sensation in the anal area (S4-S5 segments of the spinal cord). A complete injury, classified as an AIS A, indicates that there is no motor or sensory function preserved at S4-S5. An individual with an AIS A SCI may have preservation of strength or sensation below the neurological level of injury; this is referred to as the zone of partial preservation (ZPP).[6]

In an incomplete injury, the individual has some degree of voluntary motor control or sensation preserved at S4-S5. An AIS B SCI (sensory incomplete) indicates that there is sensation, but not motor control, below the neurological level of injury, including at S4-S5. An AIS C SCI (motor incomplete) indicates that there is motor function preserved below the neurological level of injury, and more than half of the key muscles below the neurological level have a muscle grade of less than 3 (Fair). An AIS D SCI (motor incomplete) indicates that there is motor function preserved below the neurological level of injury, and more than half of the key muscles have a muscle grade of 3 (Fair) or more. An AIS E SCI indicates that the individual tests as having normal sensation and motor control.[6]

An ISNCSCI exam was completed with Jack upon arrival at the trauma center and at 72 hours post-onset. For both exams his sensory examination was intact to the C6 dermatome and absent below. The key muscles innervated at C6, radial wrist extensors, were graded at 3+/5 (Fair+). Because he had 2−/5 (Poor−) strength in his triceps (C7 key muscle) at the 72-hour exam, he was given a neurological level of C6 AIS A with a ZPP at C7.

Clinical Syndromes

Central Cord Syndrome

Central cord syndrome (CCS) is the most common incomplete spinal cord injury and occurs when there is more damage in the center of the cord than in the periphery. This damage is most frequently a result of a cervical hyperextension injury, such as a fall, and is commonly seen in older adults with arthritic changes that have caused a narrowing of the spinal canal. Symptoms include paralysis that is greater in the hands and arms than in the trunk and legs, bladder dysfunction, sensory loss below the level of injury, and painful sensations, including tingling, burning, or dull aching.[32,40]

Brown-Séquard Syndrome (Lateral Damage)

Brown-Séquard syndrome results when only one side of the cord is damaged, as in a stabbing or gunshot injury. Below the level of injury there is motor paralysis and loss of proprioception on the ipsilateral side and loss of pain, temperature, and touch sensation on the contralateral side.

Anterior Spinal Cord Syndrome

Anterior spinal cord syndrome results from injury that damages the anterior spinal artery or the anterior aspect of the cord. This syndrome involves paralysis and loss of pain, temperature, and touch sensation. Proprioception is preserved.

Conus Medullaris Syndrome

Conus medullaris syndrome involves injury of the sacral cord (conus) and lumbar nerve roots within the neural canal, which usually results in an areflexic bladder, bowel, and lower extremities.

Cauda Equina Syndrome

Cauda equina injuries involve peripheral nerves rather than directly involving the spinal cord. This type of injury usually occurs with fractures below the L2 level and results in a flaccid-type paralysis. Because peripheral nerves possess a regenerating capacity that the cord does not (at a rate of 1 to 2 mm per day[34]), this injury is associated with a better prognosis for recovery. Patterns of sensory and motor deficits are highly variable and asymmetric in cauda equina injuries.

Prognosis for Recovery

The most important indicator of the long-term prognosis after SCI is dependent on whether the lesion is complete or incomplete, as determined by an ISNCSCI exam completed 72 hours to 1 week post injury.[21,28] If there is no sensation or return of motor function below the level of lesion during this time period in carefully assessed complete lesions, motor function is less likely to return. However, partial to full return of neurological function one spinal nerve root level below the vertebral fracture can be gained and may occur in the first 6 to 9 months after injury. The majority of improvements will occur within the first year post injury but may continue up to 3 to 4 years post injury.[21] Among individuals with complete tetraplegia, 70% to 85% will gain at least one level by 1 year post injury. The rates of conversion from complete (AIS A) to incomplete (AIS B, C, or D) status at 1 year post injury range from 4% to 22%; the rates of conversion from incomplete (AIS B) to motor incomplete (AIS C or D) status range from 33.3% to 71.3%.[28,30] For Jack, it is reasonable to anticipate that he will regain one neurological level, from C6 AIS A to C7 AIS A, within the next year.[38]

With incomplete lesions, progressive return of motor function is possible but varies, depending on the type of lesion. Brown-Séquard syndrome has the best prognosis—75% to 90% of individuals ambulate independently at discharge from inpatient rehabilitation.[32] CCS also has a good prognosis for recovery but is age dependent; 97% who are younger than 50 years old will ambulate, compared with 41% of individuals older than age 50.[32] Anterior cord syndrome has a poor prognosis for functional improvement, with only a 10% to 20% chance of motor recovery.[32] Frequently, the longer it takes for recovery to begin, the less likely it is that it will occur.

Questions regarding the prognosis can be expressed at any point in time along the rehabilitation continuum by the individual with an SCI, the family, or friends. The therapist's response will depend on many factors, including the age, educational level, level of adjustment, and stage of recovery of the individual. It is important to acknowledge and respect any expressions of hope, uncertainty, loss, and helplessness while simultaneously fostering effective coping strategies and feelings of independence.[15] As you build a partnership with the individual, actively promote his or her understanding of the rehabilitation process. Take opportunities to educate the client in self-management and directing care strategies. Emphasize that the purpose of rehabilitation is to prevent further medical complications through education, to maintain and improve the strength and skills that are present, to maximize function and facilitate mobility, and to optimize lifestyle options for the individual and the family.

Medical and Surgical Management of the Person With A Spinal Cord Injury

After a traumatic event in which SCI is likely, careful examination, stabilization, and transportation of the patient may keep a temporary or minimal SCI from becoming more severe or permanent. Emergency medical technicians, paramedics, and air transport personnel are trained in SCI precautions and extrication techniques for moving a person who has sustained a possible SCI from an accident site. Axial traction on the neck should be maintained, and any movement of the spine and neck prevented during this process. Initial care is directed toward preventing further damage to the spinal cord and reversing neurological damage, if possible, by stabilization or decompression of the injured neurological structures.[15,25] The effects of steroids administered within the first 24 to 48 hours post injury continue to be actively researched and, while still used, are not definitively recommended.[15,21,25] Emerging acute medical therapies include the use of cooling measures (hypothermia) and pharmacologic neuroprotective agents; both are still in experimental phases.[21,24]

Anteroposterior and lateral x-ray films are commonly taken with the individual's head, neck, or spine immobilized to help determine the type of injury. A computed tomography (CT) scan or magnetic resonance imaging (MRI) may be needed to further determine the extent of injury. Open surgical reduction with internal fixation and spinal fusion are sometimes indicated in order to decompress the spinal cord and achieve spinal stability and normal bony alignment. Surgery is not always necessary, and adequate immobilization may allow the individual to heal. Specialized beds are recommended for patients with an unstable spine if they are going to be immobilized for an extended amount of time.[15] As soon as possible a means of portable immobilization is provided, usually a cervical collar or halo vest for cervical injuries and a thoracic brace or body jacket for thoracic injuries (Fig. 36.3). This approach enables the client to be transferred to a standard hospital bed and, subsequently, to be upright in a wheelchair and involved in an active therapy program as soon as there is medical and spinal stability.[15] Initiating an upright sitting tolerance program shortly after injury can substantially reduce the incidence and severity of further medical complications, such as deep vein thrombosis, joint contractures, and the general deconditioning that can result from prolonged bed rest.

FIG 36.3 Cervical collar and thoracolumbosacral orthosis (TLSO). (Courtesy Rancho Los Amigos National Rehabilitation Center, Downey, CA.)

The benefits of early transport to a specialized SCI center have been documented and include improved outcomes and fewer complications.[15,49] Spinal cord centers are equipped to offer a complete, multidisciplinary program executed by an experienced team of professionals who specialize in this unique and demanding disability. Clients treated in specialized SCI centers demonstrate reduced total lengths of stay, reduced incidence of pressure ulcers, lower rates of joint contractures, and increased neurological recovery. It has also been found that individuals sent to rehabilitation centers specializing in the treatment of SCI make functional gains with greater efficiency.[15,24]

Jack was airlifted from the accident site to a trauma hospital where a CT scan revealed significant fractures at C5-C6. He was intubated due to signs of respiratory failure, and a catheter was placed in his bladder to drain urine. He underwent a posterior spinal stabilization and fusion from C5-T1. After his surgery he was placed on a specialty bed to prevent pressure ulcers.

Complications After A Spinal Cord Injury

After an SCI there is potential for the individual to experience secondary complications as the body adjusts to disturbances in both body functions and body structures. It is imperative that the therapist understand the signs, symptoms, and potential effects these secondary complications could have on occupational performance. During each interaction the therapist must be vigilant in detecting the signs and symptoms of these complications, proactive in preventing their occurrence, and diligent about educating the client and identified caregivers.

Neurogenic Bladder and Bowel

SCI interrupts the communication between the nerves in the spinal cord that control bladder and bowel function. Signs of a neurogenic bladder include the inability to empty the bladder, incontinence, urinary frequency, and urinary tract infections. Signs of a neurogenic bowel include bowel incontinence, constipation, and impaction. After an SCI the manner by which the bladder and bowel works is dependent on the level of injury.

A spastic (reflex) bladder usually occurs in clients with an SCI at T12 and above; these individuals will have no control over when the bladder empties. A flaccid bladder usually occurs in clients with SCI T12 to L1, and they lose the ability to detect when the bladder is full. These individuals are at risk for the bladder wall to be overstretched and, in extreme cases, ruptured. The most common approach to managing both types of SCI bladder is intermittent catheterization.

The reflex or upper motor neuron bowel occurs in lesions above T12. The anal sphincter remains closed but opens on a reflex basis when the rectum is full. Management of the reflex bowel typically involves using digital rectal stimulation and stimulant medications. The areflexic bowel occurs in lesions in the lumbar or sacral level. There is reduced reflex control of the anal sphincter, and the individual is prone to accidental defecation. The areflexic bowel is typically managed by digital stimulation.

Occupational therapists are frequently involved in assisting clients with lesions below C5 achieve independence with bladder and bowel management. The clinical practice guidelines of the Consortium for Spinal Cord Medicine—"Bladder Management for Adults with Spinal Cord Injury: A Clinical Practice Guideline for Health-Care Providers" and "Neurogenic Bowel Management in Adults with Spinal Cord Injury"—are comprehensive and valuable resources on SCI bladder and bowel management.[12,14]

Pressure Injuries

A **pressure injury** (also referred to as pressure ulcer, pressure sore, decubitus ulcer, bedsore, or skin breakdown) is a lesion or an injury to the skin or underlying tissue that is caused by a loss of blood flow to the area. Sensory loss after SCI prevents messages of pain or discomfort from reaching the brain and increases the risk of a pressure ulcer. Too much pressure on the skin, shearing forces, and trauma (cuts, burns, bumps) are all causes of pressure ulcers. The areas most likely to develop skin breakdown are bony prominences over the sacrum, ischium, trochanters, elbows, and heels; however, other bony prominences, such as the iliac crest, scapula, knees, toes, occiput, and rib cage, are also at risk.

Pressure injuries are life-threatening, but most are preventable. All rehabilitation personnel must be aware of the signs of developing skin problems. Box 36.1 presents a description of the stages of pressure injuries. Pressure injuries can be prevented by having the client perform the following measures: regular pressure reliefs (also referred to as weight shifts, pressure reduction, or pressure redistribution); complete skin inspections; routine turning and repositioning in bed;, keeping the skin clean and dry; maintaining adequate nutrition and hydration; and wearing properly fitting clothing and shoes. Specialized mattresses and wheelchair seat cushions, proper transfer techniques, and protection of bony prominences with various types of padding are also essential to pressure injury prevention.

Box 36.1

Staging of Pressure Ulcers

Stage 1—Skin is hyperpigmented and blanches to the touch.

Stage 2—Skin is hyperpigmented but does not blanch to the touch.

Stage 3—Skin is open.

Stage 4—Skin is open, and underlying fascia (muscle, tendon, bone) is visible.

Unstageable—Depth or size of the pressure ulcer cannot be determined.

Occupational therapists play a key role in pressure injury prevention. During ADL training sessions the therapist will teach clients how to examine their skin using adaptive equipment, such as a mirror, and how to integrate skin inspection into their daily routine. Other strategies, such as directing others to watch for signs of developing problems or using technology such as smart phone apps for pressure relief reminders, may be introduced. Additional skin inspection is necessary when orthoses such as hand splints and body jackets are used because they can cause skin breakdown, particularly when protective sensation in those areas is impaired.

Orthostatic Hypotension

Orthostatic hypotension is defined as a decrease of 20 mm Hg or more of systolic blood pressure and is common during the acute phase of rehabilitation when the patient moves from a supine to an upright position or changes body position too quickly.[19] A lack of muscle tone in the abdomen and lower extremities leads to pooling of blood in these areas, with a resultant decrease in blood pressure (hypotension). Risk factors are prolonged bed rest, rapid changes in position, dehydration, and eating heavy meals.[19] Symptoms are dizziness, nausea, and loss of consciousness. With time this problem can diminish as sitting tolerance and level of activity increase; however, some people continue to have hypotensive episodes.

Therapists frequently encounter orthostatic hypotensive episodes when assisting the patient to sit upright for the first time. If this occurs, the client must be reclined quickly and, if sitting in a wheelchair, should be tipped back with the legs elevated until symptoms subside. Abdominal binders, compression garments, antiembolism stockings, and medications can help reduce symptoms. Allowing the patient's body to adjust to upright sitting more gradually by elevating the head of the bed prior to therapy interventions can also help reduce symptoms.

Autonomic Dysreflexia

Autonomic dysreflexia (AD), an abnormal response to a problem in the body below the level of the SCI, is a medical emergency and can be life-threatening. It is a phenomenon seen in individuals whose injury is at the T6 level and above. AD is caused by reflex action of the autonomic nervous system in response to some stimulus, such as a distended bladder or bowel, kidney or bladder stone, constipation or bowel impaction, infection, pressure sore, ingrown toenail, thermal or pain stimuli, deep vein thrombosis, or broken bone. The most dangerous sign of AD is a rapid rise in systolic blood pressure that is 20 to 40 mm Hg or higher than the individual's normal blood pressure; most individuals with an SCI have a baseline systolic blood pressure in the 90 to 110 mm Hg range. Other symptoms are an immediate pounding headache, anxiety, perspiration, flushing, goose bumps above the level of injury, nasal congestion, and bradycardia.[11,27]

If AD is suspected, the client should be placed in an upright position and anything restrictive, such as abdominal binders or antiembolism stockings, should be removed to reduce blood pressure. The bladder should be drained or leg bag tubing checked for obstruction. Blood pressure and other symptoms should be monitored until they return to normal. The occupational therapist must be aware of symptoms and treatment because AD can occur at any time after the injury. Individuals who are susceptible to this condition are encouraged to carry an emergency card describing the condition and treatment because many emergency departments and medical personnel may be unfamiliar with it.

Decreased Vital Capacity

Acute respiratory compromise and subsequent decreased vital capacity is a problem among individuals who have sustained cervical and high thoracic lesions. Individuals with injuries at C4 and above require mechanical ventilation to breathe secondary to paralysis of the diaphragm, intercostal muscles, and abdominal muscles. They will require caregiver assistance to maintain a patent airway (free of secretions). Individuals with injuries between C4 and T6 may have a tracheostomy. They will be able to breathe on their own but will have limited chest expansion and a decreased ability to cough because of weakness of the intercostal and abdominal muscles. Persons with tetraplegia who breathe on their own may still require the assistance of a caregiver to cough (assisted cough). Individuals with injuries between T6 and T12 will have an impaired cough due to weakness of intercostal and abdominal muscles. Sequelae of respiratory compromise include an increased risk for respiratory tract infections and a decreased endurance level for activity. Strengthening of the sternocleidomastoids and the diaphragm, manually assisted cough, and deep breathing exercises are essential to maintain optimal vital capacity.[21]

Jack's vital capacity was 50% of normal capacity for a person of his size. He required assistance to cough because he did not have the force to clear his secretions upon exhaling. His endurance was low, and he initially required frequent rest breaks during treatment sessions.

Spasticity

Spasticity is an involuntary muscle contraction below the level of injury that results from a disruption in the flow of signals between the spinal cord and the brain. Patterns of spasticity change over the first year, gradually increasing in the first 6 months and reaching a plateau about one year after the injury. Moderate spasticity can be helpful in the overall rehabilitation of the patient with an SCI. It helps to maintain muscle mass, assists in the prevention of pressure ulcers by facilitating blood circulation, and can be used to assist in range of motion (ROM) and bed mobility. A sudden increase in spasticity can alert the individual to other medical problems, such as urinary tract infections, constipation, skin breakdown, and fractures or other injuries below the level of injury.[36]

Severe spasticity can be frustrating to the client because it can be painful, cause a loss of joint ROM, interrupt sleep, and interfere with activities such as self-feeding and transferring to a wheelchair. Therapeutic interventions include consistent ROM exercises and stretching to help maintain flexibility; splints, braces, or serial casting can be used to provide continuous stretch to the muscle. Severe spasticity may need to be treated more aggressively with a variety of medications (e.g., baclofen, dantrolene, benzodiazepines) or with nerve or motor point blocks using chemodenervative agents (e.g., phenol, strains of botulinum toxin). In severe cases intrathecal medication therapy (e.g., baclofen pump) or neurosurgical procedures (e.g., myelotomy, rhizotomy, tendon lengthening) may be indicated.[27,36]

Heterotopic Ossification

Heterotopic ossification (HO) is bone that develops in abnormal anatomic locations. HO occurs in 16% to 53% of individuals with an SCI. It is most commonly seen in the muscles around the hip and knee, but it can also develop at the elbow and shoulder.[27] The onset of HO is usually 1 to 6 months after injury, and the first symptoms are swelling, warmth, and decreased joint ROM. Symptoms are often discovered during physical therapy (PT) or OT sessions, even when radiologic findings are negative. Early diagnosis and initiation of treatment can minimize complications. Treatment consists of medication and the maintenance of joint ROM during the early stage of active bone formation to preserve the functional ROM necessary for good wheelchair positioning, symmetric position of the pelvis, and maximal functional mobility.[26]

Pain

Pain is a serious obstacle for many individuals with an SCI and has the potential to negatively impact engagement in meaningful occupations. Acute pain begins suddenly and is usually described as a sharp pain; it may be mild or severe and usually disappears after the underlying cause of the pain is treated or healed. For individuals with an SCI, acute pain could be a result of broken bones, surgery, pressure areas or sores, burns, or a muscle tear. Chronic pain is persistent pain that does not go away and lasts months to years.[10] It is usually the result of nerve damage related to the SCI, but the cause may be unknown.

Types of pain an individual with an SCI may experience can be further differentiated between musculoskeletal pain, neuropathic (or neurogenic) pain, and visceral pain. Musculoskeletal pain is a result of muscular, joint, or bone damage and will usually get worse with movement and get better with rest.[35] Neuropathic pain is a result of damage to the nerve fibers; this damage creates abnormal communication between the spinal cord and the brain, causing the brain to misinterpret the intensity of signals it receives from the area of injury. Neuropathic pain is usually described as burning, stabbing, or tingling pain.[1] Visceral pain is usually described as cramping or aching in the abdomen and can be a result of a medical problem such as constipation, a kidney stone, ulcer, gallstone, or appendicitis.[35]

Neck and/or back pain is often reported by individuals with an SCI. Causes of neck and back pain include recent surgery to fuse the spine, soft tissue involvement (e.g., muscle strain, bruising), increased motion above and below the spinal fusion, and overuse by individuals who use mouth- or chin-operated joysticks to control their power wheelchairs.

The shoulder is the most common location of pain after an SCI, with the incidence and severity increasing over time post injury.[39] During the acute and post-acute phases of rehabilitation, shoulder pain is extremely common in individuals with C4 through C7 tetraplegia, causing decreased shoulder and scapular ROM and impacting participation in functional activities. Possible causes include scapular immobilization resulting from prolonged bed rest, nerve root compression subsequent to the injury, and subluxation at the glenohumeral joint. During the outpatient phase of rehabilitation, shoulder pain is common in individuals with C5 through C8 tetraplegia and all levels of paraplegia. Repetitive movements, such as pushing a manual wheelchair, doing pressure reliefs, and transfers, can cause muscle overuse and strain, chronic impingement syndrome, rotator cuff tears, and arthritic changes.[35] Shoulder pain should be thoroughly assessed and diagnosed so that proper intervention and activity or equipment modifications can be provided before the onset of chronic discomfort and functional loss.

Spinal Cord Injury Rehabilitation

Rehabilitation Team

SCI rehabilitation is best delivered under the auspices of a highly cohesive interdisciplinary team. The team, with the client at its center, is ideally composed of a rehabilitation physician (physiatrist) experienced in SCI, a rehabilitation nurse, OT, PT, speech therapist, psychologist, and social worker/case manager. Team members should have an understanding of the ISNCSCI classification system and how it applies to recovery; of common medical complications of an SCI and how to prevent them; and of the psychological and social ramifications of an SCI and how to assist clients and their families during the adjustment process. Team members should also be actively involved in the education of the client throughout the rehabilitation process.[7]

Goal of Rehabilitation

The goal of all phases of rehabilitation is to help the individual with an SCI reach his or her full potential after the injury. Because every individual is unique and each injury is different, the rehabilitation program can differ markedly from one individual to the next. The severity of injury, functional goals, adjustment to injury, and discharge options will all impact the length of time an individual spends in any one phase of rehabilitation.

Occupational Therapy Evaluation

The OT evaluation of the SCI client begins during the initial contact, continues during each subsequent interaction with the client, and lasts long after discharge on an outpatient follow-up basis. It is an ongoing, fluid process that requires the OT to continually evaluate the client's functional progress, the appropriateness of any OT intervention, and the utility of recommended adaptive equipment. The top-down and client-centered approaches outlined in the current Occupational Therapy Practice Framework (OTPF-3),[4] recommend that the OT evaluation contain a thorough occupational profile and analysis of occupational performance. Box 36.2 presents key OT assessments for SCI.

Box 36.2

Key OT Assessments for Spinal Cord Injury

- Occupational profile: Client factors, context, goals
- Sensation: Light touch, pinprick (per the guidelines established by the International Standards for Neurological Classification of Spinal Cord Injury [ISNCSCI]).
- Pain: Type, location, rating scale
- Range of motion: Active, passive
- Manual muscle test
- Grip and pinch strength
- Modified Ashworth Scale (MAS)
- Self-care function
- Vision
- Cognition

Prior to treating the client, the therapist must gather pertinent data from the medical chart, including personal information, a medical diagnosis, and a history of other relevant medical information. Specific medical precautions will be obtained from the primary and consulting physicians. Skeletal instability and related injuries or medical complications will affect the way in which the client is moved and the active or resistive movements allowed.

Occupational Profile

The occupational profile is the key to the evaluation process and will help shape and guide all therapeutic interventions. It is developed in close collaboration between the therapist and the client and should include the following information about the client: (1) occupational history and life experiences; (2) patterns of daily living (i.e., daily life roles, typical day); (3) values, interests, and needs; and (4) current understanding of his or her issues and problems.[4] This information can be gathered formally through a structured interview or informally during casual conversation. Often it is helpful to involve the client's family and friends if the client is unable to participate; however, once the client is able to participate in the process, his or her input is prioritized.

Keeping the client's priorities, occupational goals, and desired outcomes central to the intervention plan will maximize the individual's engagement in the rehabilitation program, and the more physical aspects (body structure and body functions) will be put into perspective as underlying and supportive to these occupational goals.

Psychosocial Status

By gathering the information required to build the client's occupational profile and beginning OT interventions, the occupational therapist has the opportunity to learn about and observe the client's psychosocial adjustment to the disability and life in general through the nature of the activities and occupations in which the client participates.[42] The evaluation phase is important for establishing rapport and mutual trust, which will facilitate participation and progress in later and more difficult phases of rehabilitation. The client's motivation, determination, and contexts—including socioeconomic background, education, family support, personal attitudes toward disability, problem-solving abilities, and financial resources—can prove to be invaluable assets or limiting factors in determining the outcome of rehabilitation. A therapist must carefully observe the client's status in each of these areas before recommending the course of intervention.

Clinical Picture

Body Functions and Structures

A thorough physical assessment of a client with an SCI will address (1) sensory functions, (2) neuromusculoskeletal and movement-related functions (joint mobility and joint stability), (3) muscle functions (power, endurance, tone), (4) movement functions (control of voluntary movement motor skills, involuntary movement reactions, gait patterns), and (5) mental functions (cognition, affect). It is also important to understand how the SCI is affecting the individual's cardiovascular, respiratory, voice and speech, digestive, genitourinary, reproductive, and skin functions (refer to previous section on medical complications of an SCI).

Key sensory functions to be assessed include: pain, touch (light touch, superficial pain), and proprioception (see Chapter 23). Vision should be screened for impairment, particularly in clients with a dual diagnosis (SCI and traumatic brain injury) and in clients with C1-C4 tetraplegia in which there may have been trauma to the brainstem (see Chapter 24).

The presence or absence of pain must be established prior to and during each intervention. If pain is present, a quantifiable client self-report measure, such as the Numeric Rating Scale or Visual Analog Scale, should be used to establish severity and track changes in pain in response to therapeutic intervention (see Chapter 28). The OT must take careful note of how the client describes his or her pain in order to differentiate neuropathic pain (described as burning, stabbing, or tingling), musculoskeletal pain (usually gets worse with movement and improves with rest), and visceral pain (located in the abdomen).

Sensation is evaluated for light touch and superficial pain (pin prick) according to ISNCSCI guidelines and determines areas of absent, impaired, and intact sensation. These findings are useful in establishing the level of injury and determining functional limitations (see Fig. 36.1).[6] Proprioception and kinesthesia testing (particularly with incomplete lesions), stereognosis testing, and monofilament testing (particularly with peripheral nerve injuries) may also be indicated to obtain an accurate picture of upper extremity functional use.

Passive range of motion (PROM) and active range of motion (AROM) should be measured before specific manual muscle testing to determine available pain-free movement. This evaluation also identifies the presence of or potential for joint contractures, which could suggest the need for preventive or corrective splinting and positioning (see Chapter 21).

Accurate assessment of muscle power, or strength, is critical in determining a precise diagnosis of neurological and functional level and for establishing a baseline for physical recovery and functional progress. Because the occupational therapist's skills in activity analysis greatly enhance the therapist's effectiveness in treating the client with an SCI, a precise working knowledge of musculoskeletal anatomy and specific manual muscle testing techniques is essential. Use of accepted muscle testing protocols ensures accurate technique during performance of this complex evaluation. The muscle test should be repeated as often as is necessary to provide an ongoing picture of the client's strength and progress (see Chapter 22).

Muscular endurance, the muscle's ability to perform contractions repeatedly over time before fatigue sets in, is important to consider prior to planning interventions. Endurance is assessed by engaging the client in various activities or exercises and tracking the length of time that the specific muscle group can be used to continue the activity. For example, Jack was only able to feed himself three bites of his meal during his first self-feeding session. Over time his endurance increased, and after 1 week he was able to feed himself an entire meal (see Chapter 20).

Spasticity is rarely noted in the acute phase because the client is still in spinal shock. When spinal shock subsides, increased muscle tone may be present in response to stimuli. The therapist should then determine whether the spasticity interferes with or enhances function. Use of a quantifiable measure, such as the Modified Ashworth Scale (see Chapter 19), will help track changes in spasticity and help justify specific interventions.

An evaluation of wrist and hand movement function determines the degree to which a client can manipulate objects. Informal assessment of wrist and hand function is based on observation while the client interacts with and moves objects around their immediate environment. Note whether any compensatory strategies are being used to manipulate and grip objects, such as using a two-hand hold, using extreme ranges, weaving objects, dragging objects, using the teeth or a table to stabilize an object, and/or tenodesis.[18] This information is used to suggest the need for equipment such as positioning splints or universal cuffs or, later, consideration of a tenodesis orthosis (wrist-driven flexor hinge splint). Formal assessment of tetraplegic hand function is strongly recommended and can be used to track a client's progress over time and as an outcome measure in clinical research. Factors such as the client's upright sitting tolerance and adjustment to disability will influence the selection of the appropriate outcome measure. Information on websites such as *http://www.rehabmeasures.org* and *http://www.scireproject.com* can be used to guide selection of the most appropriate measure. Gross grasp and pinch measurements indicate functional abilities and may be used as an adjunct to manual muscle testing to provide objective measurements of baseline status and progress for clients who have active hand musculature.

Clinical observation is used to assess oral motor control, head control, trunk control (righting reactions and static/dynamic sitting balance), lower extremity functional muscle strength, and total body function. Additional variables, such as age, obesity, limb length, and general flexibility, could impact the client's ability to achieve independence and should be recorded. More specific assessment in any of these areas may be required, depending on the client's specific needs.

Mental (cognitive, affective, and perceptual) function should be screened in all individuals with an SCI. From 25% to 64% of individuals with an SCI have some degree of traumatic brain injury (TBI) and are referred to as having a "dual diagnosis."[27] Variables that may indicate the presence of a TBI include loss of consciousness at the time of injury, tetraplegia from a high-energy deceleration crash, evidence of brainstem or cortical damage, and/or the need for initial respiratory support.[27] Others may have a history of mental illness, such as schizophrenia, bipolar affective disorder, or depression, and still others may be showing early signs of age-related dementia. It is important to assess the client's ability to initiate tasks, follow directions, carry over learning day to day, and handle problem-solving tasks. Understanding the client's learning style, coping skills, and communication style is also essential and contributes to the information base necessary for appropriate and realistic goal setting (see Chapters 25, 26, and 34).

Due to the nature of Jack's injury (motor vehicle accident), a screening of mental function was completed both in the intensive care unit and on the inpatient rehabilitation unit. The OT in the intensive care unit noted that Jack required additional time to process new information and also verbal cues to carry over tasks between sessions, such as remembering to use his universal cuff to hold his fork. By the time Jack was transferred to inpatient rehabilitation, his affect had improved and he was able to consistently demonstrate carryover of new learning between treatment sessions.

Functional Status

Observing as the client performs ADLs is an important part of the OT evaluation. The purpose of this observation is to determine present and potential levels of functional ability. If the client is cleared of bed rest precautions, evaluation and simultaneous intervention should begin as soon as possible after injury. Light activities such as feeding, light hygiene at the sink, and object manipulation may be appropriate, depending on the level of injury (see Chapter 10). Performance is scored using outcome measures such as the Inpatient Rehabilitation Facility-Patient Assessment Instrument (IRF-PAI, also referred to as the Functional Independence Measure, or FIM) or the Spinal Cord Independence Measure (SCIM). Box 36.3 presents IRF-PAI scoring guidelines.

Box 36.3

Scoring of the Inpatient Rehabilitation Facility Patient Assessment Instrument (IRF-PAI)*

Score	Assistance Level Required
7	Independent (no helper)
6	Needs assistive device, additional time; safety concern (no helper)
5	Needs supervision or setup
4	Patient does at least 75% of task
3	Patient does 50% to 74% of task
2	Patient does 25% to 49% of task
1	Patient does less than 25% of task or requires assistance of two people
0	Activity does not occur

*This assessment is also referred to as the Functional Independence Measure (FIM).

Establishing Intervention Objectives

Establishing intervention objectives in concert with the client and the rehabilitation team is vital. The primary objectives of the rehabilitation team may not be those of the client. Psychosocial factors, cultural factors, cognitive deficits, environmental limitations, and individual financial considerations must be identified and integrated into a comprehensive intervention program that will meet the unique needs of each individual. Every client is different; therefore, a variety of intervention approaches and alternatives may be necessary to address each factor that may affect goal achievement.[15] Tools for client-driven goal setting, such as the Canadian Occupational Performance Measure (COPM),[29] should be used to aid the client in identifying and prioritizing occupations that are meaningful at this point in his or her rehabilitation. Increased participation can be expected if the client's priorities are respected to the extent that they are achievable and realistic.

General objectives for OT intervention with the individual with an SCI are as follows:

1. Maintain or increase joint ROM and prevent problems associated with body functions and other body structures (skin) via preparatory activities, such as active and passive ROM, splinting, positioning, and client education.

2. Increase the strength of all innervated and partially innervated muscles and address problems associated with other body functions (e.g., sensation, higher level cognitive functions, psychosocial functions) through preparatory activities and engagement in purposeful activities and occupations.

3. Increase physical endurance and other performance skills and performance patterns through engagement in purposeful activities and occupations.

4. Maximize independence in performance in all areas of occupation, including ADLs, IADLs, rest and sleep, education, work, play, leisure, and social participation.

5. Aid in the psychosocial adjustment to disability.

6. Evaluate, recommend, and educate the client in the use and care of necessary durable medical and adaptive equipment.

7. Ensure safe and independent home and environmental accessibility through consultation and safety and accessibility recommendations.

8. Assist the client in developing the communication skills necessary for training caregivers to provide safe assistance.

9. Educate the client and family regarding the benefits and consequences of maintaining healthy and responsible lifestyle habits in relation to long-term function and the aging process.

Occupational Therapy Intervention

Phases of Recovery

Occupational therapists provide services across the continuum of care for individuals with an SCI. The acute care phase begins in the intensive care unit and is the time when the individual is most medically fragile. Once the client is medically stable, the post-acute/rehabilitation recovery phase begins; it is during this phase that the individual receives intense inpatient therapy (at least 3 hours a day, 5 to 6 days a week). The length of time spent in the post-acute/rehabilitation recovery phase is dependent on many factors and varies from individual to individual. The outpatient rehabilitation phase begins after discharge from acute/post-acute hospitalization and can take place in a variety of settings, including clinics, private or group homes, and specialty gyms. Beyond the outpatient phase, lifetime follow-up emphasizes keeping clients healthy and active.

Acute Phase

The role of the occupational therapist in the acute care setting with individuals with an SCI includes preserving joint integrity and mobility with positioning and early mobilization, restoring function through self-care training, initiating education and training of families and caregivers, and coordinating care, including preparation for transition to the next level of care.[2] The OT evaluation during this phase will give priority to determining the baseline neurological, clinical, and functional status from which to formulate an early intervention program. While initially addressing these critical physical client factors, the OT can be simultaneously engaging the client in an occupational profile, learning the client factors related to values, beliefs, and spirituality, along with the areas of occupation that comprise and give meaning to the client's life. Medical precautions must be followed at all times. The individual may be in traction, wearing a stabilization device (e.g., halo brace or body jacket), or have limitations on joint mobility and body movement.

Preservation of joint integrity and mobility includes an evaluation of total body positioning and hand splinting needs. For individuals with tetraplegia, the arms should be intermittently positioned in 80 degrees of shoulder abduction, external rotation with scapular depression, and full elbow extension to prevent the development of ROM limitations and shoulder pain (Fig. 36.4). Hand splints are introduced when muscle strength is not adequate to support the wrist and hands properly. If wrist extension strength is less than 3+/5 (Fair+/Normal), a splint that supports the wrist at neutral, keeps the thumb in opposition to maintain the thumb web space, and allows the fingers to flex slightly at the metacarpophalangeal (MP) and proximal interphalangeal (PIP) joints should be used (Figs. 36.5 and 36.6). If wrist extension strength is 3+/5 (Fair+/Normal) or greater, a short opponens splint should be considered to maintain the web space and support the thumb in opposition (Fig. 36.7). This splint can be used functionally while the client is trained to use a tenodesis grasp. Passive, active-assisted, and active ROM of all joints should be performed within strength, ability, and tolerance levels. Muscle reeducation techniques for the wrists and elbows should be used when indicated. Light progressive resistive exercises may be introduced as permitted by the medical team. During this time families and caregivers can be trained to assist with ROM exercises, splint use, and skin inspection.

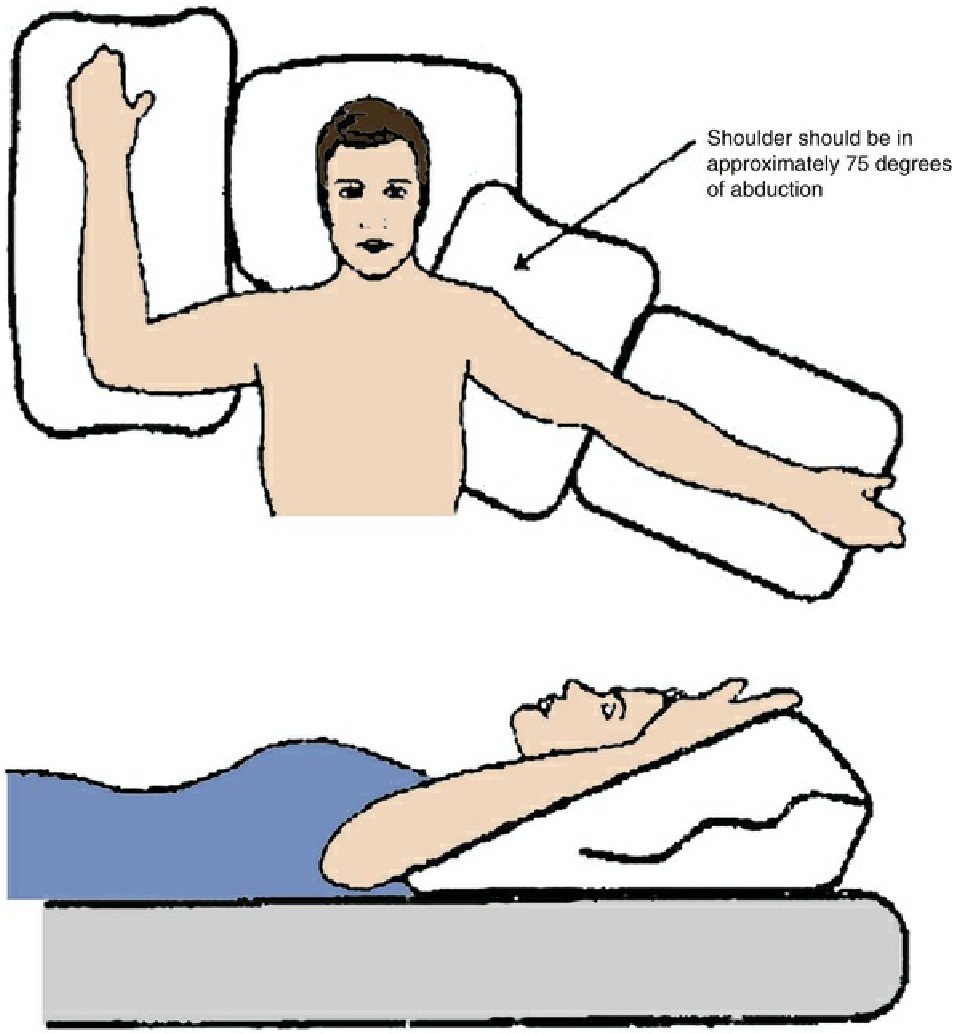


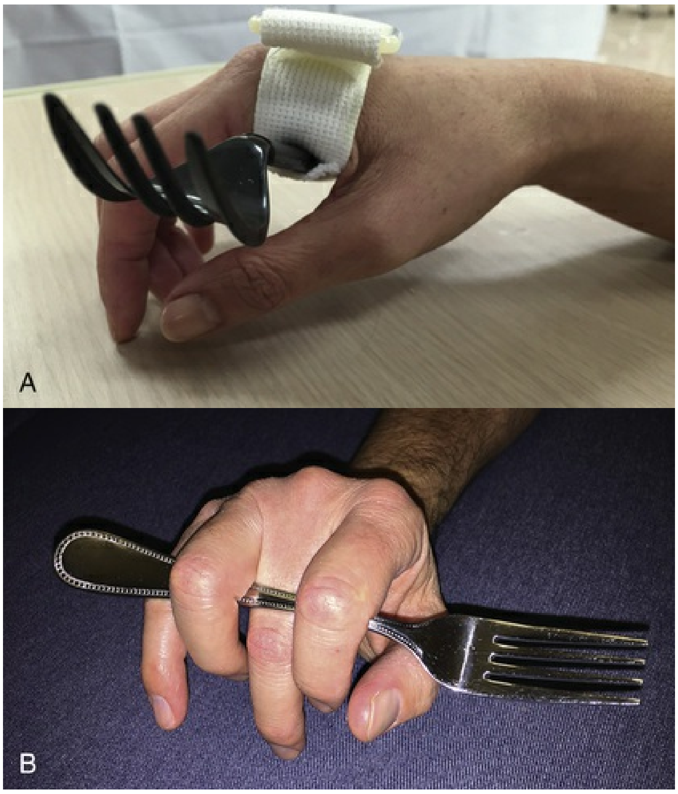
FIG 36.4 Supine bed positioning for individuals with tetraplegia. Using pillows: (1) Position arm out to the side in approximately 75 degrees of abduction. (2) Position other arm out to the side, hand back above the head, arm in abduction and external rotation, elbow bent. (3) Place pillows on either side of the legs with the railings up to help maintain the legs in a neutral position. (4) Place a pillow under the head and shoulders so that the head is not pushed forward. (Courtesy Rancho Los Amigos National Rehabilitation Center, Downey, CA.)

FIG 36.5 Resting hand splint. (Courtesy AliMed, Dedham, MA.)

FIG 36.6 Wrist support. (Courtesy Performance Health, Warrenville, IL.)

FIG 36.7 Thumb opponens splint. (Courtesy Rancho Los Amigos National Rehabilitation Center, Downey, CA.)

The client should be encouraged to engage in self-care activities (e.g., self-feeding, hygiene) using simple devices such as a universal cuff or built-up handle (Fig. 36.8). When indicated, access to bedside activities that might be of interest to the client, such as modified call systems, laptop computer setup on bedside tables, and avocational activities, can be explored. Even though the client may be immobilized in bed, discussion of anticipated durable medical equipment (DME), home modifications, and caregiver training should be initiated to allow sufficient time to prepare for discharge or transition to inpatient rehabilitation.



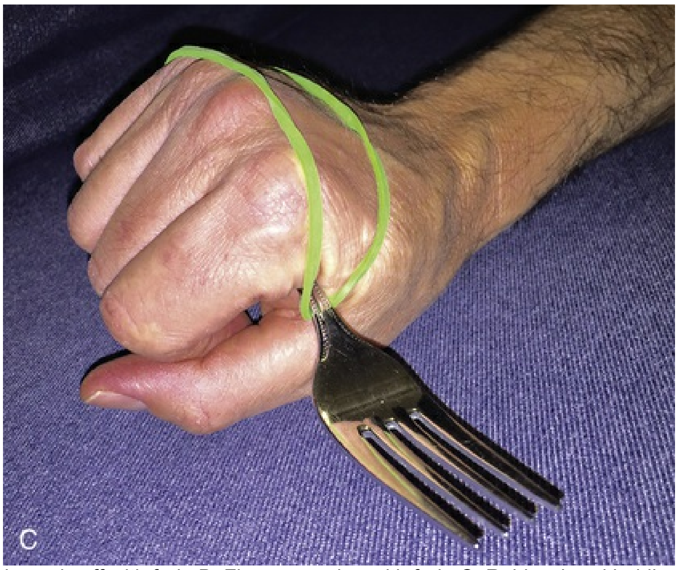


FIG 36.8 A, Universal cuff with fork. B, Finger weaving with fork. C, Rubber-band holding utensil. (Courtesy Rancho Los Amigos National Rehabilitation Center, Downey, CA.)

While Jack was in acute care, the OT assessed his arm strength and determined that he would benefit from bilateral short opponens splints. His parents were trained in passive and active-assisted ROM exercises. He was given a universal cuff for self-feeding and a stylus to access his tablet device.

Post-Acute Phase: Inpatient Rehabilitation

Some individuals will be transitioned to inpatient rehabilitation within the same facility and will require a quick reassessment of physical status. Others will be transferred from an acute care setting to a new facility for inpatient rehabilitation and will require a thorough OT evaluation. And still others may be admitted from skilled nursing facilities or from home; these individuals may be several months past their initial injury and are likely to have developed secondary complications, such as pressure ulcers and joint contractures. In all cases the beginning of the inpatient rehabilitation program is an opportunity for the OT to introduce the importance of self-management and to collaborate with the individual with an SCI in setting realistic and attainable goals.

Self-management skills, including being proactive, self-monitoring, problem solving, communicating effectively, staying organized, and managing stress, are emphasized by the rehabilitation team and taught by OT in individual and group sessions.[33] These skills have been found to be effective in increasing self-efficacy and improving health status and behaviors, decreasing pain, increasing compliance with medication programs, and decreasing overall healthcare costs.[33] These skills are essential to independence for all individuals with an SCI.

SCI education is integrated into every facet of the rehabilitation program and can be provided in many ways, including individual, small, or large group sessions; written materials, video, and online resources; and through peer mentors. Because individuals learn differently, it is important to identify the client's preferred learning style. Some topics to highlight for the individual with an SCI include transportation and driving resources, emergency preparedness, community resources, nutrition, finance management, how to select and direct caregivers, bladder management, bowel management, skin care and pressure relief, autonomic dysreflexia, pain management, and sexuality.

High tetraplegia/quadriplegia (C1-C4).

The intervention and equipment needs of clients with a high-level SCI (C4 and above) are unique and extremely specialized. Individuals with C1-C3 AIS A will be ventilator dependent and require total *physical* assistance from a caregiver to complete ADLs; however, these clients may be considered *independent in living* if they are able to direct a personal care assistant to satisfactorily assist them.[4] Individuals with C4 AIS A will initially be ventilator dependent and require total physical assistance from a caregiver to complete ADLs but may progress to breathing on their own and using equipment for self-feeding, such as a hand-free hydration system. Key muscles that may be innervated at the C1-C3 level include the sternocleidomastoid, platysma and cervical paraspinals; key muscles at the C4 level include the upper trapezius and diaphragm (Table 36.1).

TABLE 36.1

Common Functional Goals for Individuals With a Complete Spinal Cord Injury

Level of Injury	Physical Abilities	Functional Goals	Equipment Used
C1-C3	C3—Limited movement of head and neck	**Breathing:** Depends on ventilator for breathing.	Suction equipment to clear secretions, two ventilators with backup generator and battery
		Communication: Talking is sometimes difficult, very limited, or impossible. If the ability to talk is limited, communication can be accomplished with adaptive equipment.	Mouth stick and assistive technology (e.g., computer, communication board) for speech or typing
		Daily tasks: Requires full assistance from caregiver for turning in bed, transfers, and all self-care (including bowel and bladder management). Assistive technology can allow for independence in such tasks as reading a book or newspaper, using a telephone, and operating lights and appliances.	Mouth stick, environmental control unit (ECU)
		Mobility: Can operate an electric wheelchair by using a head control, mouth stick, sip and puff, or chin control. Power tilt function on wheelchair allows independence in pressure relief.	Power or manual lift, electric or semielectric hospital bed, power wheelchair with pressure-relieving cushion
C3-C4	Usually has head and neck control; with injury at C4 level, may shrug shoulders	**Breathing:** May initially require a ventilator for breathing; usually adjusts to breathing full time without a ventilator.	Cough-assist device
		Communication: Normal	
		Daily tasks: Requires full assistance from caregiver for turning in bed, transfers, and all self-care (including bowel and bladder management). May be able to use adaptive equipment to eat independently. May also be able to operate an adjustable bed and perform other tasks, such as painting, writing, typing, and using a telephone with assistive technology.	**Eating:** Sandwich holder on a gooseneck, feeder, long straw for liquids **Other activities:** ECU for operating bed (e.g., head or voice activated, mouth stick controller), hands-free devices, mouth stick for typing
		Mobility: Can operate a power wheelchair by using head control, a mouth stick, sip and puff, or chin control. Power tilt function on wheelchair allows for independence with pressure relief.	Power or manual lift, electric or semielectric hospital bed, power wheelchair with pressure-relieving cushion
C5	Typically has head and neck control, can shrug shoulders, and has some shoulder control; can bend elbows and turn palms up	**Daily tasks:** With specialized equipment, can be independent with eating and grooming (e.g., face washing, oral care, shaving, makeup application) after setup by caregiver. Requires total assistance from caregiver for bed mobility, transfers, and all other self-care. With adaptive equipment, may be able to assist caregiver with upper body dressing and some bathing.	**Eating:** Universal cuff for attachment of utensils, scoop plate, plate guard, long straw **Grooming:** Universal cuff for attachment of toothbrush, comb, or brush; adapted or electric razor, makeup applicators; wash mitt for face **Bathing:** Roll-in padded shower and commode chair, or padded tub transfer bench; wash mitt; adapted loofah
		Healthcare: Requires assistance from caregiver for cough assist. Can perform pressure relief with power tilt in power wheelchair.	Cough assist
		Mobility: May have strength to push a manual wheelchair for short distances over level surface; however, a power wheelchair with hand controls is required for daily activities. At this level, may be able to drive with specialized hand controls in a modified van with a lift, but still may require attendant to assist with transportation.	**Wheelchair:** Power or manual lift, electric or semielectric hospital bed, power wheelchair with pressure-relieving cushion **Bed:** Bed ladder, thigh straps, and bed rails for bed mobility
		Bowel and bladder management: Requires total assistance from caregiver for bowel and bladder management. May have indwelling catheter, or caregiver may perform intermittent catheterization for bladder management. Bowel management involves specialized equipment or medication.	**Bowel:** Roll-in padded shower and commode chair, or padded transfer tub bench **Bladder:** Leg bag emptier
C6	Has movement in head, neck, shoulders, arms, and wrists; can shrug shoulders, bend elbows, turn palms up and down, and extend wrists	**Daily tasks:** With some specialized equipment and setup by caregiver, can be independent with most feeding, grooming, and upper body dressing. Still requires some assistance for lower body dressing. and is able to assist with upper body during bathing. With some or total assist from caregiver, can perform sliding board transfers to padded shower commode chair and/or tub bench for toileting and bathing. Can perform some light meal preparation tasks.	**Feeding:** Universal cuff, built-up utensils, scoop plate, long straw, plate guard **Grooming:** Universal cuff, adapted electric razor or toothbrush **Dressing:** Dressing stick, leg lifter, thigh straps, dressing hook splints, adapted or specialized clothing **Bathing:** Adapted loofah, long-handled sponge with universal cuff **Transfers:** Power or manual lift, sliding board, padded drop-arm bedside commode, padded tub bench with cutout, padded shower and commode chair
		Healthcare: Can independently perform pressure relief with power tilt; may require some or no assist for forward or lateral lean pressure relief.	
		Mobility: With use of special equipment, may require some or no assist for turning in bed. With some or no assistance from caregiver, may be able to perform sliding board transfers on level surfaces. Can use a ultralight manual wheelchair for mobility, but some may use a power wheelchair for greater ease over uneven terrain. Can be independent driving a power wheelchair or with manual wheelchair propulsion with specialized equipment.	**Bed:** Bed ladder, thigh straps, bed rails **Wheelchair:** Wheelchair pegs, specialized wheelchair gloves, and rubber tubing on wheels. Also, power-assist wheels can be used for independence with manual wheelchair propulsion **Transportation:** Modified van with lift, specialized hand controls, tie-downs
		Bowel and bladder management: Requires some or total assist with adaptive equipment for management of bowel and bladder.	**Bowel:** Digital stimulation splint device, enema insertion device **Bladder:** Catheter inserter, penis positioner, thigh spreader with mirror
C7-T1	Has movement similar to C6 level, with added ability to straighten elbows. With injury at C8-T1 level, has added strength and precision of hands and fingers	**Daily tasks:** With equipment, is independent with all feeding, grooming, and upper body dressing. May require some or no assistance with lower body dressing and bathing with equipment. With some or no assistance, can perform sliding board transfers to padded shower commode chair and/or tub bench for toileting and bathing.	**Feeding:** Universal cuff, built-up handles, curved utensils, long straw, plate guard, adapted techniques for grasp **Grooming:** Universal cuff, splint material to adapt devices **Dressing:** Leg lifter, dressing stick, zipper pull, hooks on shoes **Bathing:** Adapted loofah, long-

			handled sponge with universal cuff **Transfers:** Sliding board, padded drop-arm bedside commode, padded tub bench with cutout, padded shower and commode chair
		Healthcare: Independent with wheelchair pushup or lateral lean for pressure relief.	
		Mobility: Independent with manual wheelchair propulsion and level surface sliding board transfers. May require some assistance from caregiver for uphill transfers. Can be independent with driving if able to load and unload wheelchair.	**Wheelchair:** Rigid or folding lightweight wheelchair, wheelchair pegs, wheelchair gloves **Transportation:** Hand controls, modified van if unable to perform transfer or load/unload chair
		Bowel and bladder management: Depending on hand function, requires some or total assist for bowel management, with use of adaptive equipment or medication. Can be independent or need some assist for bladder management with ICP or condom catheter.	**Bowel:** Digital stimulation splint device, enema insertion device, toileting aid **Bladder:** Catheter inserter house hold (for men), thigh spreader with mirror (for women)
T2-T12	Has normal function in head, neck, shoulders, arms, hands, and fingers. Has increased use of rib and chest muscles, or trunk control. At the T10-T12 level, more improvements in trunk control due to increase in abdominal strength	**Daily tasks:** Independent with self-care, including bowel and bladder management, with adaptive equipment if necessary.	**Dressing:** Thigh straps, reacher, dressing stick, sock aid **Bathing:** Long-handled sponge **Transfers:** Sliding board, padded drop-arm bedside commode, padded tub bench with cutout, padded shower/commode chair **Bowel/bladder:** Mirror
		Healthcare: Independent with wheelchair pushup for pressure relief.	
		Mobility: Independent with all bed mobility and transfers, with or without use of equipment. Independent with wheelchair propulsion on uneven and even surfaces and up and down curbs. Able to load and unload wheelchair independently for driving with hand controls.	**Wheelchair:** Ultra-lightweight wheelchair **Transfers:** Sliding board, leg straps **Transportation:** Hand controls
L1-L5	Has additional return of motor movement in hips and knees	**Mobility:** Independent with all bed mobility and transfers, with or without use of equipment. Independent with wheelchair propulsion on uneven and even surfaces and up and down curbs. Can ambulate with specialized leg braces and walking devices. Functionality of ambulation depends on strength and movement in legs. Ability to ambulate depends primarily on individual's level household distances. May use a wheelchair for community mobility. Able to load and unload wheelchair independently for driving with hand controls.	**Wheelchair:** Ultra-lightweight wheelchair if necessary **Walking:** Leg braces that extend to the hip, the knee, or just the ankle/foot and varying assistive devices **Transportation:** Hand controls
S1-S5	Depending on level of injury, various degrees of return of voluntary bladder, bowel, and sexual function	**Mobility:** Increased ability to walk with fewer or no bracing or assistive devices.	**Walking:** Braces that support ankle/foot

Adapted from the Model Systems Knowledge Translation Center (MSKTC): Understanding spinal cord injury. II. Recovery and rehabilitation. www.msktc.org.

TABLE 36.2
Levels of Spinal Cord Injury and Key Muscles Affected

Level of Injury	Key Muscles Affected
C1-C3	Sternocleidomastoid, cervical paraspinal, neck accessories
C3-C4	Upper trapezius, diaphragm, cervical paraspinal muscles
C5	Deltoid, biceps, brachialis, brachioradialis, rhomboids, serratus anterior (partially innervated)
C6	Clavicular pectoralis supinator, extensor carpi radialis longus and brevis, serratus anterior, latissimus dorsi
C7-T1	Latissimus dorsi; sternal pectoralis; triceps; pronator quadratus; extensor carpi ulnaris; flexor carpi radialis; flexor digitorum profundus and superficialis; extensor communis; pronator/flexor/extensor/abductor pollicis; lumbricals [partially innervated]; intrinsics of the hand, including thumbs and lumbricals; flexor/extensor/abductor pollicis
T2-T12	Internal and external intercostals, erector spinae
L1-S5	Fully intact abdominals and all other trunk muscles; depending on level, some degree of hip flexors, extensors, abductors, adductors; knee flexors, extensors; ankle dorsi, flexors, plantar flexors

Individuals with high tetraplegia begin to develop upright sitting endurance when medically stable and will require a tilt-in-space or recliner wheelchair with room to accommodate a ventilator. A mechanical lift or dependent transfer technique is used to move the individual between surfaces (e.g., between bed and wheelchair, wheelchair and car) and a pressure-relieving cushion is required. Opportunities for education include teaching the client and family members about dependent pressure relief techniques, orthostatic hypertension, and proper body mechanics.

Upper extremity management for the individual with high tetraplegia includes evaluating neck and arm positioning in bed and in the wheelchair. As in the acute rehabilitation phase, while the client is in bed, the arms should be intermittently positioned in 80 degrees of shoulder abduction, external rotation with scapular depression, and full elbow extension to assist in preventing the development of ROM limitations and shoulder pain. A lap tray, bilateral arm troughs, or pillows can be used to support the arms with the elbow at 90 degrees while the client is in the wheelchair; remember to consider what will happen to arm position when the individual is reclined or tilted back for a pressure relief. The use of hand splints is continued to maintain available ROM.

Passive and active-assisted/active ROM is started for both the neck and arms to maximize strength in available musculature in preparation for participation in functional activities and to prevent undesirable contractures. Mouth stick training is started, and activities are chosen to reflect each client's functional goals. Card games, drawing, painting, page turning, and typing are some activities that may be used to improve neck ROM and endurance.

Paul, Jack's roommate, a 25-year-old with a C4 AIS A injury secondary to a gunshot wound, had expressed a goal of being able to use his iPad to communicate with friends and family. At the beginning of his rehabilitation program, he was only able to shrug his shoulders and slightly turn his head. To strengthen these muscles, mouth stick training was initiated. His iPad was placed on a mounting device, and he was given a mouth stick stylus to interact with the touch screen surface. A mouth stick docking station was positioned so that he could independently set the stylus down when he needed to rest. As his neck strength and active ROM increased, his therapist challenged him by changing the position of the iPad and docking station and providing more challenging activities, such as typing emails and navigating the Internet.

Paul had also expressed a goal of being able to attend his daughter's first birthday party. The OT used this goal as a springboard to motivate Paul to learn to direct his care needs, including bladder and bowel management, charging his ventilator and wheelchair batteries, organizing accessible transportation, and understanding the purpose and timing of medications.

Assistive technology can be used to enhance performance skills (e.g., typing with a mouth stick to increase neck ROM and endurance) or as preparatory methods and tasks used concurrently with occupations and activities (e.g., using a laptop with voice recognition software to complete a homework assignment for school).[3] Commercially available products, such as smart phones, electronic readers, and laptop computers, many with built-in accessibility options, have greatly enhanced the options available to high-level tetraplegics, as have resources such as free adaptive telephone programs and technology lending libraries. If available, an assistive technology specialist can help determine the appropriate equipment to assist the client in reaching both short- and long-term occupational goals.

Specialized equipment, such as turning mattresses, bathing equipment (e.g., inflatable bed bath or padded tilt-in-space and reclining commode chair), and power wheelchairs should be used on a trial basis during the rehabilitation phase. Individuals with C1-C4 SCI can be independent with operating a power wheelchair using a head control, sip-and-puff, or chin control and can be independent with pressure relief when using a power tilt-in-space wheelchair (Fig. 36.9). Accessible transportation options (e.g., a van with a lift) and community transportation services are introduced. Funding resources and grant opportunities should be explored to assist the clients in obtaining this equipment. A home visit with the client as early as possible in the rehabilitation phase helps identify architectural barriers and helps the client and family prepare for discharge.

FIG 36.9 Wheelchair skills, including navigating curb cuts and uneven surfaces, are practiced during an OT-led community outing.

Tetraplegia (quadriplegia)/high paraplegia (C5-T1).

Individuals with C5-T1 tetraplegia will require varying degrees of caregiver assistance (Table 36.2). Key muscles at the C5 level include deltoids and biceps. Individuals with C5 AIS A will be dependent on caregivers for bed mobility. Bed and wheelchair positioning is similar to that of individuals with C1-C4 injuries with one exception: these individuals are at high risk for elbow flexion and supination contractures and their forearms should be positioned in pronation. Elbow extension splints and/or pronation splints may be necessary to maintain ROM as spasticity increases. Splinting or casting of the elbows may be indicated to correct contractures that are developing. Support should also be provided for the wrist and hand; a wrist support can be used during the day and a resting hand splint at night (see Fig. 36.5).

Upper extremity management will include daily passive and active-assisted ROM and activities to maximize strength. Progressive resistive exercise can be introduced through the use of upper extremity skateboard tables. Mobile arm supports are used both to strengthen weak shoulders and elbow flexors and to increase independence in desired tasks. (See the case study for Matt in Chapter 30 to learn about an individual with C4 AIS A with C5 return who uses mobile arm supports and adaptive equipment to engage in his desired occupations, including feeding, computer use, and environmental control.)

The use of adaptive equipment will allow an individual with C5 AIS A to be independent with self-care tasks such as self-feeding and grooming after setup by the caregiver. Key adaptive equipment introduced at the C5 AIS A level includes wrist support used in conjunction with a universal cuff, scoop dish, long straw, swivel spork, long-handled utensils, long-handled comb/brush, Wanchik writer, wrist support, and mobile arm support. Independence in power wheelchair mobility can be achieved using hand controls; adequate trunk support must be provided, and a mobile arm support may initially be used to facilitate driving with a joystick control.

Individuals with C6 AIS A tetraplegia, such as Jack, will have expected functional outcomes that reflect greater independence from caregivers. Key muscles at the C6 level include the extensor carpi radialis brevis, extensor carpi radialis longus, clavicular pectoralis, and serratus anterior. The serratus anterior stabilizes and assists with rotating the scapula, allowing for better control and endurance when flexing the glenohumeral joint, as in putting a T-shirt over one's head. The clavicular pectoralis allows for horizontal adduction, enabling crossing of the midline and assisting with rolling in bed, turning a steering wheel, and participating in some bimanual activities. Elbow contractures should never be allowed to develop. Full elbow extension is essential for allowing propping to maintain balance during static sitting and for assisting in transfers. With zero triceps strength, an individual with C6 AIS A tetraplegia can maintain forward sitting balance by shoulder depression and protraction, external rotation, full elbow extension (“locked elbows”) and full wrist extension. Special care should be taken to preserve tenodesis during sliding board transfers and sitting balance activities (Fig. 36.10).

FIG 36.10 Individual with C6 AIS A preserving tenodesis grasp during sitting balance activities. (Courtesy Rancho Los Amigos National Rehabilitation Center, Downey, CA.)

The presence of wrist extension allows a functional tenodesis grasp: when the wrist is extended, the fingers automatically flex and allow the individual to grasp objects (Fig. 36.11). It is desirable to develop some tightness in the long finger flexor tendons in order to give some additional tension to the tenodesis grasp and to maintain the thumb interphalangeal (IP) joint in extension in order to attain alignment of the thumb to the index finger. Tenodesis is maintained by ranging finger flexion with the wrist fully extended and finger extension with the wrist flexed, thus never allowing the flexors or extensors to be in full stretch over all of the joints that they cross (Fig. 36.12).[31] Wrist extensors should be strengthened to maximize natural tenodesis function. Those who have weak wrist movement may use a wrist-driven wrist/hand orthosis, sometimes referred to as a tenodesis hand splint, to properly position their fingers for palmar prehension or a three-jaw chuck pinch (thumb with index and middle fingers) (Fig. 36.13). Neuromuscular electrical stimulation can also be used to strengthen weak wrist extensors.[8]

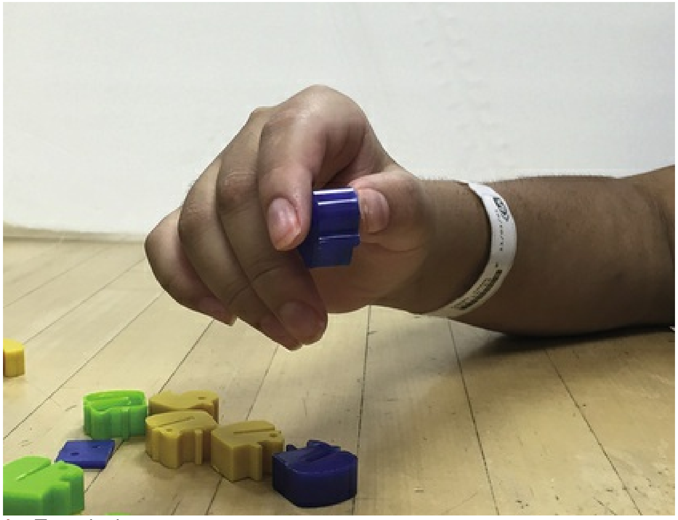


FIG 36.11 Tenodesis grasp. (Courtesy Rancho Los Amigos National Rehabilitation Center, Downey, CA.)

FIG 36.12 Tenodesis ranging. (Courtesy Rancho Los Amigos National Rehabilitation Center, Downey, CA.)

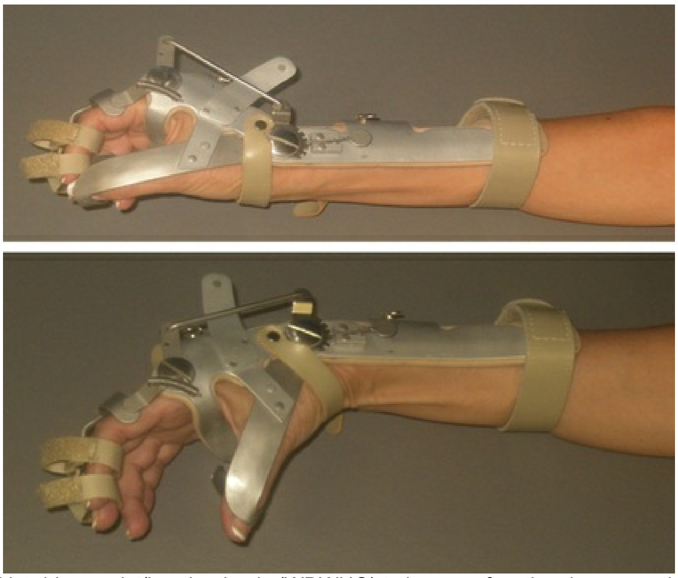


FIG 36.13 Wrist-driven wrist/hand orthosis (WDWHO) to improve functional grasp and pinch. (Courtesy Rancho Los Amigos National Rehabilitation Center, Downey, CA.)

Functional goals for the individual with C6 AIS A range from setup with adaptive equipment to independent for self-feeding, grooming, and upper body dressing. Adaptive equipment to be considered includes a universal cuff, scoop dish, built-up utensils, and a buttonhook. Some to total assistance will likely be required for lower body dressing, toileting, and bathing. Adaptive equipment such as a dressing stick, leg lifter, adapted long-handled sponge, wash mitt, padded tub bench, or padded rolling commode chair may be considered. Simple adaptations can be made to clothing, including widening the button hole, adding loops at the waist band, and using zip ties as zipper pulls to limit the use of adaptive equipment.

During Jack's inpatient rehabilitation stay he was introduced to the peer-mentoring program on the SCI unit. The peer mentors, individuals with an SCI who have completed their own rehabilitation programs and received specialized training, were instrumental in facilitating Jack's adjustment to his SCI. The peer mentors offered Jack motivation and emotional support, demonstrated self-care and body handling skills during therapy sessions, and shared valuable resources and experiences. After watching a peer mentor with a similar level of SCI demonstrate independence in lower body dressing on a standard bed and independence with depression transfers, Jack became more motivated and confident during therapy sessions, pushing himself outside of his comfort zone and challenging his problem-solving and body-handling skills.

Individuals with C7-T1 AIS A injuries will show greater independence with self-care tasks and mobility (see Table 36.2). Key muscles at the C7 level include triceps and latissimus dorsi. The triceps muscle gives individuals the ability to extend their elbows and reach overhead; the combination of triceps and latissimus dorsi allows shoulder depression, which assists with sitting balance, transfers, pressure relief, and bed mobility. Key muscles at the C8-T1 level include the flexor carpi radialis, extrinsic thumb and finger musculature, and intrinsic thumb and finger musculature. The addition of these muscles gives greater strength, control, and precision to the hands and fingers.

Upper extremity management for individuals with a C6-T1 level of injury includes strengthening through a variety of interventions, including the use of occupations (e.g., completing a morning routine, including feeding and dressing oneself), activities (e.g., playing a game of dominoes with a friend, preparing fruit smoothies), preparatory methods (e.g., daily ROM, the use of physical agent modalities such as neuromuscular electrical stimulation), and preparatory tasks (e.g., therapy putty, resisted clothespins, exercise bands). Progressive resistive exercise and resistive activities can be applied to both innervated and partially innervated muscles. Shoulder musculature is strengthened so as to promote proximal stability, with emphasis on the serratus anterior, latissimus dorsi (shoulder depressors), deltoids (shoulder flexors, abductors, and extensors), and the remainder of the shoulder girdle and scapular muscles. The triceps, pectoralis, and latissimus dorsi muscles are strengthened to increase independence with transfers and pressure relief when the client is in the wheelchair. Strengthening the intrinsic and extrinsic hand musculature is emphasized to create a stronger grasp and pinch. The intervention program should be graded to increase the amount of resistance that can be tolerated during activity. As muscle power and endurance improve, increasing the amount of time in wheelchair activities will help the individual participate in activities and occupations throughout the day.

Principles of energy conservation, in addition to self-management techniques, are important to introduce to individuals with C5-T1 tetraplegia. Jack, for example, can become capable of performing the majority of his self-care, including dressing and bathing, but these tasks require a considerable amount of time and energy for him to complete. On days when he will need to be at work or attend classes, he may choose to have a caregiver come early to help him complete his self-care routine.

Individuals with a C6-T1 level of injury are expected to be independent with pressure relief over time. If the individual with a C6 level of injury has at least 3+/5 shoulder and elbow flexor strength bilaterally, pressure can be relieved on the buttocks by leaning the client forward over the feet. Simple cotton webbing loops are secured to the back frame of the wheelchair. A person who has low tetraplegia (C7 with 3+/5 or better triceps) or paraplegia with intact upper extremity (UE) musculature can perform a full depression weight shift off the arms or wheels of the wheelchair. Some clients with C6 tetraplegia can also perform this type of weight shift by mechanically locking the elbows in extension while simultaneously externally rotating the shoulders and using their strong shoulder muscles to support their weight. Pressure relief should be performed every 30 to 60 minutes until skin tolerance is determined.

Paraplegia (T2-T12, L1-L5).

Individuals with paraplegia have normal function of the head, neck, and upper extremities and in general have functional goals of independence for all self-care tasks, wheelchair mobility, and health management (see Table 36.1). Factors that may influence goal setting during inpatient rehabilitation include obesity, length of limbs, body handling, spasticity, age, flexibility/ROM, endurance, and psychosocial adjustment. The rate at which these individuals achieve their goals may also vary. For example, individuals with T2-T9 paraplegia have weak or no trunk control, which directly affects their sitting balance, reach, and ability to complete bimanual activities. Individuals with T10-T12 and L1-L5 paraplegia have intact trunk control and will have a reduced fear of falling, a better base of support with increased stability, and an increased ability to perform bimanual activities.

Self-care interventions typically begin at the bed level and progress to the wheelchair level. Modified techniques are introduced to enable an individual to perform tasks efficiently. Adaptive equipment such as a reacher, dressing stick, sock aid, or leg lifter may initially be necessary to accomplish tasks; however, every attempt should be made to have the client perform the task with no equipment or with as little equipment as possible. Some common progressions for self-care include:

- *Lower body dressing:* Begin in the hospital bed with the head of the bed elevated. As sitting balance and bed mobility improve, progress to using a flat bed with the bed rails up and then with the rails down (Fig. 36.14). If possible, practice on a regular bed (similar to the bed the client will have at home). Once bed level dressing has been mastered, have the individual try from the wheelchair. Note that skin inspection using a mirror must be integrated into the client's daily self-care routine.

FIG 36.14 Paraplegic lower body dressing on a flat surface. (Courtesy Rancho Los Amigos National Rehabilitation Center, Downey, CA.)

- *Bathing:* Initially bathing will be performed at bed level. Once the individual has adjusted to upright sitting, have him or her shower using a padded rolling commode chair. As dynamic sitting balance and transfer skills improve, progress to using a padded tub bench. If a sliding board is used for wet tub/shower transfers, the sliding board should be covered with a pillowcase and the client should be instructed to complete a series of depression lifts across the board. Equipment needs may include grab bars, a handheld shower hose, and a long-handled sponge. The discharge bathroom setup will guide the selection of bathing equipment.
- *Bowel management:* Initially the bowel program will be performed at bed level for suppository insertion, perineal care, and clothing adjustment. As dynamic sitting balance and transfer skills improve, progress to using a padded rolling commode chair or a padded, height-adjustable commode chair placed over the toilet. Equipment needs may include a mirror, suppository inserter, digital stimulator, and toilet paper aid (see Chapter 10 for additional methods).

UE management for individuals with paraplegia will focus on strengthening and endurance in order to achieve the clients' functional goals of independence. As with individuals with tetraplegia, occupations, activities, preparatory methods, and tasks will be used and will be specific to each individual. Shoulder preservation strategies should be incorporated into therapy sessions and home exercise programs. The clinical practice guideline established by the Consortium for Spinal Cord Medicine, “Preservation of Upper Limb Function Following Spinal Cord Injury: A Clinical Practice Guideline for Health-Care Professionals,” is a comprehensive resource for this purpose.[13]

Vanessa, another client undergoing rehabilitation with Jack and Paul, is a 19-year-old college student who was injured in a motor vehicle accident and has a T10 AIS A SCI. Her goals for inpatient rehabilitation were established with her OT using the COPM. They include being able to get dressed by herself, meet friends for coffee, and return to college. Early in her inpatient stay, Vanessa and her OT went on a community outing to a nearby coffee shop. During the outing Vanessa worked on endurance training, community safety, and wheelchair skills. One week prior to discharge, Vanessa, her OT, and her PT went on an outing to her college. To prepare for this outing, Vanessa focused on being independent with bladder management from the wheelchair in a public restroom and being able to place items in a backpack on her wheelchair. She also researched resources available through her college to assist persons with disabilities.

Community reintegration activities, such as those completed with Vanessa, are an essential component of the OT program. These activities provide opportunities not only for practicing skills learned in therapy sessions, but also for psychosocial adjustment, client/caregiver training, and collaboration with interdisciplinary team members. Restaurant outings, work site visits, school visits, grocery store outings, and leisure activities, such as going to the movies, fishing, and going to the park, are just some of the possibilities (Fig. 36.15). These outings also provide opportunities for Jack, Paul, and Vanessa to support each other's accomplishments and to share ideas for solutions, in addition to their feelings about reintegration into the community. The OT leading the outing is in a perfect position to facilitate discussions as they arise.

FIG 36.15 Patients practice grocery shopping skills during a community outing with an occupational therapist.

A home evaluation should be completed for all individuals with an SCI prior to discharge home; this also is an excellent opportunity for hands-on individual and family training. The individual with an SCI should accompany the therapy team whenever possible. Consider completing a home evaluation early during the inpatient rehabilitation stay so that the family has sufficient time to make any necessary modifications and then again closer to discharge so that the individual can practice skills learned at home and with the equipment he or she will have at discharge. The results of the home evaluation should be well documented, and recommendations should be shared with the individual, his or her caregiver, the interdisciplinary team, and third-party payer sources (particularly when specific equipment is recommended).

Jack went on a home visit with his therapists and parents to his two-story home. Together they assessed the safety and accessibility of his home. Jack practiced propelling an ultra-lightweight manual wheelchair throughout the first floor to make sure all the doorways were wide enough. He practiced tasks such as transferring to a padded tub bench, opening the refrigerator and kitchen cabinets to retrieve a snack, and turning on lights. Some of the immediate recommendations for Jack and his parents included building ramps to access both the front and back entrances of the home, relocating his bedroom from the second floor to the first floor, using furniture risers to raise the height of his bed to facilitate transfers, removing the glass sliding doors in the bathtub and replacing them with a curtain, and placing grab bars in the bathtub. Other options for home accessibility that are more costly involve extensive structural modification, and require the services of a contractor well versed in the provisions of the Americans with Disabilities Act of 1990 (ADA; see Chapter 15), include modifying the bathroom to have a roll-in shower and accessible sink and installing a stair lift or elevator in order for Jack to access the second floor independently.

Incomplete SCI/clinical syndromes.

For individuals with an incomplete SCI, functional outcomes are harder to predict. Therapy interventions will be guided by the clinical presentation and will rely on a thorough OT evaluation. Motor return will be greater and occur over a longer period of time, and the potential for ambulation must be considered. UE management may have the added complexity of protecting a weak shoulder girdle and preventing shoulder subluxation when the client is standing or ambulating. Supportive devices such as slings and waist/fanny packs can be used to support the shoulder but may require caregiver assistance to put on. Treatment interventions such as neuromuscular electrical stimulation can be used to strengthen partially innervated muscles and can be used in conjunction with taping to provide support.[43]

Equipment

The assessment, ordering, and fitting of durable medical equipment (e.g., wheelchairs, seating and positioning equipment, mechanical lifts, beds, and bathing equipment) are extremely important parts of the rehabilitation program. This equipment should be specifically evaluated and should be ordered only when definite goals and expectations are known. Inappropriate equipment can impair function and cause further medical problems, such as skin breakdown or trunk deformity. The therapist must take into account all functional, positioning, environmental, psychological, and financial considerations in evaluating the client's equipment needs. The desired equipment—especially wheelchairs, seat cushions, back supports, positioning devices, and bathing equipment—should be available for demonstration and trial by the client before final ordering. The therapist involved in the evaluation and ordering of this costly and highly individualized equipment should be familiar with and have considerable experience with currently available products and also should be knowledgeable about ordering equipment that will provide the client with optimal function and body positioning on a short- and long-term basis. A good working relationship with an experienced and certified assistive technology provider (ATP) (i.e., a **durable medical equipment provider** who assists in the selection of custom assistive technology for the consumer's needs and provides training in the use of the selected devices) is preferable. Advances in technology and design have provided a wide variety of equipment from which to choose, and working with another professional specializing in such equipment will help ensure correct selection and fit (see Chapter 11, Section 2, for a more detailed discussion of wheelchairs, seating, and positioning equipment.)

In addition to enhancing respiratory function by supporting the client in an erect, well-aligned position that maximizes sitting tolerance and optimizes UE function, wheelchair seating must assist in the prevention of deformity and the development of pressure ulcers. An appropriate and adequate wheelchair cushion helps distribute sitting pressure, assists in the prevention of pressure ulcers, stabilizes the pelvis as necessary for proper trunk alignment, and provides comfort. Whether it is the OT's or the PT's role to evaluate and order the wheelchair and cushion, the two should work closely together to ensure consistent training and use for the individual needs of each client.

Outpatient Rehabilitation

Decreases in the amount of time devoted to inpatient rehabilitation have moved the extended phase of intervention to an outpatient basis or home therapy context. Adaptive driving, home management, leisure activities (Fig. 36.16), and work skill assessments are feasible and appropriate intervention modalities for evaluating and increasing UE strength, coordination, and trunk balance; however, they may not have been a priority during inpatient hospitalization. OT training in such activities can improve the client's socialization skills and can also assess and improve problem-solving skills and potential work habits. (See Chapter 11, Section 3, and Chapters 14, 16, and 17 for additional information on these topics.)

FIG 36.16 Patient participates in trick-or-treating activity during an OT session.

OT services can offer valuable evaluation and exploration of the vocational potential of individuals with an SCI. The occupational therapist can assess the client's level of motivation, functional aptitudes, attitudes, interests, and personal vocational aspirations during the process of the intervention program and through the use of ADLs, IADLs, mobility, and work simulation occupations. The therapist can observe the client's attention span, concentration, problem-solving ability, judgment, and other high-level cognitive functions, in addition to his or her manual ability with splints and devices, accuracy, speed, perseverance, work habits, and work tolerance level. The therapist can serve as a liaison between the client and the vocational rehabilitation counselor by offering valuable information gleaned from observation during the client's performance of activities and occupations. When suitable vocational objectives have been selected, they may be pursued in an educational setting or in a work setting, usually out of the realm of OT.

Throughout the inpatient and outpatient rehabilitation phases, the occupational therapist should provide psychosocial support by allowing and encouraging clients to express frustration, anger, fears, and concerns. The OT clinic in an SCI center can provide an atmosphere in which clients can establish support groups with other inpatients and outpatients, who can share their experiences and problem-solving advice with those in earlier phases of rehabilitation. Direct OT intervention to address psychosocial issues of an SCI can include training in stress management; coping skills training; and education regarding social connectedness, sexuality, relationship-building strategies, and the connection between occupation and emotional health.

Sexual Function

Sexual drive and the need for physical and emotional intimacy are not altered by an SCI. However, the ability of the individual with an SCI to engage, develop, and explore sexuality is affected. Education is essential for the individual with an SCI and all clinicians. In addition, as an important area of occupation (both in ADLs and social participation), it is a critical part of the rehabilitation process.

In males with an SCI, the two most common issues affecting sexual function are the ability to have and maintain erections and ejaculation. These problems vary, depending on the location of and type of SCI and should be evaluated individually. Pharmacological interventions (oral medications, penile injection therapy), vacuum pumps, and penile prostheses are some options that may assist with erections. The decreased ability to ejaculate and decreased motility of sperm in males with an SCI can affect fertility. Penile vibrostimulation (inexpensive, used at home) and rectal probe electroejaculation (more costly, done at a fertility clinic) are two of the methods used to produce ejaculation; however, the assistance of a fertility clinic is often needed to fertilize the egg, and these methods can be costly.[9,22]

Females with an SCI will usually experience changes in lubrication of the vagina during sexual activity and an interruption of menses for weeks to months after injury. In contrast to males, there is no change in female fertility. Females with an SCI can conceive and give birth. Special attention must be given to the interaction of pregnancy and childbirth with the SCI, especially with regard to blood clots, respiratory function, bladder infections, autonomic dysreflexia, and the use of medications during pregnancy and breast-feeding.[16,44]

The occupational therapist can address sexuality across all phases of SCI recovery. The type of intervention will be guided by the individual with the SCI and influenced by the developmental and life stages of the individual, the nature of the physical impairment, and the client's psychosocial adjustment to the SCI, readiness to learn, and sociocultural influences and expectations. OT interventions may include health promotion (e.g., education on changes in sexual function after an SCI, leading support group discussions on body image), remediation (e.g., introduce gentle stretching techniques for spastic muscles as part of foreplay, develop social interaction skills), and modification (e.g., adapt a sexual device for an individual with limited hand function, teach optimal bed positioning using pillows).[3] Recent discussions in the literature emphasize the need for more timely discussions regarding the effects of an SCI on sexual intimacy, family planning and parenthood, and developing sexual self-confidence and relationship skills.[20,22] The clinical practice guideline from the Consortium for Spinal Cord Medicine, "Sexuality and Reproductive Health in Adults with Spinal Cord Injury: A Clinical Practice Guideline for Health-Care Providers," is a comprehensive and valuable resource on the impact of SCI on sexuality.[13] There are also many consumer-driven resources available regarding SCI and sexuality (see Resources at the end of this chapter; also see Chapter 12).

Sleep and Rest

Sleep disturbances for individuals with an SCI can be attributed to physiological, psychological, and/or environmental factors. Physiological factors that influence the quality of sleep may include respiratory compromise from muscle weakness (diaphragm, abdominals), spasticity, and pain. Psychological factors include anxiety and depression. Environmental factors include the need for frequent turning in bed to prevent pressure ulcers, the need for intermittent catheterization, side effects of medications to control pain and spasticity, and poor sleep hygiene (e.g., frequent napping throughout the day). Promoting optimal sleep and rest patterns and quality is essential to enhancing the quality of life for individuals with an SCI. The occupational therapist can help the individual with an SCI establish a predictable sleep hygiene routine; identify ideal positioning in bed to decrease pain, prevent pressure ulcers, and prevent ROM limitations; promote self-management and caregiver management skills; and explore equipment options (e.g., turning mattresses) that will limit sleep disturbances (see Chapter 13 for more on the OT's role in promoting sleep and rest).

Children and Adolescents With A Spinal Cord Injury

Of the 12,500 new cases of spinal cord injury each year, approximately 3% to 5% affect children and adolescents under the age of 16.[47] Unique manifestations of SCI in children include birth injuries, lap belt injuries, and SCI without radiographic abnormality (SCIWORA), in addition to an increased incidence of higher cervical injuries (C1-C3) versus lower cervical injuries (C4-C8) in younger children.[47] Motor vehicle accidents and sports injuries are the leading cause of injury in teenagers, and violence is the leading cause of injury in African American and Hispanic teenagers.[5,47] Special considerations are required during the ISNCSCI exam for the pediatric population; these guidelines are available at the website *http://www.asialearningcenter.org*. Equipment ordered for children and adolescents with an SCI must allow for growth; measures should be taken to prevent the formation of scoliosis and hip deformities. Power wheelchair mobility may be appropriate for children with an SCI as young as 20 months old; readiness can be assessed via developmental screening tools such as the Pediatric Powered Wheelchair Screening Test.[46]

OT intervention for the pediatric SCI population needs to be developmentally appropriate and family centered. Participation in age-appropriate play, school, leisure, and social activities is integrated into the rehabilitation program. Mouth stick activities could include playing board games and making invitations to a tea party. Upper extremity ROM and strengthening could include word games played on an incline table. Balance and postural retraining activities could be done on a mat or the floor while the child plays with siblings. For children and adolescents with an SCI, an area of focus must be the transition to adulthood and the development of independent living skills, vocational exploration, social skill development, and a healthy lifestyle.

Consider the story of Julia, who sustained a T10 AIS A SCI as a result of a gunshot wound from a drive-by shooting when she was 9 years old. During her inpatient rehabilitation program she participated in self-care activities such as dressing and bathing, and her mother was trained in bladder and bowel management. Her mother worked full-time and wanted Julia to be independent with bladder management at school. The OT first introduced self–intermittent catheterization techniques to Julia using a doll, and over time she was able to learn how to complete her own catheterization.

Julia was a fourth-grade student at the time of her injury, and she was eager to go back to school and be with her friends. A school site visit was completed with Julia and her mother; during this visit the OT was able to assess the accessibility of the school and make recommendations to school administrators, speak to Julia's teacher about modifications she may need in the classroom (e.g., wheelchair-accessible desk), and allow Julia the opportunity to interact with her classmates for the first time since her injury while having the support of her mother and the OT.

As the years passed, Julia became involved in a local wheelchair sports program for children and returned to the SCI clinic to participate in a support group for adolescents with SCI. She graduated from high school, and with the encouragement of her support system, pursued a college degree, learned how to drive, and became a peer mentor for newly injured individuals with an SCI.

Aging With A Spinal Cord Injury

Aging with an SCI is a multifaceted topic, and several distinct themes must be considered: the onset of an SCI at an advanced age, the changing definition of independence as one adjusts to life with an SCI, and the consequences of aging with a SCI.

There are increasing numbers of individuals age 65 or older who are diagnosed with SCI; they account for 11.5% to 22.2% of new injuries each year.[48] As mentioned earlier, there has also been a rise in the average age at onset, from 29 years old in the 1970s to 42 years old since 2011.[41] The primary cause of injury for individuals over age 65 is falls, followed closely by motor vehicle accidents. These injuries result predominantly in incomplete tetraplegia, typically CCS. There is also an increased likelihood that these individuals will present with comorbidities that may negatively influence their long-term prognosis for recovery.[48] OT interventions for these individuals may include integration of chronic disease management strategies (e.g., consistently monitoring blood pressure or glucose levels and administering insulin) into daily self-care routines (see Chapter 46).

The primary goals of the individual with an SCI and the clinician are to maximize independence in all areas of occupation during the initial phases of rehabilitation. The role of the OT during these initial phases is to introduce the possibilities and mechanisms for independence while simultaneously teaching concepts of directing caregivers, energy conservation, and work simplification. It is ultimately up to the individual with an SCI to determine his or her own definition of independence, with the understanding that this definition is fluid and will change throughout the lifespan. For example, after several months at home Jack became physically independent with his morning routine; however, he required 3 hours to complete this routine and was exhausted after doing so. He decided to hire a caregiver to complete the tasks in a fraction of the time so he could focus his energy on other activities, such as school. Jack is still considered independent with his morning routine because he is in control and directing the actions of the caregiver.

Physical aging is a natural, inevitable process. The signs of the process can occur at varying rates for each individual, and aging affects most systems of the body (see Chapter 46). Individuals with an SCI are susceptible to an increased rate of changes in their health and abilities as they age. The aging process is accompanied by enhanced secondary effects of the disability, including pressure ulcers, infections (urinary and respiratory), muscular imbalance, pain, and joint degeneration secondary to overuse.[17] Regular screening should be performed for chronic health conditions such as diabetes, cardiovascular disease, high cholesterol, and cancer and appropriate maintenance therapies provided.[45]

When an SCI is compounded by the increased fatigue and weakness often associated with normal aging, the functional status of the individual with an SCI may decline. Occupational therapists may cite this change to justify additional services or equipment. Many considerations must be weighed to make appropriate short- and long-term decisions. Consulting experienced experts who have a perspective on both acute and long-term injuries and issues can provide valuable insight into intervention decisions. Approximately 20 years after injury appears to be a point at which some of the aging problems begin to increase. Thus, an individual with an SCI who was independent during transfers at home and with loading a wheelchair into and out of the car may now require assistance getting into and out of bed because his or her shoulders have deteriorated. The client may have to trade the car for a van that requires costly modifications. Similarly, someone who is at a level normally associated with functional independence (e.g., T10-level paraplegia) may now need personal care assistance and possibly a power assist or power wheelchair because of degenerative changes in the shoulders, elbows, and wrists. The occupational therapist should incorporate shoulder preservation strategies (e.g., the Strengthening and Optimal Movements for Painful Shoulders [STOMPS]) protocol) into the earliest stages of the rehabilitation program.[39]

Research

Current research conducted in clinical settings and scientific laboratories around the world focuses on understanding the nature of an SCI and defining the nervous system's response to this injury. There is now a sense of optimism in the scientific community that it will be possible to restore function after an SCI. This optimism is based on the combined research efforts of scientists in many disciplines. It is important for occupational therapists treating clients with an SCI to be aware of the scientific and technological advances so as to better educate their clients, while at the same time providing them with the most realistic and comprehensive rehabilitation interventions for their immediate and long-term needs. There are many trusted resources, such as the American Spinal Injury Association (*http://asia-spinalinjury.org/elearning/clintrials.php*) and the U.S. National Institutes of Health (*http://www.clinicaltrials.gov*) that can provide clinical trials advice to consumers.

Threaded Case Study

Jack, Part 2

Upon discharge from acute inpatient rehabilitation, Jack returned to his two-story home, and his mother moved in as his caregiver. Jack's father and friends built ramps for the front and back entrances and moved his bed and clothing to a room on the first floor. Bathroom modifications, including removing the glass doors and installing grab bars, were also completed. Initially his mother assisted him with lower body dressing, bathing, bladder and bowel management, sliding board transfers, and other home-making tasks, such as meal preparation. He required a padded transfer tub bench for bathing and a padded rolling commode for his bowel program, which his mother performed for him.

He was evaluated for an ultra-lightweight manual wheelchair to offer him independent manual wheelchair mobility at home and in his community. He did not wish to use a power wheelchair at this time; however, he is aware that he may require one in the future. He was educated on the premature degenerative changes that will likely occur in his shoulders from pushing a manual wheelchair and transferring himself to many necessary surfaces. He was also educated on skin care and the need for a maximal pressure-relieving wheelchair cushion. He was specifically evaluated for the optimal wheelchair sitting position that will offer him good trunk and pelvic alignment and pressure relief.

Over time Jack's need for caregiver assistance decreased, and he decided to hire a caregiver to assist him in the morning as he prepared for his day and in the evening as he prepared for bed. He regularly visits a neighborhood gym to maintain upper extremity strength and endurance, and he will soon be driving a modified van. He and his occupational therapist had many discussions regarding how he could return to college. Jack decided to return to school with a reduced class schedule and used services available at his school for note taking.

Jack has continued his involvement with the peer-mentoring program at the SCI clinic and loves to interact with clients who have been recently injured, sharing his own tricks and techniques that he has learned since leaving the hospital. He continues to set goals and challenge himself; currently he is learning to play quad rugby and hopes to one day travel to tournaments with his team and without his caregiver.

Summary

An SCI can result in substantial paralysis of the limbs and trunk. The degree of residual motor and sensory dysfunction depends on the level of the lesion, whether the lesion was complete or incomplete, and the area of the spinal cord that was damaged. The goal of OT is to aid the individual with an SCI in achieving optimal independence and functioning by exposing him or her to what is possible and prioritizing what is important. Areas of focus are physical restoration of available musculature; self-care; independent living skills; short- and long-term equipment needs; environmental accessibility; and educational, work, and leisure activities. The psychosocial adjustment of the client is instrumental, and the occupational therapist offers emotional support and intervention toward this end in every phase of the rehabilitation program.

Review Questions

1. List three causes of SCI. Which is the most common?
2. What is the difference between tetraplegia and paraplegia?
3. What testing is completed for an accurate diagnosis of neurological level?
4. Describe the difference between complete and incomplete lesions.
5. When one refers to a "C5 level" of tetraplegia, what is meant in terms of level of injury and functioning muscle groups?
6. What is the prognosis for recovery of motor function in complete lesions and incomplete lesions?
7. What are the purposes of surgery in management of SCI?
8. What are some medical complications common among clients with SCI that can limit achievement of functional potential?
9. How should orthostatic hypotension be treated?
10. How should autonomic dysreflexia be treated?
11. What is the role of the occupational therapist in the prevention of pressure sores?
12. Why is vital capacity affected in individuals with SCI?
13. What effect does reduced vital capacity have on the rehabilitation program?
14. Which level of injury features full innervation of the rotator cuff musculature, biceps, and extensor carpi radialis and partial innervation of the serratus anterior, latissimus dorsi, and pectoralis major?
15. What additional muscle power does the client with C6-level quadriplegia have over the client with C5-level quadriplegia? What is the major functional advantage of this additional muscle power?
16. What are the additional critical muscles that the client with C7-level quadriplegia has, as compared with the client with C6-level quadriplegia?
17. What additional functional independence can be achieved because of this additional muscle power?
18. What is the first spinal cord lesion level that features full innervation of the UE musculature?
19. Which assessments do occupational therapists use to evaluate the client with SCI? What is the purpose of each?
20. List five goals of OT for the client with SCI.
21. How is wrist extension used to affect grasp by the individual with tetraplegia?
22. How does the individual with C6-level tetraplegia substitute for the absence of elbow extensors?
23. What contracture is encouraged in clients with SCI? Why? How is it developed?
24. What splint allows the client with C6-level tetraplegia to achieve functional prehension in the presence of weak wrist extensors?
25. What are some of the first self-care activities that the client with a C6-level SCI should be expected to accomplish?
26. List four assistive devices commonly used by persons with tetraplegia and tell the purpose of each.
27. How can ordering an ill-fitting wheelchair affect the UE function and skin care of someone with C6-level tetraplegia?
28. Describe the role of OT in the vocational evaluation of a client with SCI.
29. What are two considerations when predicting the future functional outcomes for a 25-year-old

client with T4-level paraplegia?

30. Why would a person with paraplegia require homemaking assistance if they are independent in all self-care and mobility activities?

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Resources

American Spinal Injury Association—<http://www.asia-spinalinjury.org>

Christopher and Dana Reeve Foundation—<http://www.christopherreeve.org>

Innovative products for seniors and people with disabilities—<http://www.nuprodx.com>

Life coaching and peer mentoring services for individuals with SCI—<http://www.knowbarriers.org>

Model System Knowledge Translation Center—<http://www.msktc.org>

National Spinal Cord Injury Statistical Center (NSCISC)—<http://www.nscisc.uab.edu>

New Mobility (magazine for active wheelchair users)—<http://www.newmobility.com>

Paralyzed Veterans of America—<http://www.pva.org>

Peer support website run by individuals with spinal cord injuries—<http://www.apparelyzed.com/quadriplegia.html>

Reachers and grabbers for tetraplegics—<http://www.quadtools.com>

Spinal Cord Injury Research Evidence Project—<http://www.scireproject.com>

United Spinal Injury Association/NSCIA—<http://www.spinalcord.org>

USC Pressure Ulcer Prevention Project—<http://www.usc.edu/programs/pups/about/about.html>

37

Disorders of the Motor Unit*

Alison Hewitt George

CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Describe the characteristics of motor unit disorders.
2. Discuss the clinical manifestations of motor unit disorders.
3. Discuss the impact of motor unit disorders on occupational performance.
4. Identify assessments and interventions for an occupational therapy program for the various motor unit disorders discussed in this chapter.

KEY TERMS

Brachial plexus

Guillain-Barré syndrome

Lower motor neuron system

Motor unit

Muscular dystrophy

Myasthenia gravis

Peripheral nerve injuries

Peripheral neuropathies

Poliomyelitis

Postpolio syndrome

Threaded Case Study

Edith, Part 1

Although this case study is specific to Guillain-Barré syndrome, many of the aspects of Edith's occupational profile and occupational performance needs apply to the other diagnoses in this chapter.

At age 67, Edith had been enjoying her retirement, primarily spending time with her husband, three children, and five grandchildren. She had recently recovered from the flu and was looking forward to a day at the park with her family. While showering, she suddenly lost strength in her legs and collapsed. While lying on the shower floor, she noticed that her arms also felt weak. Her cognition was intact, but she was physically helpless. Her husband called 9-1-1. It was fortunate that she received immediate medical care because she later required mechanical assistance to breathe. After extensive neurologic testing, Edith was diagnosed with Guillain-Barré syndrome (GBS). Neither she nor her family had ever heard of GBS.

Edith suddenly found herself dependent in all of her life roles and occupations. She was hospitalized in the intensive care unit (ICU) for several weeks, was dependent on a ventilator to breathe, and needed physical assistance because of her total body paralysis. Her muscles were painful, sore, and tender, and pain medications helped to manage the discomfort.

Jen, the occupational therapist assigned to the ICU, interviewed Edith, and together they identified the occupational needs and client factors that should be addressed. Jen performed passive range of motion (ROM) exercises, fabricated static hand splints to maintain a functional resting position and to prevent contractures, provided proper bed positioning, and taught the family about GBS. Jen also provided support, encouragement, and active listening, employing therapeutic use of self during the intervention. Edith often spoke about her spiritual beliefs and reported that she found hope and strength with prayer and meditation. She spoke of her favorite previous performance pattern of reading her Bible every morning, and said she felt depressed because she was now unable to physically hold a book or turn pages. After receiving training and modifications from Jen, Edith was able to listen to the Bible on CD, using a mouth switch to turn it on and off; this modification allowed her to resume her previous valued morning routine.

Edith made slow but steady gains in physical abilities and was transferred to an acute rehabilitation hospital to actively participate in an intensive interdisciplinary therapy program. Lara, the occupational therapist on the rehabilitation unit, evaluated Edith's specific functions as they related to supporting performance and engagement in occupations and activities targeted for intervention. The goals for Edith as determined by the Canadian Occupational Performance Measure[24] included the following: (1) to be able to feed herself, brush her teeth, and shower; (2) to cook for her family; (3) to go shopping at the mall with her granddaughter; and (4) to drive to her friend's house to play cards. Detailed upper extremity manual muscle testing, muscle belly tenderness screening, ROM measurements, and sensation testing were completed during the evaluation phase.

Intervention strategies focused on using compensatory methods and improving strength and endurance. Lara taught Edith adaptive strategies to eat, groom, and bathe. The use of adaptive equipment, work simplification, and energy conservation techniques were encouraged while Edith engaged in activities such as cooking and light cleaning. Lara supported Edith's community mobility and accompanied Edith to the mall with her granddaughter. After the brief outing, Edith expressed a sense of increased self-confidence and accomplishment. She practiced playing cards with other clients in a group environment. She also participated in a daily individualized strengthening program.

Lara provided Edith with community resources to aid in her independence. For example, the Guillain-Barré Syndrome/Chronic Inflammatory Demyelinating Polyneuropathy (GBS/CIDP) Foundation International offers local support groups, literature, and conferences to GBS survivors and caregivers.[14] In addition, her family received extensive training from the interdisciplinary team members to help Edith to apply the learned strategies and equipment in the home and community. Driving was not addressed at an inpatient level, but Edith was referred to an outpatient training program.

Critical Thinking Questions

1. What are the phases of Guillain-Barré, and what occupational therapy interventions might be used in each phase?

2. In what ways were the client's psychosocial needs addressed during recovery?

3. Describe energy conservation techniques that you think would be appropriate for Edith while engaging in her valued occupation of cooking.

This chapter examines the symptoms, course, medical treatment, and occupational therapy (OT) assessment and intervention for clients who have motor unit disorders most commonly seen in OT practice. The **motor unit** is the basic functional unit of the peripheral nervous system and consists of four elements: the cell body of the motor neuron located in the anterior horn of the spinal cord; the axon of the motor neuron, which travels via spinal nerves and peripheral nerves to muscle; the neuromuscular junction; and the muscle fibers innervated by the neuron (Fig. 37.1). Disorders of the motor unit may be of neurogenic, neuromuscular, or myopathic origin and generally cause muscle weakness and atrophy of skeletal muscle. Those with a neurogenic basis are referred to as lower motor neuron disorders, affecting the cell bodies and peripheral nerves of the motor unit. Those with a neuromuscular or myopathic origin affect the neuromuscular junction or the muscle itself.[7]

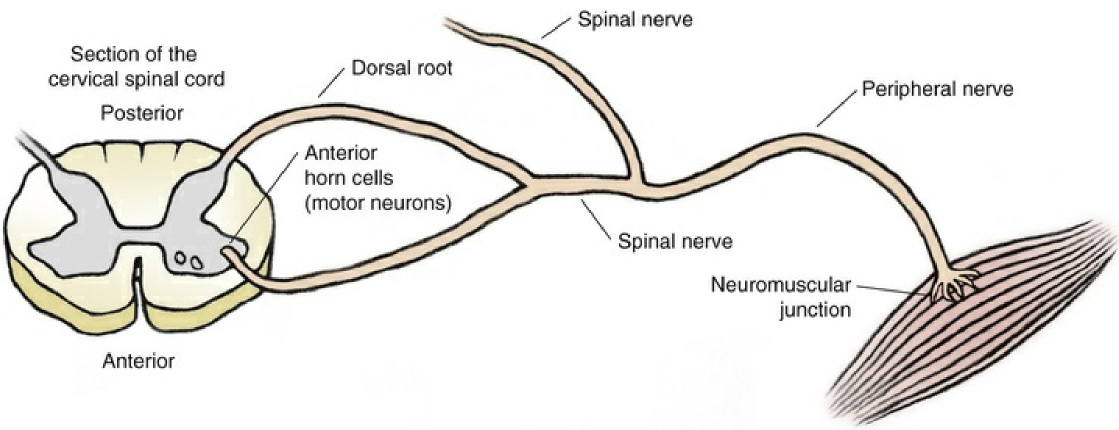

FIG 37.1 Motor unit consisting of motor neuron cell body in the anterior horn of the spinal cord, the axon of the motor neuron (which travels via spinal nerves and peripheral nerves to muscle), the neuromuscular junction, and the muscle fibers innervated by the neuron.

This chapter also discusses the physical, psychosocial, and emotional factors that occupational therapists address when assessing and providing interventions for people with motor unit disorders.

Occupational therapists, with their holistic view of persons with physical disabilities, are uniquely positioned to recognize and include interventions that address mental health concerns for persons with disorders of the motor unit. The sudden onset of severely disabling peripheral neuropathies, such as Guillain-Barré, or the chronic aspects of living with fatigue and experiencing role alterations will have ramifications for the client, the family, and their social network as described in Edith's case study.

Neurogenic Disorders

Peripheral Neuropathies

The motor neurons in the anterior horn of the spinal cord mediate voluntary movement and reflexes that produce motor behavior. Muscle strength and endurance contribute to coordinated and skilled movement and the ability to move through available range of motion. The characteristics of movement are determined by the pattern and firing frequency of specific motor units. Muscle contraction is the output of the motor system.[7]

The **lower motor neuron system** includes the cell bodies in the anterior horn of the spinal cord and their axons (which pass by way of the spinal nerves and peripheral nerves to the neuromuscular junction) and the nuclei of cranial nerves III through X (located in the brainstem) and their axons. The motor fibers of the lower motor neurons contain somatic motor components, including the alpha motor neurons, which innervate skeletal muscles (extrafusal fibers), and gamma motor neurons, which innervate muscle spindles (intrafusal fibers). A lesion in any of these neurologic structures results in peripheral neuropathy or a lower motor neuron dysfunction.[7]

Peripheral neuropathies involve lesions of the lower motor neuron system and may be located in the anterior horn cells of the spinal cord, spinal nerves, peripheral nerves, and cranial nerves or their nuclei in the brainstem. Lesions can result from nerve root compression, trauma (eg, bone fractures and dislocations, lacerations, traction, or penetrating wounds and friction), toxins (eg, lead, mercury, alcohol), infections (eg, poliomyelitis, Epstein-Barr virus or herpes varicella zoster), neoplasms (eg, neuromas and multiple neurofibromatosis), vascular disorders (eg, arteriosclerosis, diabetes mellitus, or peripheral vascular anomalies), and congenital malformations.[35] "Like static on a telephone line, peripheral neuropathy distorts and sometimes interrupts messages between the brain and the rest of the body."[35]

OT assessments for motor unit disorders follow a similar sequence and are described in Table 37.1. An occupational profile is developed during an interview with the client and caregivers. The Canadian Occupational Performance Measure[24] is an excellent instrument for establishing goals and measuring intervention outcomes. Performance skills, performance patterns, client factors, and activity demands in context must also be clinically assessed. Specific assessments such as range-of-motion evaluations, manual muscle testing, scales designed to measure coping and depression, and activities of daily living assessments are appropriate for each of the motor unit disorders described in this chapter.

TABLE 37.1

Occupational Therapy Assessments and Descriptions

Assessments	Descriptions
Occupational profile	Interview client (and family members and caregivers, if appropriate) to gain information about problems and concerns, successful and unsuccessful strategies when engaging in occupations, ways in which contexts influence functional abilities, activity demands, and priorities of meaningful occupations.
Canadian Occupational Performance Measure[24]	The interview is conducted before and after intervention to describe problems, level of satisfaction with performing activities, and level of perceived performance abilities in areas of self-care, productivity, and leisure. Testing methods must be measurable to assess intervention results.
Performance skills in areas of occupation: activities of daily living, instrumental activities of daily living, education, work, play, leisure, social participation	Following the occupations that the client prioritizes in the occupational profile, the therapist can perform formal assessments and observation of the client's performance during activity engagement in the appropriate context, with attention paid to motor, process, and communication/interaction skills. (See Chapter 18 for additional assessment details and Chapter 16 for a description of specific leisure assessments.)
Performance patterns	Client (independently or with assistance from caregivers or occupational therapist) maintains a log of activities and symptoms to analyze. In collaboration with the occupational therapist, the client uses this information to discover habits and routines that are detrimental or helpful to occupational performance. Reestablishment or adjustment of roles should be discussed and implemented.
Client factors: manual muscle testing, range of motion testing, eating and swallowing assessments, pain scale, sensory testing, depression scale, Ways of Coping Scale, clinical observations during activities of daily living.	The therapist should perform specific assessments of the client's bodily function, including systems that support participation in meaningful occupations (eg, neuromusculoskeletal, pain, joint range of motion, sensation, cardiovascular, respiratory, swallowing, skin). Because fatigability is so prevalent in these disorders, assessments should be adequately spaced and preferably performed when clients are feeling their best (often in the morning). Assessment of emotional stability, motivation, sexual activity, depression, ways of coping, and so forth is critical to forming an overall picture of the client's strengths and weaknesses.
Activity demands	Analysis of the required sequence, body functions, and body structures is necessary to complete the activity. Analysis must include assessment of the tools or equipment used to perform the activity and any adaptations that could be made to ensure success.
Contexts	The therapist should always consider the client's culture, physical environment, socioeconomic status, personal and spiritual beliefs, temporal aspects, and virtual contexts.

Data from American Occupational Therapy Association: Occupational therapy practice framework: domain and process, 3rd edition, *Am J Occup Ther* 68:S1–S51, 2014.

Two complex syndromes, Guillain-Barré and postpolio, are discussed in detail in the following section. The concepts are applicable to the other motor unit disorders described later in the chapter.

Guillain-Barré Syndrome

Guillain-Barré (ghee-YAN bah-RAY) **syndrome** (also known as acute idiopathic neuropathy, infectious polyneuritis, and Landry's syndrome) is an acute inflammatory disorder in which the body's own immune system attacks part of the peripheral nervous system. The immune system destroys the myelin sheath that surrounds the axons of many peripheral nerves or even the axons themselves, damaging the nerves' ability to transmit signals to the muscles. Guillain-Barré syndrome (GBS) has no known cause or cure, and no one knows why this disorder strikes some people and not others.[32] The onset of GBS often occurs after an upper respiratory or gastrointestinal viral infection, usually within 1 to 2 weeks. The syndrome is also occasionally triggered by surgery or vaccinations and occasionally occurs with no known precipitating event.[4,32]

This acute and complex disorder came to public attention when it struck a number of people who received the 1976 swine flu vaccine. It continues to claim thousands of new victims each year, striking any person, at any age, regardless of gender or ethnic background.[14] Affecting males and females equally, the annual incidence of GBS in the United States is approximately 1.6 to 1.79 persons in 100,000.[46]

The initial symptoms of Guillain-Barré syndrome most often include varying degrees of weakness and sensory changes in the legs. GBS is characterized by rapidly progressive ascending symmetric weakness of bilateral extremities, usually proceeding from distal to proximal (feet to trunk). Descending paralysis with predominant proximal muscle weakness rarely appears.[4,32] Because the myelin sheaths of the peripheral nerves are injured or degraded, the nerves cannot transmit signals efficiently. The muscles begin to lose their ability to respond to the brain's commands. The brain also receives fewer sensory signals from the rest of the body, resulting in an inability to feel textures, heat, pain, and other sensations. Clients often report initial sensations such as tingling, "crawling skin," or painful sensations. The signals to and from the arms and legs must travel the longest distances, so they are most vulnerable to interruption. Therefore muscle weakness and tingling sensations usually first appear distally in the hands and feet and progress proximally.[32]

Typically, the weakness and abnormal sensations first noticed in the legs progress to the arms and upper body, and some muscles are almost totally paralyzed. As the demyelination continues, the client may experience problems with breathing, speaking, swallowing, blood pressure, or heart rate. The client may require use of a respirator to assist with breathing and is monitored closely for an abnormal heart rhythm, infections, blood clots, and high or low blood pressure. After the initial clinical manifestations of the disease, the symptoms can progress over the course of days or weeks. By the third to fourth week of the illness, 90% of all clients are at their weakest. Some may be completely paralyzed and dependent on a respirator for breating.[32]

The typical progression of GBS occurs in three phases. The *initial, or acute, phase* begins with the client's first conclusive symptoms and lasts until there is no further decline in physical status. This phase may last for up to 4 weeks. The *plateau phase* begins when the client's physical state stabilizes, with no further deterioration of physical status and no evidence of physical recovery. The plateau phase generally lasts a few weeks, during which the physical status of the client remains unchanged. The *recovery phase* is that period when the client slowly begins to recover physical abilities and symptoms gradually decrease. Recovery can occur over 6 months up to 2 years, depending on the extent of paralysis. Although complete recovery is possible, many individuals (20%-30% of those diagnosed with GBS) will experience long-term residual deficits.[29,46]

Being paralyzed is a frightening experience for people with GBS, their family members, and friends. Clients can be expected to proceed through varying stages of adapting to the acute and residual effects of this physical disability.[38] However, the prognosis is generally good for the majority of clients; therefore it is appropriate to be optimistic during intervention sessions and encourage clients and families to look forward to recovery (Table 37.2).

TABLE 37.2

Guillain-Barré Syndrome: Prognosis and Outcomes

Recovery Status	Percentage of Clients	Description
Recover well spontaneously	85%	20%-30% of those who recover well have some residual deficits such as distal numbness, weakness, fatigue; these may interfere with some daily functions but usually are not severe; 3% experience a relapse of muscle weakness and tingling sensation years after initial attack.
Significant impairments	10%	Fatigue and severe weakness in specific muscle groups significantly impair daily function.
Death	5%	Death is usually the result of pneumonia, sepsis, adult respiratory distress syndrome, autonomic dysfunction, or pulmonary embolism.

Data from National Institute of Neurological Disorders and Stroke: *Guillain-Barré syndrome fact sheet.* www.ninds.nih.gov/disorders/gbs/gbs.htm; Walling AD, Dickson G: Guillain-Barré syndrome. *Am Fam Physician* 87:191–197, 2013.

There is no known cure for GBS. However, there are interventions that lessen the severity of the illness and accelerate the recovery in most individuals. There are also a number of ways to treat the complications of the disease.[32] Immunomodulatory therapy (plasmapheresis or intravenous immunoglobulin IVIg) is the recommended medical treatment at the onset of GBS. Plasmapheresis has shown clinical improvements, reducing the time required for ventilation and critical care, time to achieve ambulation, and hospital length of stay.[4,46] This process is used to separate the whole blood from the plasma and then return the whole blood to the client without the plasma to reduce the length of the acute phase. Intravenous immunoglobulin therapy involves the injection of proteins that the immune system uses naturally to fight invading organisms. High doses of these immunoglobulin proteins can lessen the immune attack on the nervous system and hasten recovery.[32,46]

Role of the Occupational Therapist

The client with GBS may be referred to OT when medically stable. An occupational profile of the client will be developed through OT assessments related to the level of dysfunction that the client is experiencing. For example, physical abilities are assessed using range of motion (ROM) and manual muscle testing (MMT), sensation testing, and a swallowing assessment. Functional assessments of quality of movement, coordination, and self-care may also be performed. It is critical to assess emotional and psychosocial factors of the client and family. (See Table 37.1 for OT assessments.)

After the initial OT evaluation, an intervention plan is developed to meet the client's needs throughout the disease process. Frequent revisions may be necessary, depending on the client's recovery status. During the initial phases of intervention (the acute phase and plateau phase of the disease), problematic client factors are addressed in conjunction with the healthcare team. These may include providing daily passive ROM, positioning, and splinting to prevent contracture and deformity and to protect weak muscles. Passive ROM should begin with gentle movement of the joints and should not exceed the point of pain. Particular attention should be paid to determining residual weakness in the intrinsic muscles of the hands. Passive activities (eg, watching television) and nonstrenuous social visits from family and friends are encouraged. Muscle belly tenderness (a flu-type muscle soreness) is closely monitored, and activities are modified as needed.[6] Many clients may benefit from the use of electronic aids for daily living (EADLs). EADLs increase the level of independence in the client's control of the environment through the use of technology. For example, a client with GBS might lack the strength and motor skills to operate the television, lights, telephone, and radio in the environment. With the use of EADLs, the client may be able to use the head, mouth, or other parts of the body to operate switches and successfully control the environment.

An intensive interdisciplinary rehabilitation program is typically implemented during the recovery phase as the client begins to regain physical movement. After the evaluation process, the OT intervention plan, developed in collaboration with the client, must be carefully designed to respect muscle belly tenderness and to prevent fatigue and further damage to the nerves. Because muscle belly tenderness usually decreases in the proximal musculature before it decreases distally, proximal musculature movements can be facilitated first while distal joints continue to be supported (eg, using mobile arm supports).[6] Activity is gradually increased with close monitoring of pain or fatigue after each intervention session. The therapist should continue to monitor for increased muscle belly tenderness, muscle imbalance, and substitution patterns. Progressive resistive exercises should be used conservatively, with attention to joint protection and fatigue. Throughout the course of recovery, the therapist should guard against fatigue and irritation of the inflamed nerves. Instruction to the client and family in key concepts such as energy conservation, work simplification, avoidance of overstretching, and overuse of muscles is critical to recovery.[41]

As the client's strength increases, activities promoting more resistance can be incorporated into the intervention program. Self-care (grooming, eating, dressing, bathing, and toileting) and other activities of daily living (ADLs), instrumental activities of daily living (IADLs), and leisure occupations should be included as soon as the client is capable of participating in them. Activities should be graded for success as strength and endurance improve. Adaptive equipment, frequent rest breaks, and creative strategies are typically necessary during this phase. Mobile arm supports may be used to alleviate muscle fatigue, promote active assistive use of upper extremities, and encourage independence with occupations. Activities and occupations should be varied among gross motor, fine motor, resistive, and nonresistive exercises to prevent undue fatigue.[41]

OT Practice Notes

Engagement in light occupations that are meaningful to the client is essential for building the self-confidence necessary to resume previous life roles and interests. For example, a client may be able to participate in enjoyable leisure occupations such as scrapbooking, surfing the web, planning a family gathering, and reading books to grandchildren (see Chapter 16).

People with GBS face not only physical difficulties but emotionally painful periods as well.[28] It is often extremely difficult for clients to adjust to sudden paralysis and dependence on others for help with routine daily activities.[38] Eisendrath, Matthay, and Dunkel found that clients experienced severe anxiety, fear, and panic during the acute progressive phase.[11] When clients reached the plateau phase, they often expressed anger and depression. When improvement began during the recovery phase, severe depression occurred as clients contemplated the long, slow convalescence and the possibility of permanent neurologic deficits. An occupational therapist can support the client by facilitating feelings of self-worth, a positive attitude, and encouragement through the engagement in valued occupations.[38,44] A psychologist or physician should also closely monitor the client's mood and provide necessary interventions as a member of the intervention team.

After becoming medically stable and being discharged from the hospital, many GBS survivors find themselves living at home without proper medical follow-up and therapy. Families are left to their own devices to successfully create real-life solutions to functional limitations and to locate and use resources. Schmidt conducted a survey of 90 voluntary participants from the Guillain-Barré Syndrome Foundation International to explore the extent of functional limitations within home, work, community, and leisure roles after hospitalization.[41] The majority of the participants stated that they had to independently research information about GBS because their doctors and team members either lacked the knowledge or did not provide them with any verbal or written information. One participant noted, "My family had to learn everything about GBS on the Internet. My doctors and nurses didn't know anything about it. We had to educate them (doctors, nurses, therapists, etc.)." These families reported feeling most frustrated about the fact that healthcare professionals did not address significant psychosocial issues such as depression, anxiety, fear, and hopelessness. Physically demanding tasks that required fair to good strength and endurance were scored the lowest in satisfaction and ability by participants. The great majority of respondents (98%) reported that they were living with factors that limited their ability to participate in life, such as fatigue, weakness, pain, sensation disturbances, coordination problems, and psychosocial changes. Nearly half of the participants agreed that they would benefit from OT services to improve the use of their upper extremities and to learn ways to manage daily fatigue and maintain their current health status. This study indicates the need for continued OT services to optimize occupational performance and occupational roles many years after the onset of the syndrome and apparent recovery.

The complex process of adjusting to the disabling condition, problem solving, learning, and redesigning a life for a GBS survivor is a long-term, therapeutic experience. The lifestyle redesign process can be initiated by the occupational therapist during the inpatient rehabilitation phase; however, there must be a continuum of care established for follow-up treatment. An occupational therapist working in an outpatient or home setting can skillfully guide clients back to the resumption of their previous life roles, assist clients in returning to productive community involvement and leisure occupations (see Chapter 16), and teach engagement and participation in meaningful occupations.[26,28,41]

Poliomyelitis and Postpolio Syndrome

Transmission of the **poliomyelitis** virus has been severely curtailed throughout the world as a result of the Global Polio Eradication Program; only 223 confirmed cases of polio were reported globally in 2012, and polio was endemic in only three countries.[8] The number of polio cases in the United States peaked in 1952, with more than 21,000 persons paralyzed. According to the Centers for Disease Control and Prevention (CDC), the last case of indigenous polio acquired in the United States was in 1979. A program to eradicate polio in the Western hemisphere, led by the Pan American Health Organization, eliminated polio in this region of the world in 1991.[8] Poliomyelitis is a highly contagious viral disease that enters through the mouth via the fecal-oral route (ie, it is spread in unsanitary conditions with poor hand-washing techniques). The virus moves from the throat into the digestive tract and is shed through fecal material for several weeks. The poliovirus enters the bloodstream and, in some cases, infects the motor neurons of the anterior horn and brainstem. Up to 72% of individuals who contract the disease are asymptomatic but can still spread the disease. According to the CDC, flaccid paralysis results in less than 1% of all polio infections, and most people recover completely. If weakness or paralysis lasts more than 12 months, it is usually permanent.[8]

The CDC recognizes three types of paralytic polio: spinal polio, bulbar polio, and bulbospinal polio. Spinal polio was the most commonly diagnosed type between 1969 and 1979, involving 79% of the reported cases. This type produces asymmetric flaccid paralysis predominantly in the legs. Bulbar polio (2% of reported cases) infects the cranial nerves, leading to muscle weakness in oral and facial musculature, and a combination of the two types results in bulbospinal polio (19% of cases).[8] With paralytic polio, marked atrophy can be seen in the involved extremities, and deep tendon reflexes are often absent. Sensation and cognition remain intact. The asymmetry of muscles pulling on various joints sometimes produces deformities, such as subluxation, scoliosis, and contractures.[8]

Even though substantial efforts have dramatically reduced the presence of poliomyelitis, the effects of polio still exist. Between 12 million and 20 million people in the world who had polio are still alive. After an interval of 15 to 40 years, 25% to 40% of these adults will experience new muscle pain, exacerbation of existing weakness, and the development of new weakness or paralysis. This exacerbation is referred to as **postpolio syndrome** (PPS).[8] According to the CDC,

Factors that increase the risk of postpolio syndrome include increasing length of time since acute poliovirus infection,[8] presence of permanent residual impairment after recovery from the acute illness, and being female. The pathogenesis of postpolio syndrome is thought to involve the failure of oversized motor units that were created during the recovery process of paralytic poliomyelitis. Postpolio syndrome is not an infectious process, and persons experiencing the syndrome do not shed poliovirus.[8]

According to the National Institute of Neurological Disorders and Stroke,[36] the following criteria should be considered for the diagnosis of PPS: previous paralysis due to poliomyelitis, period of partial or complete functional recovery, slowly progressive and persistent new muscle weakness, or decreased endurance, new difficulties with breathing and swallowing (less common), these symptoms persisting for a year or more, and other causes of symptoms ruled out (Table 37.3). PPS progresses slowly with intermittent periods of stability. People who had severe cases of acute polio experience a greater degree of disability resulting from PPS than do those whose initial response to the poliovirus was mild. Fatigue is the most debilitating symptom because it limits activity. The fatigue may be severe and out of proportion to the apparent physical demands of the activity, and it can be overwhelming. People with PPS risk additional disabling problems such as muscle atrophy, scoliosis, osteoporosis, fractures, contractures, and depression.[17,51,52] An increase in difficulty with ADLs and IADLs accompanies the symptoms. Problems with ambulation, transfers, stairs, home management, driving, dressing, eating and swallowing, and bladder and bowel control may occur, and people report a poorer functional status and health-related quality of life.[23,51] Unless there is severe pulmonary or swallowing involvement in postpolio syndrome, the symptoms are rarely life threatening.

TABLE 37.3

Six Criteria for Postpolio Syndrome

Criteria	Description
Prior paralytic poliomyelitis	Documented history of acute polio diagnosis, motor neuron loss, residual weakness, muscle atrophy, and electromyography (EMG) showing denervation of muscles
Period of partial or complete recovery	Evidence of acute paralytic polio with recovery and stable neurological functions for an interval of about 15 years or more
Gradual or sudden onset of progressive and persistent new muscle weakness or abnormal muscle fatigability	Decreased endurance, muscle and joint pain; onset possibly occurring after surgery, trauma, or periods of inactivity
New difficulties with breathing and swallowing	Unlikely but possible development of problems with breathing and swallowing
Symptoms as listed here that may persist for at least a year	Length of time that client reports having symptoms sometimes relevant in the diagnosis of postpolio syndrome
Other causes of these symptoms ruled out	Exclusion of other neurologic, medical, and orthopedic problems

Data from Jubelt B, Agre JC: Characteristics and management of postpolio syndrome, *J Am Med Assoc* 284:412, 2000; National Institute of Neurological Disorders and Stroke: *Post-polio syndrome fact sheet*. www.ninds.nih.gov/disorders/post_polio/detail_post_polio.htm.

Role of the Occupational Therapist

Occupational therapists should consider that the psychological and emotional aspects of PPS may be as disabling as the physical symptoms. Persons who originally had polio most likely assumed that the disease was over, that disability was in the past, and that any residual weakness was static. Therefore the onset of new symptoms and the accompanying disruption of occupational performance and lifestyle may be devastating as the client, family, and friends are confronted for a second time with the notion of being disabled. A supportive and realistic approach by the healthcare team, along with client and family education, is the key to lifestyle modification.[51,52]

Case Study

George

During his seventh birthday party, in February of 1955, George fell after another child kicked a ball, which hit George's legs. By the next morning, he could not get out of bed or stand on his own. He was admitted to a hospital and diagnosed with polio. George was placed in an iron lung that did the breathing for him. This was at the height of the polio epidemic, and the hospital wards and even the halls were filled with children in iron lungs. The complete confinement was terrifying, as was the constant presence of medical staff and equipment.

Over the years, George gradually recovered and was able to walk unassisted and participate fully in life. However, at the age of 60, George began experiencing new weakness in his legs, muscle pain, disproportionate fatigue related to activities, and an unstable gait. He was afraid that he was getting polio again. George quit his full-time job, stopped playing tennis, and became disengaged from his social life because he feared the full reemergence of polio and did not want anyone to know. His wife was very concerned and scheduled an appointment for George with their doctor, who prescribed occupational therapy, physical therapy, and counseling.

Analysis

George is among the many people worldwide who are affected by postpolio syndrome. Through occupational and physical therapy and counseling, he will be able to resume a near normal life. His fears must be addressed because they will hamper whatever remaining function he has. Through occupational therapy, George can learn to pace his activities, protect his joints, recognize fatigue before it becomes severe, and modify his leisure occupations so that he can lead an enjoyable life.

Occupational therapy has an important role to play in helping the client to stabilize function. Goals to adjust lifestyle may be accomplished by collaborating with the client and family to use work simplification, energy conservation, and adaptive equipment as needed. These measures, along with a healthy diet and enjoyment of remaining abilities, may improve the client's engagement in meaningful occupations and participation in the various contexts of his or her life.[36,52]

When assessing a client with the diagnosis of PPS, the occupational therapist collaborates with the client and caregivers (if appropriate) to develop the occupational profile. After discussing the client's problems and concerns, the therapist can explore what strategies the client has used and how useful the client reports those strategies to be. The occupational therapist selects specific assessments, such as ROM, MMT, and assessment of client's equipment for proper fit and function, to provide additional needed information (see Table 37.1).

Information gained from the evaluation process is used to prioritize and select valued, relevant activities for the client with PPS. The Knowledge of Polio Test can reveal what the client and family understand about polio and its sequelae.[50] Education about the effects of polio when the client was a child, combined with information about current symptoms, is important.

Fatigue and pain are the two symptoms most frequently mentioned by clients with PPS. Scoliosis is found in nearly all survivors of polio. Even though scoliosis itself generally does not produce pain, the strain it puts on joints and muscles through abnormal biomechanics can produce degenerative disk disease, as well as pain in the shoulders, knees, and other joints and muscles.[48] Decreased vital capacity and difficulty breathing with deventilation during sleep is observed frequently in these clients. If the client complains of frequent awakening during the night or breathing problems, the therapist should refer the client to a pulmonologist immediately.[48,52]

A client-centered intervention plan is designed to help the client and caregiver improve functional outcomes. Adaptive strategies and preventive measures are key factors to include in the OT intervention plan. The prognosis and selection of intervention methods depend on the progression of the disorder. Functional and leisure activities that are meaningful to the client are used in combination with work simplification, pacing the activity for energy conservation, passive and active ROM exercises, muscle reeducation, proper posture and body mechanics, joint protection, and training in the use of assistive and adaptive devices and mobility aids, as needed. In all cases, the therapist must teach the client to carefully monitor fatigue level and to modify or stop the activity when necessary.[52] Prioritizing goals is critical to reach the desired outcome, and intervention goals should be coordinated with the client and members of the interdisciplinary team for a comprehensive rehabilitation program. Psychosocial aspects of the disorders must be addressed in the intervention plan.[20,38]

Understanding the client's psychosocial reactions to the various disabilities associated with PPS will help the therapist and client select interventions that will facilitate rehabilitation efforts and the patient's adjustment to new limitations. Changes in physical capacities, abnormal fatigue, and curtailment of valued life skills confront the client with psychological issues of coping, adjustment, and adaptation. These changes may be as traumatic as they were at the time of the original illness. It is important to be aware of the stages of adapting to a chronic disabling condition.[38,39] Feelings of denial, anger, and hopelessness and the sense of being a burden should be identified and addressed as a part of the OT intervention. Helping clients and families connect with support groups can make a difference in psychosocial acceptance and motivation.[52] If the client's psychological needs are beyond the scope of the OT practice, referral to a psychologist is appropriate.

Because the client with PPS may be psychologically fragile when facing increasing levels of disabilities, the occupational therapist should introduce lifestyle changes gradually because modifying performance patterns and introducing adaptive equipment could threaten the client's self-image. Small changes may be more acceptable than major ones, even if the latter are obviously necessary. The client's spiritual beliefs must be considered when developing an intervention plan, and “activities of the spirit” may be helpful to foster a sense of hope.[9]

The benefits of exercise are controversial. Muscles affected by PPS may actually function at levels of strength lower than estimated from the results obtained on the MMT, and upper extremity strength varies markedly throughout the ROM. Thus careful observation is essential during engagement in occupations. Exercise must be carefully supervised because it may aggravate pain and overwork muscles innervated by a limited number of motor units.[12,52] Signs of excessive activity are further weakness, discomfort, pain, muscle spasm, and chronic fatigue.[36,51,52]

Chronic pain can be managed or alleviated by prescribed pharmaceuticals, improving body mechanics during occupations, supporting weakened muscles through splinting and adaptive equipment, and promoting lifestyle and role modifications through a multidisciplinary treatment approach based on cognitive-behavioral therapy (CBT), a method that is frequently used by chronic pain management programs and may be employed by occupational therapists. CBT teaches clients about the dynamics of pain and coping strategies such as stress management, relaxation and visualization, appropriate use of play and humor, recognition of fatigue and implementation of activity pacing, monitoring of self-talk, and family training.[10,22,42,48] Strategies can be taught to reduce or eliminate nonessential activities, thus reducing overuse of muscles and resultant pain. Energy conservation for the most valued activities may mean delegating less valued ones to others or performing them with the assistance of equipment, such as orthoses, assistive devices, or ambulation aids.[51,52] Body weight reduction may be medically recommended for some clients to reduce pain, and occupational therapists can work in conjunction with dietitians to address weight loss through cooking groups that create the recommended high-protein diet.[39]

It is important to make referrals to appropriate healthcare professionals depending on the needs of the client and family. These healthcare professionals may include an orthotist, physical therapist, pulmonologist, and psychologist.[52]

GBS and PPS are two disorders that require OT services; they have been presented in detail to outline the process used for individuals with these disorders. The remaining portion of this chapter describes other disorders related to the motor unit that result in compromised occupational performance. The principles behind the interventions described for both GBS and PPS apply to the following disorders as well.

Peripheral Nerve Injuries

Thus far, this chapter has described diseases affecting the anterior horn cell and peripheral nerves. This section covers three specific upper extremity **peripheral nerve injuries**: axillary nerve, brachial plexus, and long thoracic nerve injury. The **brachial plexus** includes the nerves from C5 through T1.[37] These nerve fibers, both sensory and motor, intertwine closely to the vertebral column. The fibers join to form trunks of the brachial plexus, and from the trunks arise the divisions at which further interweaving of fibers occurs. The divisions give rise to the cords of the brachial plexus, and from the cords the terminal branches or named peripheral nerves arise. From an anatomic presentation, this complexity has the potential to preserve function if one root is compressed. For example, the radial nerve is composed of fibers originating from C6, C7, C8, and T1. For a list of nerves, muscles innervated, and actions performed, see Table 37.4. (See Chapter 39 for additional information on peripheral nerve injuries, peripheral pain syndromes, and the management of these disorders.)

TABLE 37.4

Clinical Manifestations of Peripheral Nerve Lesions of the Brachial Plexus

Spinal Nerves	Nerve	Motor Distribution	Clinical Manifestations
C5	Dorsal scapular	Rhomboid major and minor, levator scapulae	Loss of scapular elevation, adduction, downward rotation
C5-6	Suprascapular	Supraspinatus, infraspinatus	Weakened lateral rotation of humerus
C5-6	Subscapular	Subscapularis, teres major	Weakened internal rotation of humerus
C5-6	Axillary	Deltoid, teres minor	Loss of shoulder abduction, flexion, and external rotation and extension
C5-7	Musculocutaneous	Biceps brachii, brachialis, coracobrachialis	Loss of forearm flexion and supination
C5-7	Long thoracic	Serratus anterior	Winging of the scapula
C6-8	Thoracodorsal	Latissimus dorsi	Loss of arm adduction and shoulder extension
C6-8, T1	Radial	All extensors of arm, wrist, fingers, thumb, abductor pollicis longus, supinator, brachioradialis	Wrist drop, extensor paralysis, inability to supinate
C6-8, T1	Median	Flexors of wrist, hand, and digits; forearm pronators; opponens pollicis; abductor pollicis brevis; flexor pollicis brevis; first and second lumbricales	"Ape-hand" deformity, weakened grip, thenar atrophy, unopposed thumb
C8-T1	Ulnar	Supplies muscles on ulnar side of forearm and hand; adductor pollicis, abductor digiti minimi, opponens digiti minimi, flexor digiti minimi brevis, flexor digitorum profundus (digits 4, 5), third and fourth lumbricales, flexor carpi ulnaris, palmaris brevis, dorsal and palmar interossei, flexor pollicis brevis (deep head)	"Claw-hand" deformity, also known as an intrinsic minus hand deformity; interosseus atrophy, loss of thumb adduction

From Hislop HJ, Avers D, Brown M: *Daniels and Worthingham's muscle testing: techniques of manual examination*, ed 9, Philadelphia, 2013, WB Saunders.

Many people are injured every year by car accidents, falls, sports mishaps, gunshots, and violent acts (eg, blunt and sharp wounds) that result in severed, crushed, compressed, or stretched peripheral nerves.[35] The most obvious manifestation of peripheral nerve injury is muscle weakness or flaccid paralysis, with symptoms depending on the extent of the nerve damage. Deep tendon reflexes are depressed or absent. Sensation along the cutaneous distribution of the nerve is also altered or lost. Trophic changes, such as dry skin, hair loss, cyanosis, brittle fingernails, painless skin ulcerations, and slow wound healing in the area of involvement, may be present.

Extensive peripheral nerve damage may produce deformity if contractures, joint stiffness, and poor positioning are allowed to occur. Disfigurement of the hands is particularly noticeable and may produce psychological distress. Other complications may include osteoporosis of bone and epidermal fibrosis of the joints. See Table 37.4 for descriptions of clinical manifestations of peripheral nerve lesions of the brachial plexus.

Axillary Nerve Injury

The axillary nerve is composed of the C5-C6 spinal nerves and arises from the upper trunk of the brachial plexus. The motor branches of the axillary nerve innervate the deltoid muscle and the teres minor muscle (see Table 37.4).[19] The axillary nerve is "the most commonly injured nerve in the shoulder, and the most common cause of injury is anterior dislocation of the shoulder or fracture of the neck of the humerus."[25] Nerve damage may occur as a result of the actual dislocation or of the reduction; other causes include compression (eg, crutches) or trauma (eg, blunt or lacerating wounds). As a result, the client has weakness or paralysis of the deltoid muscle, which causes limitations in shoulder flexion, abduction, extension, and weakness in lateral rotation of the arm. In addition to the loss of muscle power, atrophy of the deltoid muscle produces asymmetry of the shoulders, which may cause issues with body image.[25]

See Table 37.1 for OT assessments. ROM assessment and MMT, as well as clinical observation of the client's ability to use the arm functionally, are critical.

Interventions for axillary nerve injury require that the shoulder dislocation be reduced and that the arm be supported for a brief time in a sling. When the physician prescribes OT for rehabilitation of shoulder function, interventions include passive and active ROM of shoulder flexion and extension and shoulder abduction and adduction exercises while the client is supine or lying on the noninjured side to minimize gravity (Table 37.5). Functional movements are graded as the muscles become stronger.

TABLE 37.5

Occupational Therapy Interventions for Peripheral Nerve Injuries

Nerve Injury	Intervention	Example of Activities
Axillary nerve	Passive ROM to prevent deformity and improve circulation; necessary to protect teres minor and deltoid muscles from stretch during the passive ROM activities	Passive ROM performed two or three times daily while client is supine or lying on uninjured side to minimize effects of gravity; family or caregiver instructed in techniques; client instructed in self-ranging techniques performed on a daily basis
	Adaptive equipment	Instruction in use of long-handled assistive devices to compensate for upper extremity abduction deficit
	Joint protection	Instruction in joint protection to allow nerve time to heal and to prevent further injury; instruction in adaptive equipment, as needed for activities of daily living and leisure, work, and play occupations
	EMG biofeedback	Biofeedback potentially beneficial in providing the client with visual and auditory incentives during muscle reeducation sessions
	Retrograde massage	Use of retrograde massage if edema occurs in hand or arm; client, family, or caregivers instructed in technique to be performed several times per day
	Graded activities	Shoulder movement critical to recovery; incorporation of long, sweeping shoulder movements in the client's meaningful activities; graded from horizontal to vertical
Brachial plexus	Passive ROM to maintain joint flexibility	Passive ROM performed while supine twice daily, with emphasis on shoulder flexion, abduction, and external rotation; family or caregiver instructed in techniques
	Tactile stimulation to upper extremity to increase awareness	Massage, vibration, application of various textures to the arm
	Proprioceptive stimulation to upper extremity	Joint approximation through progressive weight bearing to increase awareness; always necessary to ensure proper alignment of joints
	Bilateral integration to improve body scheme	Use of developmentally appropriate bilateral activities (eg, toys, crafts, or activity that requires two hands)
	Pool therapy	Therapeutic exercises with gravity minimized in water; swimming or weight lifting possible as client's strength improves
	Electrical stimulation	As prescribed by physician after EMG
	Slings	For damage to C5 and C6, sling fabricated to fit around humerus to support arm and allow hand to engage in occupations; especially important if arm is flaccid and the individual is able to walk—prevents further traction injury to nerves
	Splints	Resting splint for flaccid hand/wrist seen with damage to C8 and T1 to maintain part in functional position and prevent contractures; other splints available or fabricated for specific joints; air splints sometimes used to provide stability in elbow extension to bear weight with damage to C7
	Retrograde massage	For edema in hand or arm; client, family, or caregivers instructed in technique to be performed several times per day
Long thoracic nerve	Shoulder stabilized to limit scapular motion while nerve heals	After medical treatment, encouragement of maximal functional independence during activities and education in use of long-handled devices to compensate for shoulder limitations
	If nerve regeneration is not complete, possible consideration of surgery to relieve the excessive mobility of the scapula	
	Retrograde massage	For edema in hand or arm; client, family, or caregivers instructed in technique to be performed several times per day

EMG, electromyography; *ROM*, range of motion.

Data from Storment M: *Margaret Storment's guidelines for therapists: treating children with brachial plexus injuries.* www.ubpn.org/awareness/A2002storment.

Brachial Plexus Injuries

The nerve roots that innervate the upper extremity originate in the anterior rami between the C5, C6, C7, C8, and T1 spinal segments. This network of peripheral nerves is collectively called the brachial plexus. This important nerve complex can be palpated just behind the posterior border of the sternocleidomastoid as the head and neck are tilted to the opposite side.[15]

Case Study

William

William, a 60-year-old husband and teacher, was in a car accident that dislocated his right dominant shoulder. He was taken to the emergency room, given a sling, and sent home. Over the next few days, he noticed that he could neither flex nor abduct his humerus more than approximately 45 degrees. His physician reviewed his x-rays, repositioned the humerus, and diagnosed axillary nerve injury. Once the glenohumeral joint was stable, she prescribed occupational therapy to recover arm function.

During his therapy sessions, Marla, his occupational therapist, instructed William and his wife about joint protection, ROM exercises, and use of a reacher. As William's strength improved, Marla explored meaningful activities with him. After he enthusiastically mentioned a map project illustrating the places where he and his family had traveled, the two of them worked together to mount the map on poster board. Marla graded the activity and encouraged William to use long, sweeping movements of his right shoulder in flexion/extension and abduction/adduction when spreading the glue. William then sanded the frame and painted it, again using gliding shoulder movements. His home program also included smooth, gliding shoulder movements (eg, wiping the counters, which his wife happily endorsed).

Analysis

Injury to the axillary nerve is one of the most common peripheral nerve injuries. Once the dislocation of the humerus has been reduced and the nerve begins to regenerate, rehabilitation of function may be possible. In this case, the occupational therapist was able to identify an activity that related to William's role as husband and home project enthusiast. This meaningful occupation caught his attention and engaged him in participation to accomplish the task.

Most brachial plexus injuries are typically unilateral and occur during birth.[31] Obstetric brachial plexus injury occurs if the baby's shoulders become impacted during delivery, which causes the brachial plexus nerves to stretch or tear. For example, if the infant's shoulder is stuck in the birth canal during delivery and the head is pulled, the neck is stretched, which can subsequently stretch or tear the brachial plexus. In adults, traumatic brachial plexus injuries are caused by damage to the nerve roots from a variety of causes (eg, car or motorcycle accidents, sports misadventures, falls, blows to the neck with blunt or sharp objects, radiotherapy).[30] The two types of brachial plexus lesions are Erb-Duchenne syndrome and Klumpke's (Dejerine-Klumpke) syndrome.[15,31,40] These disorders are also referred to as Erb's palsy and Klumpke's palsy.

Erb-Duchenne syndrome is seen with lesions to the upper trunk of the brachial plexus, which consists of C5 and C6 nerve fibers. The incidence among newborns is 2 to 5 per 1000 births with 80% to 90% full recovery within 3 to 24 months.[43] The incidence among adults is not known. Typically, the muscles of the shoulder and elbow are affected, whereas hand movement is retained. Paralysis and atrophy occur in the deltoid, brachialis, biceps, and brachioradialis muscles (see Table 37.4). Upon observation, the arm hangs limp in internal rotation and adduction of the shoulder. The elbow is extended, the forearm pronated, and the wrist flexed, resulting in the “waiter's tip position.” Even though hand muscles are unaffected, functional movement of the upper extremity is extremely limited.[15,25,43]

Klumpke's syndrome results from compression or traction to the lower trunk of the brachial plexus (comprising nerves arising from C8 and T1) and is seen less often than Erb-Duchenne syndrome. Traction during birth or later in life that is caused by a strong upward pull on the upper extremity when it is in an abducted position can result in this disorder. The involved nerves innervate muscles whose actions are wrist and finger flexion and abduction and adduction of the fingers (see Table 37.4). Consequently, paralysis to the distal musculature of the wrist flexors and the intrinsic muscles of the hand results in a “claw-hand deformity,” also referred to as an intrinsic minus hand deformity (Fig. 37.2).[14,25,43] (See Table 37.1 for OT assessments.)

FIG 37.2 Klumpke's syndrome: paralysis to the distal musculature of the wrist flexors and the intrinsic muscles of the hand that results in a “claw-hand deformity” or intrinsic minus hand. (From Chung KC, Yang LJS,

McGillicuddy JE. *Practical management of pediatric and adult brachial plexus palsies*, Edinburgh, 2012, Saunders.)

OT interventions initially involve partial immobilization and positioning. Passive ROM is critical for maintaining joint flexibility, and the client's family or caregiver should be taught to perform these exercises with the client two or three times daily. Intervention includes a variety of tactile and proprioceptive sensory input exercises to increase sensory awareness. Preventing contractures is critical to a functional outcome. For individuals with Erb-Duchenne syndrome, performance of passive and active assistive exercises and fabrication of a sling that fits around the humerus to support the arm are important. If strength improves, resistive exercises and activities can be implemented, and the sling may be removed or used intermittently during walking to support the shoulder.[40,43] For those with Klumpke's syndrome, a short opponens hand splint that supports the thumb in opposition is often used. It is important to provide occupations that are appropriate to developmental ages and stages and that appeal to the client and encourage active use of the extremity in bilateral activities. Surgery to improve nerve growth and upper extremity function may be recommended if improvement is not spontaneously observed within a few months.[40,43] Other interventions are described in Table 37.5.

Long Thoracic Nerve Injury

The long thoracic nerve, arising from C5-C7 nerve roots, innervates the serratus anterior muscle, which anchors the apex of the scapula to the posterior of the rib cage. The serratus anterior's action is scapular abduction and upward rotation (see Table 37.4).[19] Although injury to this nerve is not common, the nerve can be injured in a number of ways: carrying heavy weights on the shoulder (eg, backpacks), blows to the neck, compression caused by prolonged lying on the lateral trunk, and wounds. The resulting clinical picture involves "winging" of the scapula where the inferior angle and lower portion of the medial border of the scapula is protruding off the thoracic rib cage. The individual experiences difficulty flexing the glenohumeral joint above shoulder level and protracting the shoulder or performing scapula abduction and adduction.[15,25] Asking the client to perform a wall pushup is a commonly used screening assessment technique. If the long thoracic nerve is impaired, the scapula on that side will elevate and move medially, with the inferior angle rotating medially to produce a winging of the scapula.[25] Other OT assessments are described in Table 37.1.

Lesions of the radial, median, and ulnar nerves and cumulative trauma disorders affecting the hand are discussed in Chapter 39.

Psychosocial Interventions for Peripheral Nerve Injuries

Brachial plexus, thoracic, and axillary nerve injuries are life changing, affecting the psychological and emotional states of clients and their families and friends. Clients often experience depression, which may be a reaction to the traumatic event that caused the injury or may become chronic and serious. Occupational therapists can be helpful in this regard by discovering activities that are meaningful to the client and adapting them for success. The client's self-image is challenged and may require revision to accommodate the client's changed health status. For example, if the deltoid muscle has atrophied, the client can wear a foam or thermoplastic pad under clothing to round out the shoulders. Use of these aesthetic pads may increase the client's willingness to venture out into society. Referrals to support groups or a psychologist also may help clients adjust to a changed appearance.[38]

Participation in leisure occupations has been found to help people with physical disabilities redefine themselves (see Chapter 16), and occupational therapists should consider leisure as an important area of occupation to include in an intervention plan.[2]

Neuromuscular Disorders

Neuromuscular Junction: Myasthenia Gravis

Myasthenia gravis (MG) is the most common chronic disease involving a disorder of chemical transmission at the nerve-muscle synapse, or neuromuscular junction. The term *myasthenia gravis* is derived from Greek and Latin and means "grave muscle weakness."[21,34,49] It is caused by an autoimmune response in which antibodies are produced that block, alter, or destroy the nicotinic acetylcholine receptors on the postsynaptic membrane and interfere with synaptic transmission at the nerve-muscle junction. Because neurotransmission is defective, skeletal (voluntary) muscles, typically the cranial muscles, become weak and easily fatigued. The incidence of MG in the United States is approximately 14 to 20 in a population of 100,000, but it may be underdiagnosed, especially among very old persons. The latest statistics show that with the aging of the population, men are diagnosed more often than women, with symptoms beginning after 50 years of age.[3,7,21,45]

Most clients diagnosed with MG initially experience symptoms in the oculomotor muscles that cause eyelid drooping, referred to as ptosis, and double vision, referred to as diplopia. Oropharyngeal muscle weakness, which results in difficulty in chewing, swallowing, and speaking, is seen in some clients. Weakness of limb musculature is not typically an initial symptom. People with MG tend to be stronger in the morning, but their strength and endurance decrease as the day progresses and muscles fatigue. Therefore the client may experience increased double vision, severe drooping of the eyelids, difficulty with speech or swallowing, and fatigue with repetitive activity as muscles tire (Table 37.6).

TABLE 37.6

Myasthenia Gravis: Initial Symptoms, Description, and Percentage of Clients With Symptoms

Initial Symptoms	Description	Approximate Percentage of Clients With Initial Symptoms
Oculomotor dysfunction	Severe drooping of eyelids (ptosis), double vision (diplopia), inability to move eyes in certain directions	70%
Otopharyngeal muscle weakness	Difficulty chewing, swallowing, speaking; in severe cases, problems breathing and coughing resulting in aspiration	20%
Limb weakness	May be limited to specific muscles or may progress to generalized fatigue	10%

Data from Cabrera CS, et al: Myasthenia gravis: the otolaryngologist's perspective, *Am J Otolaryngology* 23:169, 2002; Howard JF: *Myasthenia gravis: a summary.* www.myasthenia.org/information/summary; Brown RH, Cannon SC, Rowland LP: Diseases of the nerve and motor unit. In Kandel ER, et al, editors: *Principles of neural science,* ed 5, New York, 2012, McGraw-Hill; Kernich CA, Kaminski HJ: Myasthenia gravis: pathophysiology, diagnosis and collaborative care, *J Neuroscience Nurs* 27:207, 1995; Yee CA: Getting a grip on myasthenia gravis, *Nursing* 32:1, 2002.

Most clients with MG have abnormalities of the thymus glands, and some have thymic tumors. Removal of the thymus gland (thymectomy) is standard therapy for most clients, but response time for symptom reduction varies with individuals and may take as long as 2 to 5 years after surgery. Clients without thymomas have a better response to surgery than those with a tumor. Clients are also treated with corticosteroids (prednisone) and immunosuppressive and cholinesterase-inhibiting drugs.[7,21] High-dose intravenous immune globulin has been reported to decrease symptoms in 50% to 100% of clients for a period of weeks to months. For clients with symptoms that suddenly worsen, those about to have surgery, or those who have not responded well to other interventions, plasma exchange is used as a short-term treatment. Nearly all people with MG improve for weeks to months after plasma exchange.[21]

Most people with MG usually experience maximal weakness during the first year after diagnosis. The course of the disease fluctuates but is usually progressive. However, according to the Myasthenia Gravis Foundation of America (www.myasthenia.org), the current prognosis for most patients with this disease is good; most live normal or nearly normal lives. Remissions or a decrease in symptoms and an improvement in strength and function can last for years. However, emotional upset, extended exertion, infections, medications, thyroid conditions, elevated body temperature, or childbirth may induce exacerbations of unpredictable severity.[21] With modern diagnosis and treatment effectiveness, the mortality rate of MG is nearly zero.[45]

Role of the Occupational Therapist

Because similarities exist among the diagnoses of motor unit disorders, OT evaluation follows the same pattern, with specific assessments selected according to the disorder (see Table 37.1). A significant area for assessment in MG is eating and swallowing because of the dangers of aspiration. Because some clients may experience difficulty with diaphragmatic and intercostal muscle strength, they may have trouble coughing to clear secretions. An occupational therapist with advanced training in dysphagia should assess and treat clients with severe eating and swallowing dysfunction (see Chapter 27).

Case Study

Jan

For several months, Jan, a 45-year-old photographer, had noticed unusual changes in her body. Her eyelids felt heavy, and her vision would blur after she was reading for a short period of time; it felt as if she was cross-eyed. Jan's speech became slurred if she was in a lengthy conversation. More recently, she had become aware that when she was drinking thin liquids, such as coffee, she would frequently choke. When she visited her doctor and received the results of medical tests, she was shocked to hear that she had an autoimmune disorder called myasthenia gravis. Jan's physician referred her to a surgeon for removal of her thymus gland, and she was given a prescription for prednisone.

Jeri, an occupational therapist trained in dysphagia, assessed Jan's swallowing abilities and recommended that thickening agents be added to liquids to decrease choking. As Jan improved, Jeri performed ongoing swallowing assessments and was able to gradually add thinner liquids so that Jan could again enjoy coffee. Jan reports that the most important thing that anyone did for her was when Jeri helped her enroll in a myasthenia gravis support group, where she experienced empathy, was given resources, and, to her surprise, found herself laughing again.

Analysis

People with myasthenia gravis can be helped through a variety of therapies to lead a near normal life. When a swallowing disorder is present, an occupational therapist with advanced training must perform a dysphagia assessment and make recommendations to prevent aspiration and pneumonia. A social support system is critical to the well-being and recovery of people with this disease.

Interventions for clients with MG depend on the results of the OT evaluation, which includes client and caregiver goals. The therapeutic program should not cause fatigue; therefore the therapist must be aware of the client's medication regimen, ability to tolerate activity, and the time of day that the client has the most energy. The client's muscle strength must be monitored on a regular basis, and the occupational therapist keeps a running record to document any important changes that must be reported to the medical team. Specific intervention protocols for MG are scarce, but one study described the ways in which subjects with MG self-managed fatigue. “Effective self-care actions include stress reduction techniques, pacing all activities, and increased rest and sleep.”[13]

An important aspect of treatment is to educate the client and family members to use energy conservation and work simplification strategies when engaging in ADLs, IADLs, and leisure occupations (see Chapters 10, 14, and 16). Adaptive and assistive devices may be introduced to decrease effort during daily activities. Because vision may be impaired, the occupational therapist should visit the client's home to assess architectural barriers, bathroom safety, and furniture arrangements; otherwise, the client might fall. If chewing and swallowing are problems, an eating program should be designed and monitored by an experienced occupational therapist (see Chapter 27).

Because of the client's facial appearance (eg, drooping eyelids), fear of choking, or steroid-related changes in appearance, the psychosocial effects of MG may be distressing to clients and their family and friends. The therapist should always treat the client with empathy and encourage honest discussion. For general well-being, the client must be able to express his or her feelings about these physical changes.[38] The client and family members may also be referred to an MG support group, a psychologist, or both.

Myopathic Disorders

Muscular Dystrophies

The muscular dystrophies are a group of more than 30 genetic diseases. The dystrophies have in common the progressive degeneration of muscle fibers while the neuronal innervation to muscle and sensation remains intact. As the number of muscle fibers declines, each axon innervates fewer and fewer of them, resulting in progressive muscle weakness. Some forms of **muscular dystrophy** (MD) have an onset in childhood, whereas others may not appear until middle age or later. The disorders also differ in terms of the distribution and extent of muscle weakness, rate of progression, and pattern of inheritance.[33] The major types of MD—Duchenne, Becker, facioscapulohumeral, myotonic, and limb girdle—are described in Table 37.7.

TABLE 37.7

Major Types of Muscular Dystrophy

Type	Description	Age of Onset and Progression
Duchenne	Affects boys only because it is inherited as an X-linked recessive trait	Onset age: 3-5 years—begins in muscles of pelvic girdle and legs
	Results from gene mutation that regulates the protein involved in maintenance of muscle integrity	By 12 years unable to walk; uses wheelchair
		Weakness spreads upward to shoulder girdle and trunk
		By 20 most need respirator to breathe, with death usually occurring by age 30
Becker	Similar to Duchenne, with milder symptoms	Onset age: 2-16 years
	X-linked recessive, affects boys	Slower progression of weakness
		Survival into middle age
Fascioscapulohumeral	Affects both genders	Onset age: Adolescence
	Autosomal dominant	Slow progression of weakness resulting in a near normal lifespan
	Affects primarily the muscles of the face and shoulder girdle (hence its name)	
Myotonic	Affects both genders	Onset age: Varies, often adult
	Causes weakness but also myotonia—prolonged muscle spasm or delayed muscle relaxation after vigorous contraction—especially in fingers and face; floppy, high-stepping gait; appearance of long face and drooping eyelids	Involves cranial muscle and distal limb weakness rather than proximal
		May be mild or severe
		Associated symptoms progress to involve cardiac abnormalities, endocrine disturbances, cataracts, and, in men, testicular atrophy and baldness
Limb girdle	Affects both genders	Onset age: teens to early adulthood
	Progressive weakness affecting pelvic girdle and shoulder girdle first	Weakness leads to loss of ability to walk within 20 years
		Relatively slow progression
		Death in mid to late adulthood

From the National Institute of Neurological Disorder and Stroke: *Muscular dystrophy: hope through research*, March 4, 2016; Brown RH, Cannon SC, Rowland LP: Diseases of the nerve and motor unit. In Kandel ER, et al, editors: *Principles of neural science*, ed 5, New York, 2012, McGraw-Hill.

Because this group of diseases is degenerative, the decline of muscle function cannot be prevented. As yet, there is no cure. Medical management is largely supportive. Drug therapy includes corticosteroids to slow the rate of muscle degeneration, immunosuppressants to delay some damage to dying muscle cells, drugs to provide short-term relief from muscle spasms and weakness, anticonvulsants to control seizures and some muscle activity, and antibiotics to fight respiratory infections. Various treatment therapies are currently being investigated but are not yet available. These include gene replacement, gene modification, and cell-based and drug-based therapy.[33]

Rehabilitation measures are vital in delaying deformity and achieving maximal function within the limits of the disease and its debilitating effects. In addition to occupational therapy, rehabilitation may include physical therapy, speech therapy, and respiratory therapy services.[33]

Role of the Occupational Therapist

The primary goal of OT is to help the client with MD maintain maximal independence as long as possible. Self-care activities and assistive devices that promote independence during home, school, leisure, and work activities are a vital part of the treatment program.[40] Leisure occupations need to be considered in a comprehensive OT intervention plan to ensure balance in all areas of the client's life. Play and laughter are particularly important to the health, well-being, and social adjustment of the growing youth (see Chapters 6 and 16).

A comprehensive team evaluation of the client's abilities and disabilities should be administered. The team includes the physician, occupational therapist, physical therapist, and psychologist. A social worker may advise the family on community resources. The occupational therapist assesses the client's functional status in ADLs and IADLs, ROM exercises, and muscle strength, as well as the fit and proper use of adaptive equipment, engagement in leisure activities, and emotional status. (See Table 37.1 for assessments.)

After the evaluation process is complete, an OT intervention plan is developed to address specific concerns. Active exercise may help the client to maintain strength, but overexertion and fatigue must be prevented. Because people with MD may experience cardiac complications, occupational therapists must be aware of the client's medical history and use exercise judiciously, observing cardiac precautions when necessary. Incorporating exercise into meaningful, age-related activities that are monitored by a therapist can promote engagement in participation. Parachute games, obstacle courses, and swimming may be implemented with frequent built-in rest breaks.[16]

Two pilot studies involving clients with MD and exercise show that improvements are possible; investigators recommend further research. Clients with myotonic dystrophy showed significant improvement in hand function and self-rated occupational performance on the Canadian Occupational Performance Measure after a 3-month hand training OT intervention.[1] An experimental pilot study quantitatively evaluated qigong and determined that it may be used as an adjunct therapy program. Subjects with MD reported perceived maintenance of general health and positive coping when compared to the control group. The treatment group tended to "maintain balance function during training and performance of qigong whilst there was a decline when not training." The researchers concluded that qigong decreased the rate of decline and is worthy of further study.[47]

Adaptive equipment and environmental modifications are often used as OT interventions. Instruction in work simplification and energy conservation—as well as in creative and effective strategies to perform ADLs, IADLs, and various other occupations—is important in the OT program.[16,40] A powered wheelchair, a wheelchair lap board, suspension slings, or mobile arms supports may facilitate greater independence in self-feeding, writing, reading, computer use, and tabletop leisure activities when there is substantial shoulder girdle and upper limb weakness. Built-up utensils are helpful when grip strength declines. Home and workplace modifications will be necessary for most clients. Client and family education is an important part of a team rehabilitation program.[40] A supportive approach to the client and family is helpful as function declines and new mobility aids, assistive devices, and community resources become necessary.[16]

Wheelchair prescription and mobility training in either a manual or powered wheelchair are included in the OT intervention program. The wheelchair may require a special seating system or supports to minimize the development of scoliosis, hip and knee flexion contractures, and ankle plantar flexion deformity.[16,40] Powered wheelchairs are often recommended to conserve energy and decrease strain on shoulders and trunk. Instruction in methods to maneuver power chairs can cause overexertion, and this activity, like any other, must be graded for difficulty. One study found that young people (ie, those between 7 and 22 years of age) diagnosed with either MD or cerebral palsy who were inexperienced powered wheelchair drivers significantly improved their wheelchair driving performance through the use of simulator training. The researchers concluded that this method of instruction conserved energy and was effective.[18]

Chronic pain in children, adolescents, and young adults (ie, persons between 8 and 20 years of age) with physical disabilities has not been widely studied, but research indicates that chronic pain interferes with ADLs and IADLs in young people with MD, cerebral palsy, spinal cord injury, acquired and congenital limb deficiency, and spina bifida.[27] Pain appears to be more prevalent in female subjects than male subjects during the performance of daily routines, it interfered most often with physical activities, and it negatively affected mood. McKearnan noted that the young people in this study frequently reported pain associated with physical therapy, OT, and therapeutic home programs.[27] They also complained that the use of splints, orthotics, and prosthetics was sometimes painful. Therapists must be aware of their client's pain levels and modify activities, splints, and orthotics as needed. Helping clients with MD to manage pain will most likely lead to improved quality of life.

The sense of self is challenged as clients with MD realize that they will experience a progressive loss of bodily function. Occupational therapists must realize that these clients are constantly forced to redefine themselves as they go through life, making "continuous trade-offs as function is lost."[38] A critical element in OT intervention is to help the client and family members find meaningful activities in which to participate either as individuals or as a family. For example, connecting with spiritual activities that engage clients and families on the deepest level could be critical to a sense of hope and well-being.[9] Alternatively, encouraging families to use humor and to play and laugh together can promote bonding, reduce fear and anxiety, and produce positive physical and emotional feelings.[5]

Psychosocial issues related to MD involve the whole family. Parents go through phases of shock, fear, and despair when the diagnosis is made and as the child ages and function decreases (eg, when the wheelchair is prescribed). Encouraging parents not to be overprotective and to continue to promote their child's independence is an important aspect of therapy. Further, therapists can anticipate times in the growing child's life when psychosocial support will be most essential and can offer education and support during intervention sessions. Some potentially disturbing developmental milestones for the client and family occur when the child starts school (at approximately age 5), when the child loses the capacity for independent ambulation (at 8 to 12 years), when adolescent social life is limited, and, of course, when young adulthood arrives with the expectation that death is imminent.[16,40] Referral to a psychologist, family counselor, or spiritual adviser during these times should be considered.

Summary

The motor unit consists of the lower motor neuron, neuromuscular junction, and muscle. Some motor unit dysfunctions are reversible, and others are degenerative. The role of the occupational therapist is to assess functional capabilities in all occupational performance areas and contexts. ADLs and IADLs (including self-care, home management, mobility, and work-related tasks), energy conservation, work simplification, joint protection, spiritual approaches, and appropriate humor may be used to restore or maintain function. Proper positioning, exercise programs, and pain management techniques are used as indicated to facilitate recovery and increase functional capacity. Orthoses, assistive devices, communication aids, and mobility equipment and training in their use may be necessary. Psychosocial considerations and client and family education are important aspects of the OT program.

Threaded Case Study

Edith, Part 2

Return to the case study presented at the beginning of this chapter, and compare your answers with the ones given here.

1. What are the phases of Guillain-Barré, and what occupational therapy interventions might be used in each phase?

The typical progression of GBS occurs in three phases. The initial, or acute, phase begins with the client's first conclusive symptoms and lasts until there is no further decline in physical status. This phase may last from 1 to 4 weeks.[29] During this phase, Edith's condition progressed from generalized weakness to paralysis of her extremities and muscles of the trunk and diaphragm. She was completely dependent in activities of daily living and required a ventilator to breathe. Jen, the occupational therapist assigned to the intensive care unit, established four goals with Edith and her family.

Goal	Intervention
Maintain full ROM in all joints.	Perform passive ROM two times per day to all joints.
Prevent contractures.	Fabricate resting hand splints, and educate client, family, and nursing aides in proper ways to position Edith in bed.
Teach Edith and family about GBS.	Provide and discuss handouts, reading materials, and GBS websites.
Provide a strategy for Edith to listen to the Bible.	Instruct Edith in ways to use the control switch with her tongue to turn the CD player on and off.

Phase 2, the plateau phase, began when Edith's physical status stabilized, with no further deterioration. She was transferred to a regular hospital unit. She was able to breathe on her own, speak softly, and sit up in bed in a semireclining position with pillows positioned for support. Some strength had returned to her proximal musculature, but her hands remained paralyzed and she fatigued easily. The plateau phase lasted a few weeks during which Edith's physical status remained unchanged. The goals for this phase were essentially the same as for the acute phase except that now Edith could choose to either read the Bible by turning the pages with a mouth stick or listen to the CD using the mouth stick to turn the player on and off. She could also control the television set with the mouth stick and was able to view her favorite shows. Family and friends were encouraged to visit but were cautioned not to fatigue her.

The recovery phase began when Edith's strength and sensation began to return to her distal extremities. She was transferred to the rehabilitation unit. The occupational therapist, Lara, and Edith came up with four goals during the recovery phase. The use of adaptive equipment such as built-up handles, work simplification and energy conservation techniques (eg, breaking the task down into steps and resting between steps), and the use of electric appliances were encouraged during activities. Edith practiced playing cards with other clients in a group environment. Lara set her up with a cardholder and a battery-powered card shuffler when her hands were too weak to hold the cards, but Edith eventually was able to play independently. Edith went to the mall with her granddaughter and Lara. During the outing, Lara taught them, in the context of shopping, how to gauge fatigue and to rest for 5 or 10 minutes when feeling tired. She also served as a role model, pacing the activity by limiting the initial shopping trip to 30 minutes and encouraging gradual lengthening of the experience over time. Lara provided Edith with community resources to aid in her independence. For example, the Guillain-Barré Syndrome Foundation International (GBSFI) offers local support groups, literature, and conferences to all GBS survivors and caregivers. In addition, Edith's family received extensive training from the interdisciplinary team members on how to continue the learned strategies and use the equipment in the home and community. Driving was not addressed at an inpatient level, but Edith was referred to the OT driver training program, where she would be assessed when her strength returned.

2. In what ways were Edith's psychosocial needs addressed during recovery?

Edith's fears about being paralyzed were addressed in several ways. Edith and her family were taught about the disease and encouraged to have hope because most people with GBS recover well. Edith's spiritual needs were met by making it possible for her to continue her morning Bible routine; she initially used a tongue switch to turn a Bible CD on and off and then was able to use a mouth stick to turn pages until her hands recovered strength. Edith expressed a desire to be as independent as possible in activities of daily living, to cook for her family, and to enjoy family outings and card playing. These activities were all made possible through occupational therapy adaptive interventions. Her family members and friends were encouraged to visit, gradually increasing the length of time that they stayed.

3. Describe energy conservation techniques that you think would be appropriate for Edith while engaging in her valued occupation of cooking.

First, Edith and Lara reviewed the recipe and listed the necessary items while seated at the kitchen table. Edith used a wheeled kitchen cart to gather items and carry them to the counter. Lara provided her with a reacher to obtain items on high shelves. When the items were assembled, Edith sat and rested on a bar stool near the counter while she and Lara reviewed the next step. Electric appliances were used to chop and stir the ingredients. Edith rested after this step. Lara showed Edith how to slide containers along the counter to the stove without lifting them. They walked back to the table to play a game of cards while the meal cooked. When the food was cooked, Edith placed plates and utensils on the kitchen cart with the one-dish meal and wheeled the cart to the table to enjoy her meal.

Review Questions

1. Name the components of the motor unit and one disorder that may result in dysfunction for each component.
2. Describe Guillain-Barré syndrome and the occupational therapy interventions used for clients with this disorder.
3. Describe the symptoms of postpolio syndrome.
4. What are the elements of the occupational therapy program for the client with postpolio syndrome?
5. List at least six clinical manifestations of peripheral nerve injury.
6. Describe the occupational therapy treatment strategies, including any contraindications, for peripheral nerve injuries.
7. Describe a method of managing pain that an occupational therapist may use.
8. Discuss the clinical signs of myasthenia gravis.
9. Describe the role of occupational therapy for clients who have myasthenia gravis.
10. What is the primary treatment precaution in myasthenia gravis?
11. Name and differentiate the four types of muscular dystrophy.
12. What are the treatment goals for muscular dystrophy?
13. Discuss ways that occupational therapists address the psychosocial needs of clients with each of the motor unit disorders.

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Suggested Readings

Ways of Coping Scale. [Available at Mind Garden Inc., 1690 Woodside Road, Suite 202, Redwood City, CA 94961] www.mindgarden.com.

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38

Arthritis

Lisa Deshaies

CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Understand the distinct disease processes of osteoarthritis and rheumatoid arthritis.
2. Describe common similarities and differences in the symptoms of osteoarthritis and rheumatoid arthritis.
3. Identify joint changes and hand deformities commonly seen with osteoarthritis and rheumatoid arthritis.
4. Recognize medications commonly used in the treatment of arthritis and their side effects.
5. Understand the physical and psychosocial effects of arthritis and their impact on occupational functioning.
6. Identify important areas to evaluate in clients with arthritis.
7. Identify the intervention objectives of occupational therapy for clients with arthritis.
8. Design an appropriate individualized intervention plan based on diagnosis, stage of disease, limitations in functional activity, and client goals and lifestyle.
9. Identify key resources helpful to persons with arthritis and to healthcare providers.
10. Identify evaluation and treatment precautions related to arthritis.

KEY TERMS

Arthritis

Crepitus

Gelling

Joint laxity

Nodes

Nodules

Osteoarthritis

Rheumatoid arthritis

Subluxation

Synovitis

Systemic

Tenosynovitis

Threaded Case Study

Nina, Part 1

Nina is a 52-year-old woman with a 4-year history of rheumatoid arthritis. She lives with her husband in a large two-story home. Her primary roles are managing her household and caring for her two grandchildren (ages 7 and 9) after school. Additionally, she is self-employed as an accountant who contracts her services to three small companies in nearby cities. Nina values being active and productive. Her part-time job serves as both a source of enjoyment and needed household income. In her leisure time, she participates in church activities and attends her grandchildren's school and sporting events.

Nina was referred to outpatient occupational therapy after an exacerbation of her arthritis that resulted in increased pain, fatigue, and difficulty engaging in many important daily occupations. On initial evaluation, Nina identifies her primary concerns as maximizing her functional level and reducing her pain so that she can resume full participation in work, housecleaning, and child care. Clinical examination reveals pain and limitations in active range of motion in all upper extremity joints, especially her wrists and fingers. Mild synovitis is present at her wrist and metacarpophalangeal joints, but no other joint changes are noted. Pain and stiffness are interfering with daytime activities and are also making sleep difficult. Her energy level has significantly decreased, and she reports feeling tired all the time. Although she still manages to watch her grandchildren for 2 hours each afternoon, she is unable to care for her house to her liking and is able to work only half of her usual 20 hours a week; she is fearful of losing her contracts.

Critical Thinking Questions

1. What components of evaluation would you choose to assess regarding Nina's prior and current clinical and functional status?

2. Which aspects of the disease process are most problematic, and what are the major performance skills, performance patterns, contexts, activity demands, and client factors influencing Nina's ability to engage in her employment and other areas of occupation?

3. What interventions would you use to help Nina reach her goal of being able to continue working?

Overview of Rheumatic Diseases

The term **arthritis** is of Greek derivation and literally means "joint inflammation." It is used to describe different conditions that fall under the larger umbrella of rheumatic diseases. Rheumatic diseases encompass more than 100 conditions characterized by chronic pain and progressive physical impairment of joints and soft tissues (eg, skin, muscles, ligaments, tendons). These conditions include osteoarthritis (OA), rheumatoid arthritis (RA), systemic lupus erythematosus, ankylosing spondylitis, scleroderma, gout, and fibromyalgia. One in every five adults in the United States has signs and symptoms of arthritis, increasing to nearly 50% in persons over the age of 65.[24] Arthritis is a major public health problem that costs the U.S. economy nearly $128 billion in medical care and indirect expenses annually.[26] Rheumatic diseases are a leading cause of disability with significant economic, social, and psychological impact[25] resulting in worse health-related quality of life for those affected than for those without arthritis.[41] Between 2010 and 2012, approximately 52.5 million Americans were affected by arthritis and other rheumatic conditions, with an estimated 43% experiencing limitations in their ability to participate in daily activities and 31% limited in their ability to work.[24,118] As the population continues to age, the prevalence of arthritis-related conditions is expected to increase to an estimated 67 million by the year 2030, with disability occurring in 37%.[24]

Occupational therapists are likely to encounter clients with rheumatic diseases in their practice settings, whether the condition is manifested as a primary or secondary type. To recognize problem areas and plan effective intervention strategies, the occupational therapist should know the unique features of each disease, its underlying pathology, and its typical clinical findings; the therapist should also be familiar with commonly prescribed medications and their adverse reactions. Given the scope and intended purpose of this book, it is neither appropriate nor possible to adequately describe every rheumatic disease. Therefore this chapter focuses on two of the most prevalent diseases: OA and RA. Armed with an understanding of the noninflammatory and inflammatory disease processes that they represent, the therapist can apply many of the evaluation and intervention principles to other rheumatic conditions. Table 38.1 provides a quick summary of the contrasting features of OA and RA.[3,12,24,32,59,91,108,110,113]

TABLE 38.1

Primary Features of Osteoarthritis and Rheumatoid Arthritis

	Osteoarthritis	Rheumatoid Arthritis
Prevalence	Affects 27 million Americans	Affects 1.5 million Americans
Peak incidence	Increases with age, <50 years old more common in males and >50 years old more common in females	Ages 40–60, 3 : 1 female-to-male ratio
Onset	Usually develops slowly over period of years	Usually develops suddenly, within weeks or months
Systemic features	None	Fever, fatigue, malaise, extraarticular manifestations
Disease process	Noninflammatory, characterized by cartilage destruction	Inflammatory, characterized by synovitis
Joint involvement	Individual	Polyarticular, symmetric
Joints commonly affected	Neck, spine, hips, knees, MTPs, DIPs, PIPs, thumb CMCs	Neck, jaw, hips, knees, ankles, MTPs, shoulders, elbows, wrists, PIPs, MCPs, thumb joints
Morning stiffness	<30 minutes	At least 1 hour, often >2 hours

CMC, carpometacarpal, *DIP*, distal interphalangeal; *MCP*, metacarpophalangeal; *MTP*, metatarsophalangeal; *PIP*, proximal interphalangeal.

Osteoarthritis

Osteoarthritis (OA), also referred to as degenerative joint disease, is the most common rheumatic disease and affects approximately 27 million people in the United States.[59,91] It ranks third among health problems in the developed world.[16] Its prevalence strongly correlates with age. In fact, evidence of characteristic cartilage damage is almost universal in persons older than 65 years.[16] Before the age of 50, men are more likely to have OA; past the age of 50, women predominate.[12] In addition to age and gender, risk factors include heredity, obesity, anatomic joint abnormality, injury, and occupation leading to overuse of joints.[12] It is interesting to note that because RA may cause malalignment or instability of joints, it often results in premature OA.[27]

OA is classified as primary or secondary. Primary OA has no known cause and may be localized (ie, involvement of one or two joints) or generalized (ie, diffuse involvement generally including three or more joints). Secondary OA can be related to an identifiable cause, such as trauma, anatomic abnormalities, infection, or aseptic necrosis.[16,32]

OA is a disease that causes the cartilage in joints to break down, with resultant joint pain and stiffness. Unlike RA, which is **systemic** (affecting the entire body), OA limits its attack to individual joints. Also in contrast to RA, the basic process of OA is noninflammatory, although secondary inflammation caused by joint damage is common. Once considered simply "wear and tear" arthritis, OA is now thought to involve more than just the passive deterioration of cartilage. The agent that initiates OA is not well understood, but it is known to involve a complex dynamic process of biomechanical, biochemical, and cellular events.[59] These are affected by local, systemic, genetic, environmental, and mechanical factors, which directly or indirectly influence the vulnerability of cartilage.[12] It is, in essence, the "final common pathway" for a variety of conditions.[16]

A healthy joint is lined by articular cartilage that is relatively thin, highly durable, and designed to distribute loads and limit stress on subchondral bone (Fig. 38.1).[16] OA destabilizes the normal balance of degradation and synthesis of articular cartilage and subchondral bone and involves all of the tissues of a diarthrodial (ie, synovial-lined) joint.[12,16] OA is basically a two-part process: deterioration of articular cartilage and reactive new bone formation.[73] This breakdown of joint tissue occurs in several stages. First, the smooth cartilage softens and loses its elasticity, which makes it more susceptible to further damage. Eventually, large sections of the cartilage wear away completely and result in reduced joint space and painful bone-on-bone contact. The ends of the bone thicken, osteophytes (bony growths) are formed where ligaments and capsule attach to bone, and the joint may lose its normal shape (Fig. 38.2). Fluid-filled cysts may form in the bone near the joint, and bone or cartilage particles may float loose in the joint space.[3,72]

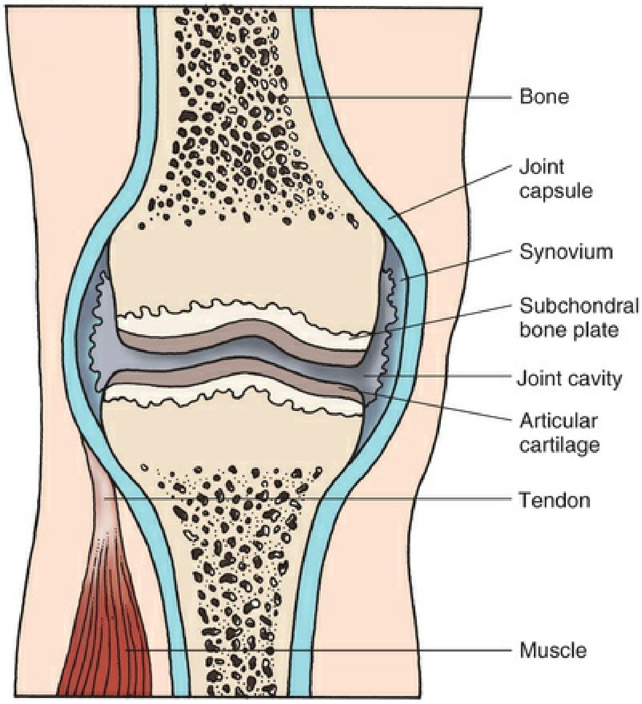

FIG 38.1 Normal joint structures. (From Ignatavicius DD, Workman ML: *Medical-surgical nursing: patient-centered collaborative care,* ed 7, St. Louis, 2013, Saunders.)

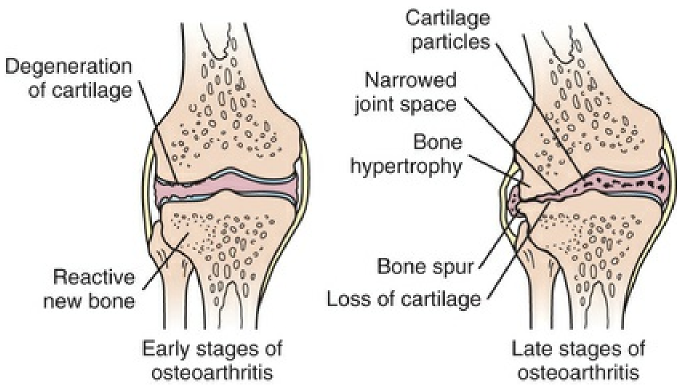

FIG 38.2 Joint changes in osteoarthritis. (From Magee DJ, et al, editors: *Pathology and intervention in musculoskeletal rehabilitation,* ed 2, St. Louis, 2016, Elsevier.)

Clinical Features

OA is characterized by joint pain, stiffness, tenderness, limited movement, variable degrees of local inflammation, and **crepitus** (an audible or palpable crunching or popping in the joint caused by the irregularity of opposing cartilage surfaces).[32,52] It can affect both axial and peripheral joints. The most common joints are the distal interphalangeal (DIP), proximal interphalangeal (PIP), and first carpometacarpal (CMC) joints of the hand; the cervical and lumbar apophyseal joints; the first metatarsophalangeal (MTP) joints of the feet; and the knee and hip joints.[32,59] Symptoms are usually gradual and may begin as a minor ache with motion. Pain and stiffness typically occur with activity and are relieved by rest, but eventually they become present at rest and at night. Morning stiffness (lasting less than 30 minutes) and stiffness after periods of inactivity (known as **gelling**) may develop. With advanced disease, patients may complain of the "bony" appearance of their joint, which is a result of osteophyte formation and possibly muscle atrophy.[32,59]

Diagnostic Criteria

The diagnosis of OA is initially made on the basis of the patient's history and physical examination, with a lack of systemic symptoms ruling out inflammatory disorders such as RA. The cardinal symptoms are use-related pain and stiffness or gelling after inactivity. The clinical diagnosis is typically confirmed with radiographs of the affected joint, which will show osteophyte formation at the joint margin, asymmetric joint space narrowing, and subchondral bone sclerosis.[32] Magnetic resonance imaging (MRI) may be used to improve diagnostic imaging; MRI is able to more sensitively detect loss of cartilage, osteophytes, and subchondral cysts.

Medical Management

OA currently has no cure. Goals in the treatment of OA are to relieve symptoms, improve function, limit disability, and avoid drug toxicity.[59,94] Pharmacologic treatment may be systemic or local. Commonly prescribed systemic medications include analgesic agents and antiinflammatory agents (Table 38.2).[5] Analgesic agents provide relief to painful joints and may be non-narcotic (nonopioid) or narcotic (opioid) for advanced and severe OA that fails to respond to other measures. Antiinflammatory agents relieve pain, with the added benefit of decreasing local joint inflammation. Because of the risk for gastrointestinal and renal toxicity, these drugs are typically used when analgesics are ineffective. Nonsteroidal antiinflammatory drugs (NSAIDs) and cyclooxygenase-2 (COX-2) inhibitors fall into this category. Though proved effective in treating OA, NSAIDs must be chosen and monitored carefully to minimize potentially serious side effects. COX-2 inhibitors provide clinical benefits similar to NSAIDs but with a lower incidence of gastric problems; however, they carry a black box warning due to links with an increased risk for heart attack and stroke.[5] Local pharmacologic treatment of OA includes topical agents and intraarticular corticosteroid injections, alone or as an adjunct to systemic medications. Among topical agents are aspirin and capsaicin creams, as well as the first topical NSAID approved for treating OA pain (Voltaren gel).[5] Cortisone injections in a joint are often limited to fewer than three per year because of the possible risk for progressive cartilage damage.[21]

TABLE 38.2

Common Arthritis Medications and Side Effects

Class	Medication	Possible Side Effects
Analgesics		
Nonopioid	Excedrin, Tylenol	Usually none if taken as prescribed
Opioid	Norco, Tylenol with codeine, Vicodin	Constipation, dizziness or lightheadedness, drowsiness, mood changes, nausea, vomiting, drug tolerance, and physical dependence with long-term use
Nonsteroidal Antiinflammatory Drugs (NSAIDs)		
Traditional	Advil, Aleve, Feldene, Indocin, Motrin, Naprosyn, Voltaren	Abdominal pain, dizziness, drowsiness, gastric ulcers and bleeding, greater susceptibility to bruising or bleeding, heartburn, indigestion, lightheadedness, nausea, tinnitus, kidney and liver effects
COX-2 inhibitors	Celebrex	Same as traditional NSAIDs, except less likely to cause gastric ulcers and susceptibility to bruising or bleeding; black box warning for increased risk for heart attack and stroke
Salicylates	Anacin, Bayer, Bufferin, Ecotrin	Abdominal cramps, diarrhea, gastric ulcers, headache, heartburn, increased bleeding tendency, confusion, dizziness, tinnitus, nausea, vomiting, deafness
Corticosteroids		
	Cortisone, Methylprednisolone, Prednisone	Cushing's syndrome (weight gain, moon face, thin skin, muscle weakness, osteoporosis), bruising, cataracts, hypertension, elevated blood sugar, insomnia, mood changes, nervousness or restlessness; black box warning for increased risk for cardiovascular problems and gastric bleeding
Disease-Modifying Antirheumatic Drugs (DMARDs)		
	Imuran	Immunosuppression
	Methotrexate	Liver and blood effects, decreased fertility
	Plaquenil	Visual damage with long-term use
Biologic Response Modifiers (Subset of DMARDs)		
	Enbrel	Dizziness, fatigue, headache, injection site irritation, nausea; black box warning for increased risk for serious infection
	Humira	Injection site irritation; black box warning for increased risk for serious infection
	Remicade	Infusion reaction, injection site irritation; black box warning for increased risk for serious infection

COX, cyclooxygenase.

Use of nonpharmacologic agents, also known as nutraceuticals, is extremely common in persons with OA as alternative or complementary treatments and continues to gain favor in the general public.[6,57,59,94] These agents include nutritional supplements such as glucosamine sulfate and chondroitin sulfate. Although they may have some effect in improving symptoms or slowing the progression of OA, studies citing their efficacy have not yet been of optimal quality.[59] However, even if their benefits have not been proved convincingly, use of nutraceuticals typically carries little risk. Even so, patients should be aware that supplements are not regulated like prescription medications. Use of complementary and alternative treatments should be discussed with one's physician to minimize potential negative effects.[57]

Surgical Management

Operative intervention may be performed to slow joint deterioration, improve joint integrity, restore joint stability, or reduce pain, with the overarching goal of improving the patient's overall function. Common surgical procedures for OA include arthroscopic joint debridement, resection or perforation of subchondral bone to stimulate the formation of cartilaginous tissue, use of grafts to replace damaged cartilage, joint fusion, and joint replacement.[21,59]

Rheumatoid Arthritis

Rheumatoid arthritis (RA) is a chronic, systemic inflammatory condition that affects approximately 1.5 million Americans.[91] The etiology of RA is not well understood, other than that a yet-unknown trigger causes an autoimmune inflammatory response in the joint lining of a genetically predisposed host.[110,113] Onset can take place at any age, but prevalence does increase with age. The peak incidence occurs between 40 and 60 years of age, with the rate of disease two to three times higher in females.[4,108,113] Its onset is commonly insidious, with symptoms developing over a period of several weeks to several months.

The disease manifests itself as **synovitis**, which is inflammation of the synovial membrane that lines the joint capsule of diarthrodial joints. The function of normal synovial tissue is to secrete a clear fluid into the joint for the purpose of lubrication.[2,27] In RA, synovial cells produce matrix-degrading enzymes that destroy cartilage and bone. Joint swelling results from excessive production of synovial fluid, enlargement of the synovium, and thickening of the joint capsule. This weakens the joint capsule and distends tendons and ligaments. As the inflammatory process continues, the diseased synovial membrane forms a pannus that actively invades and destroys cartilage, bone, tendon, and ligament (Fig. 38.3). Scar tissue can form between the bone ends and cause the joint to become permanently rigid and immovable.

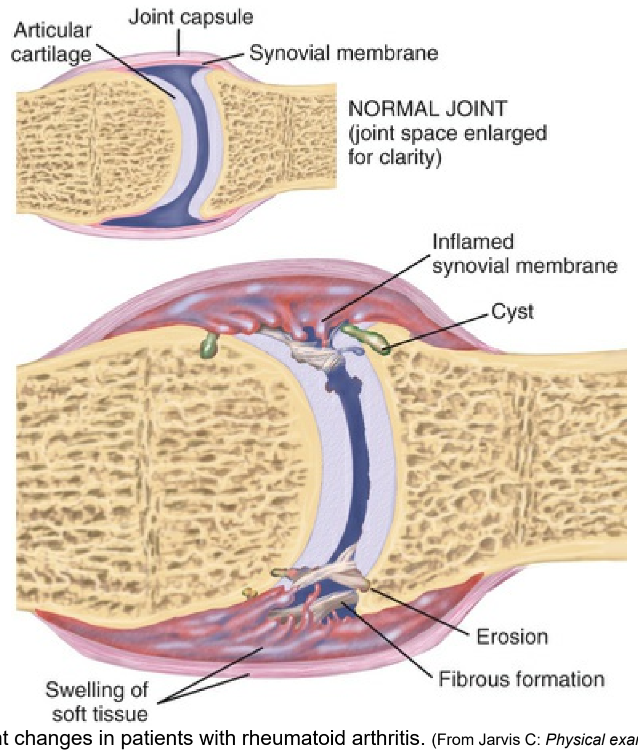

FIG 38.3 Joint changes in patients with rheumatoid arthritis. (From Jarvis C: *Physical examination and health assessment*, ed 7, St. Louis, 2016, Elsevier.)

Articular manifestations of RA fall into two categories: (1) reversible signs and symptoms related to acute inflammatory synovitis and (2) irreversible cumulative structural damage caused by recurrent synovitis over the course of the disease. Structural damage typically begins between the first and second years of the disease and progresses as a linear function of the amount of prior synovitis.[40,108] Almost 90% of joints ultimately affected by RA become involved during the first year.[88,108] Progressive joint damage in the majority of patients results in significant disability within 10 to 20 years.[110]

The course of RA is variable from person to person. Approximately 20% of those affected have a single episode of inflammation with a long-lasting remission. The majority of people with RA experience a series of exacerbations and remissions, with periodic flares of inflammation followed by complete or incomplete remissions.[108,113] Outcomes are similarly variable. Patients' functional abilities vary according to the course of the disease, the severity of the symptoms, and the amount of joint damage. Because RA is a systemic disease, certain extraarticular features occur in about half of patients.[108,113] These features include fatigue, rheumatoid nodules, and vasculitis. Ocular, respiratory, cardiac, gastrointestinal, renal, and neurologic manifestations are also seen as secondary complications. Patients with severe forms of RA may die between 10 and 15 years earlier than expected as a result of accompanying infection, pulmonary and renal disease, gastrointestinal bleeding, and especially cardiovascular disease.[78]

Clinical Features

RA is characterized by symmetric polyarticular pain and swelling, prolonged morning stiffness, malaise, fatigue, and low-grade fever. Joints most commonly affected are the PIP, metacarpophalangeal (MCP), and thumb joints of the hands, as well as the wrist, elbow, ankle, MTP, and temporomandibular joints; the hips, knees, shoulders, and cervical spine are also frequently involved.[108,110] Even though joint involvement is bilateral, disease progression may not be equal on both sides. For instance, a patient's dominant hand may show more severe involvement and different joint changes or deformities than the other hand. Clinical features vary from patient to patient and also in individual patients over the course of their disease. Pain can be acute or chronic. Acute pain occurs during disease exacerbations, or flare-ups. Chronic pain results from progressive joint damage. Synovial inflammation is manifested as warm, spongy, and sometimes erythematous, or red, joints. This is seen in active phases of the disease process. Rheumatoid **nodules**, a cutaneous manifestation of RA, develop in 25% to 30% of persons with RA during periods of increased disease activity. These soft tissue masses are commonly found over the extensor surface of the proximal end of the ulna or at the olecranon.[108,110] Morning stiffness is an almost universal feature of RA. Unlike the shorter-duration stiffness seen with OA, RA morning stiffness can last 1 or 2 hours. It frequently disappears during periods of disease remission. The duration of morning stiffness tends to correlate with the degree of synovial inflammation, and its presence and length are useful measures for monitoring the course of RA.[78] Feelings of malaise, fatigue, and depression also fluctuate, with many patients experiencing worse symptoms in the afternoon. These nonspecific symptoms may precede other typical signs of RA by weeks or months.[108]

The inflammatory process has been described as having four stages: acute, subacute, chronic active, and chronic inactive.[72] Stages may overlap, and patients may move back or forward through them, depending on the course of their disease. Clinical symptoms seen in the acute stage include limited movement; pain and tenderness at rest that increase with movement; overall stiffness, weakness, tingling, or numbness; and hot, red joints. In the subacute stage, the limited movement and tingling remain. A decrease in pain and tenderness indicates that the inflammation is subsiding. Stiffness is limited to the morning, and the joints appear pink and warm. The chronic active stage is characterized by less tingling, pain, and tenderness and increased tolerance of activity, although endurance remains low. No signs of inflammation are present in the chronic inactive stage. The patient's low endurance and pain and stiffness at this stage result from disuse. Overall functioning may be decreased as a result of fear of pain, limited range of motion (ROM), muscle atrophy, and contractures.[72]

The characteristic joint deformities will develop as late manifestations of the disease in more than 33% of patients with RA. Deformity of the small joints of the hand will develop within the first 2 years in more than 10%.[110] Wrist radial deviation, MP ulnar deviation, and swan neck and boutonnière deformities of the digits are the joint changes most often seen. Joint changes, or deformities, can result from a variety of mechanisms, including joint immobility, destruction of cartilage and bone, and alterations in muscles, tendons, and ligaments.[97] **Tenosynovitis** (inflammation of the tendon sheath) and the presence of nodules within the flexor tendon sheaths can cause trigger finger. Patients may also exhibit symptoms of nerve compression of the median or ulnar nerves at the wrist. Tendon rupture may also be seen, usually in the extensor tendons of the fifth, fourth, and third digits. Stages of the disease based on joint deformity and radiographic changes are defined in Box 38.1.

Box 38.1

American College of Rheumatology Classification of Progression of Rheumatoid Arthritis

Stage I: Early

No destructive changes on roentgenographic examination*

Possible presence of radiographic evidence of osteoporosis

Stage II: Moderate

Radiographic evidence of osteoporosis, with or without slight subchondral bone destruction; possible presence of slight cartilage destruction*

No joint deformities, although possible limitation of joint mobility*

Adjacent muscle atrophy

Possible presence of extraarticular soft tissue lesions, such as nodules and tenosynovitis

Stage III: Severe

Radiographic evidence of cartilage and bone destruction, in addition to osteoporosis*

Joint deformity, such as subluxation, ulnar deviation, or hyperextension, without fibrous or bony ankylosis*

Extensive muscle atrophy

Possible presence of extraarticular soft tissue lesions, such as nodules and tenosynovitis

Stage IV: Terminal

Fibrous or bony ankylosis*

Criteria for stage III

*These criteria must be present to permit classification in any particular stage or grade.

Data from Steinbrocker O, Traeger CH, Batterman RC: Therapeutic criteria in rheumatoid arthritis, *JAMA* 140:659, 1949.

Diagnostic Criteria

No single test leads to a definitive diagnosis of RA. Diagnosis is based on clinical evaluation of characteristic signs and symptoms, laboratory findings, and radiologic findings.[78,108,110] A positive laboratory test is not necessary to establish a diagnosis of RA, but such tests may help confirm the clinical impression. Rheumatoid factor is an antibody found in the blood serum of approximately 85% of persons with RA, but it can also be found in other inflammatory diseases associated with synovitis. The presence of rheumatoid factor correlates with increased severity of symptoms and increased systemic manifestations. The erythrocyte sedimentation rate correlates with the degree of synovial inflammation and is useful in ruling out noninflammatory conditions such as OA and tracking the course of inflammatory activity.[108,110] Radiographs may show nothing other than soft tissue swelling early in RA, but in more than half of patients radiographic changes will develop within the first 2 years after onset of the disease.[78,108,110]

Medical Management

RA currently has no known cure. The major goals in the treatment of RA are (1) reducing pain, swelling, and fatigue; (2) improving joint function and minimizing joint damage and deformity; (3) preventing disability and disease-related morbidity; and (4) maintaining physical, social, and emotional function while minimizing long-term toxicity from medications.[79,110] Maintaining normal joint anatomy can be accomplished only by controlling the disease before irreversible damage occurs. Major advances in the treatment of RA have occurred as a result of improved understanding of the pathogenetic mechanisms of the disease, development of therapies that more specifically target the pathophysiologic processes, and recognition that early initiation of aggressive drug therapies can alter the outcome and reduce the severity of physical disability and psychological distress of RA.[79,80,110]

Drug categories used for RA include NSAIDs, corticosteroids, and disease-modifying antirheumatic drugs (DMARDs; see Table 38.2).[5] Because the fast-acting NSAIDs can decrease joint pain and swelling but cannot alter progression of the disease, they are rarely, if ever, used alone for the treatment of RA. The antiinflammatory effects of the large number of medications in this category are about equal. COX-2 inhibitors show no evidence of greater efficacy than other NSAIDs but are thought to pose a lower risk for serious gastrointestinal side effects.[108] Corticosteroids have a long history in the medical management of RA and remain a key element. They produce rapid and potent suppression of inflammation with improvement in joint pain and fatigue. Because of the significant adverse effects of corticosteroids, they are frequently used on a temporary basis in patients with active disease and significant functional decline while awaiting the full therapeutic effect of DMARDs. DMARDs lack a pain relief effect, but they may actually affect the course of the disease. Because of their slow-acting nature, weeks or months of drug therapy may be necessary before a clinical benefit is recognized. The potency of these drugs requires that patients be closely monitored for side effects; they carry a black box warning for increased risk of serious infection.

Traditionally, the approach to treatment of RA began with less toxic medications such as NSAIDs and progressed to the stronger drugs needed later in the disease course. The approach is now more aggressive, with early use of DMARDs to control the disease process as soon as possible, as completely as possible, and for as long as possible.[78,120] Drug therapy constantly changes, depending on the patient's needs and response to treatment, as well as the physician's treatment philosophy. This uncertainty can be frustrating for the patient, who may have to experiment with myriad new medications when current drugs become ineffective or side effects too severe. It is important for the occupational therapist and other team members to know the specific medications that the patient is taking and what adverse reactions may arise.

Surgical Management

Because of the extensive joint damage caused by RA, surgical intervention is frequently indicated to relieve pain and improve function. Several surgical procedures may be of benefit to patients with RA. Synovectomy (excision of diseased synovium) and tenosynovectomy (removal of diseased tendon sheaths) are performed to relieve symptoms and slow the process of joint destruction, but they do not prevent progression of the disease. These procedures are most commonly performed in the wrist and hand. Tendon surgery, including relocation of displaced tendons, repair of ruptured tendons, and release of shortened tendons may be performed to correct hand impairments. Tendon surgery occurs most frequently on the extensor tendons of the wrist and hand. Tendon transfers and peripheral nerve decompression (such as carpal tunnel release) are also performed to optimize function. Arthroplasty (joint reconstruction) and arthrodesis (joint fusion) are options when joint restoration is not possible. These procedures may be performed to relieve pain, provide stability, correct deformity, and improve function. Common sites for arthroplasty include the hip, knee, and MCP joints. Common sites for arthrodesis include the wrist, thumb MCP and interphalangeal (IP) joints, and cervical spine.[21,72]

Occupational Therapy Evaluation

It is important to recognize that every client with arthritis has a unique manifestation of clinical problems and functional impairment. A strong client-centered and occupation-based approach is helpful in determining each client's specific needs. The evaluation process for clients with arthritis includes many of the same elements as for any physical disability. Special considerations related to arthritis include closer attention to pain, joint stiffness, joint changes/deformity, fatigue, and coping strategies, especially as they relate to limitations in activity. Because clients with arthritis typically experience good days and bad days, many symptoms and problems are unpredictable. Thorough systematic assessment of the client's functional, clinical, and psychosocial status is key to prioritizing problems and planning effective intervention.

The extent of specific components of the evaluation will often be driven by the main reason for referral. Clients seen for preoperative hand assessment, postoperative hip replacement, education after diagnosis, splinting while in a flare-up, or a decline in functional status will all require the therapist to customize evaluation priorities.

Because of the chronic nature of rheumatic diseases, some clients are able to clearly state their specific needs and should be afforded the opportunity to do so. Other clients may be overwhelmed by multiple problems or a newly made diagnosis and will look to the therapist to guide the intervention process. Regardless of the client's status, close collaboration and partnership among the client, family, therapist, and other team members is crucial in helping deliver the best treatment possible.

The occupational therapy (OT) evaluation process consists of (1) a client history; (2) occupational profile; (3) occupational performance status; (4) cognitive, psychological, and social status; and (5) clinical status.

Client History

A thorough history should be obtained through review of the client's report and medical record. Important details include diagnosis, dates of onset and diagnosis, secondary medical conditions, current medications and medication schedule, alternative or complementary therapies, and surgical history.[99] Asking the client questions—“What type of arthritis do you have?” “How long have you had it?” “What medications are you currently taking?” and “What other things are you doing to manage your arthritis?”—can provide insight regarding the client's level of understanding about his or her condition, medical treatment, and health habits. Previous experiences with OT and physical therapy should also be ascertained to build on them. The therapist must ask and actively listen to the client's current primary complaints through questions: “What is bothering you most about your arthritis?” “How is your arthritis limiting your ability to do things right now?” “What are you hoping therapy can help you with?”

This was Nina's first referral to OT. She was knowledgeable about her diagnosis and medications but uncertain about the potential benefits of therapy. Through her responses to key questions, Nina was able to clearly state that her pain and difficulty performing household and work activities were her main priorities.

Occupational Profile

It is helpful to begin the process of assessing occupational performance with an occupational profile. Obtained through an open-ended interview, the profile yields important details about the client's previous and current roles, occupations, overall activity level, and ability to participate in meaningful activities. It can also provide insight into the client's sense of self-efficacy, adjustment to disability, and themes of meaning in his or her life.[60,68] An effective method to obtain a client's occupational profile is to have the client describe how he or she spends a typical day. This typical-day assessment allows the therapist to become familiar with the client's routines, use of time, sleep/wake habits, energy and fatigue patterns, important people and environments, activity contexts, and other details that may not otherwise come up in conversation. Because arthritis involves fluctuant symptoms, the client should be asked to describe how time is spent on a good day and a bad day so that the therapist can compare the two and understand how arthritis affects the client's daily life and how effectively the client is able to balance activity and rest. It is helpful to ask the client to estimate the percentage of good versus bad days per week or month. It may also be advantageous to explore time spent on weekend days versus weekdays; the client may reveal other occupations, such as those involving spirituality, social participation, and leisure. This fluid dialogue also develops rapport, establishes the client as the valued expert in his or her occupations and lifestyle, and frames the role of OT in the client's rehabilitation.

Occupational Performance Status

Once the client's typical and preferred occupations are identified, his or her level of independence engaging in these functional activities can be assessed by interview or by observation. If observation is used, the activity should occur as close as possible to the time that it is normally performed because the client's abilities may fluctuate at different times of the day. For instance, stiffness and pain may make dressing very difficult in the early morning, but if this task is assessed in the afternoon, the client's status may appear much better. Ideally, the activity should also be done in the client's own home, community, or work contexts.[7] In addition to assessing the client's level of independence during activities of daily living (ADLs), instrumental activities of daily living (IADLs), school, work, sleep and rest, play, leisure, and social engagements, it is important to note any assistive devices (eg, mobility aids or adaptive equipment) and compensatory techniques that the client may use. The activity demands of the occupation performed (eg, tools, equipment, and skills required), as well as the specific contexts in which it is performed (eg, the client's living situation, others in the home, and architectural set-up relative to occupational performance), should be detailed in tandem with existing physical, environmental, or social barriers. Finally, the amount of time required to complete certain activities should be explored. A client who experiences significant morning stiffness or limited endurance often chooses to accept assistance in an activity such as dressing to save time or conserve energy to participate in a more meaningful occupation later in the day. This strategy may contribute to the client's overall satisfaction with and participation in life, and it should be respected as such.

In RA, functional status may be classified according to the American College of Rheumatology's revised criteria for the classification of functional status in clients with RA (Table 38.3). This system was devised for rapid, global assessment of functional status by health professionals.[52] The therapist should be familiar with this system because it is often used in clinical research and can provide a general framework for defining advancing disability.[49,122] Nina's status would be considered class III because of limitations in her work activities.

TABLE 38.3

American College of Rheumatology Classification of Global Functional Status in Patients With Rheumatoid Arthritis

Classification	Description
Class I	Completely able to perform usual activities of daily living (self-care,* vocational, and avocational)
Class II	Able to perform usual self-care and vocational activities, but limited in avocational activities
Class III	Able to perform usual self-care activities, but limited in vocational and avocational activities
Class IV	Limited in ability to perform usual self-care, vocational, and avocational activities

*Usual self-care activities include dressing, feeding, bathing, grooming, and toileting. Avocational (recreational or leisure) and vocational (work, school, homemaking) activities are client desired and age and sex specific.

Courtesy American College of Rheumatology ©2004.[52]

A decrease in occupational functioning in clients with arthritis may be due to pain, joint changes or instability, loss of motion, weakness, fatigue, change in the living environment, or change in social support, among other contributing circumstances. The effects of medication can also limit performance. The challenge for the therapist is not only to identify deficits in occupational performance but also to determine the factors that are causing them. Asking the client why an activity cannot be done yields the important client perspective.[7] Nina was having difficulty with many occupations, including sleeping, playing actively with her grandchildren, managing her home, and performing her job to her level of satisfaction. She reported having to give up or cut back on activities because of increased pain, stiffness, and fatigue from her recent flare-up.

Cognitive, Psychological, and Social Status

The effects of arthritis are not merely physical and functional. Clients with arthritis should be screened for cognitive and psychosocial deficits. Although arthritis does not directly affect cognition, pain, sleep disturbances, depression, and medication can all have profound effects on attention span, short-term memory, and problem-solving skills.[72, 83] People with a chronic illness must develop coping strategies to deal with the disability. Coping strategies are particularly crucial for persons with arthritis, who may face serious changes in physical function, life roles, and appearance because of deformity and pharmacological side effects. Because arthritis is both unpredictable and painful, normal responses to the disability include depression, denial, need to control the environment, and dependence. Psychosocial adaptation is affected by the complex interplay of physical, psychological, and situational factors.[60,82] Approximately 20% of persons with RA are estimated to suffer from a major depressive disorder, with as high as 48% having significant depression symptoms.[70] About half of individuals with RA or OA may experience loss of social relationships.[121] Constant pain and fear of pain, changed body image, perception of self as a sick person, continuous uncertainty about the course and progression of the disease, sexual dysfunction, altered roles, and loss of income resulting from inability to work can lead to significant psychological stress.[60,82] Evidence has shown that the disability associated with RA relates to psychosocial factors almost to the same extent as to biomedical factors.[37] Occupational therapists must understand the ways in which their clients manage stress in their lives because these stressors may exacerbate the disease.[60] Family relationships and cultural backgrounds also affect the client's healthcare behavior and response to disability.[87] The therapist should be sensitive to all factors that will influence rehabilitation. Referral to other health professionals (such as psychiatrists, psychologists, and social workers) should be made if needed.[82]

Nina reported that she had increasing difficulty concentrating on tasks because she was unable to get adequate restful sleep. She expressed frustration about her inability to keep her house in order and anxiety about losing income because she was unable to work her customary hours. She was also fearful about her health because her arthritis had been adequately controlled for the past few years and she had not experienced any flares.

Clinical Status

For clients with arthritis, the elements of inflammation, ROM, strength, hand function, stiffness, pain, sensation, joint instability and deformity, physical endurance, and functional mobility should be included through either brief screening or detailed evaluation. As with assessment of function, the time of day and antiinflammatory or analgesic medications taken should be noted because these factors may influence the results. In addition, future reevaluations should be performed under the same conditions.[72] When the client's functional deficits are identified first, assessment of client factors can be much more focused. Additionally, asking the client a question such as “What joints are you having the most problems with?” can help prioritize assessment needs. Given Nina's initial findings, the detailed evaluation focused primarily on synovitis, pain, stiffness, ROM, strength, physical endurance, and functional mobility. Even though joint deformities were not immediately evident, the therapist was careful to search for signs of instability that would place Nina's joints at risk for deformity.

The clinical evaluation may take considerable time. It should be approached in a systematic manner with the results clearly documented. The occupational therapist may need to perform assessments over several sessions, especially if the client is experiencing significant pain or fatigue. Intervention can begin immediately and does not necessarily depend on completion of the evaluation. The evaluation actually begins with a general observation of the client's posture, willingness to move, and pain behavior during the initial interview.

The presence and location of inflammation or synovitis should be noted because these signs indicate an active disease process. Several types of swelling may be present and should be described. An effusion (excess fluid in the joint capsule) is seen as fusiform swelling that is spindle shaped and conforms to the shape of the joint. Boggy swelling is thin and full of fluid. Puffy, spongy, and soft to the touch, boggy swelling is seen in the early active stages of synovitis. Chronic synovitis feels firm because the joint fills with synovial tissue.[72]

Active and passive ROM can be measured. Depending on the reason for referral and the client's complaints, the therapist may not find it necessary to obtain goniometric measurements of all joints but instead focus only on the joints of most concern. Active motion will allow the therapist to see the amount of mobility that the client has available for function, whereas passive motion will elicit the joint's capacity to move. The client's range of active motion may be significantly less than the range of passive motion; this is known as lag and is caused by pain, weakness, or the mechanical inefficiencies attributable to joint damage. Goniometric measurement of hand joints may be difficult in the presence of deformity. Assessment of composite (combined motion of all joints) flexion, composite extension, and thumb opposition can provide more functional information.[9] Active opening and closing of the hand can be measured by the distance from the fingertips to the tabletop in maximal extension (opening) when the dorsal side of the hand is resting on the table and by the distance from the fingertips to the distal palmar crease (closing). While performing the ROM assessment, the therapist should note whether the client's joints feel stiff or unstable. A hard end-feel in the presence of contracture indicates bony blockage.[73] A firm end-feel that still has some give indicates that the joint capsule or ligaments are limiting motion.[51] The presence and location of crepitus, along with the motions that cause it, should also be noted because crepitus often indicates extensive joint damage. The source of crepitation may be bony, synovial, bursal, or tendinous (see Chapters 20 through 22 for additional information).[9,72]

Gross strength should be assessed with more specific manual muscle testing as indicated. One important detail to understand is that strength testing in clients with arthritis differs from normal testing procedures. Resistance is applied at the end range of pain-free motion rather than at the true end of the ROM. It is not unusual for clients with arthritis to have pain in the last 30 to 40 degrees of joint motion. When resistance is applied within the pain-free range, inhibition of muscle strength by pain will be avoided. It is also important to consider joint protection principles when applying resistance and to discontinue resistance if the client experiences pain. If use of resistance is contraindicated (as may be the case in an acute or active phase of arthritis, in which resistance may be harmful to inflamed tissue and joints), functional muscle or motion testing may be substituted.[72]

Hand strength and function are important to test, but care must be taken to not stress painful or vulnerable joints during assessment. Grip and pinch may be measured by standard meters, but in the presence of severe weakness or hand deformity, adapted methods, such as use of a blood pressure cuff to measure force in millimeters of mercury, may be indicated.[9,72] Although it is more comfortable for the client, the results of strength testing in this manner are less reliable, with no established norms. Other specific devices for measuring grip strength in hands with arthritis, including pneumatic bulb dynamometers, are commercially available. As a result of joint deformity, the client may not be able to assume the standard testing positions for lateral and palmar pinch. Because it is important to assess pinch strength relative to function, pinch should still be tested, with notation made of the client's prehensile pattern (eg, "4 pounds of pinch with the meter placed in web space between thumb and second metacarpal"). The presence and location of muscle atrophy should be recorded because it indicates severe weakness and possible nerve compression that may require further investigation. Intrinsic atrophy can be seen as flattening of the thenar and hypothenar eminences and as hollowing between the metacarpals on the dorsal aspect of the hand.

Hand function can be assessed through standardized tests (eg, the Jebsen-Taylor Hand Function Test)[55] or observation of the client performing common functional tasks that involve various grasp and prehensile patterns. These tasks can include opening a medication bottle, writing, holding a glass, picking up small pins, turning a doorknob and key, cutting with a knife, and fastening buttons. In addition to noting whether the client is able to perform each task, the value of this testing lies in observation of how the client uses his or her hands and determination of which factors interfere most with activity: instability, lack of motion, deformity, pain, weakness, or something else. The therapist cannot predict function solely on the basis of the hand's appearance. Deformities caused by arthritis often develop slowly, and many clients learn how to adapt their hand function gradually over time. It may be surprising to see significantly deformed hands performing tasks with relatively good function. The therapist should remember this when planning an intervention because it might eliminate a problem that is actually functional for the client.

Joint stiffness is a distinct feeling of excessive stiffness that eventually wears off.[72] It can occur as a result of low-grade inflammation, effusion, synovial thickening, muscle shortening, or spasm.[13,73] The stiffness experience, its impact on daily life, and adaptations clients need to make greatly vary.[79] The therapist can determine the extent of joint stiffness by asking the client which joints experience stiffness, under what conditions, and for how long. Morning stiffness and gelling should be considered separately and can be measured in hours or minutes. The duration of morning stiffness is often used as an objective indicator of the degree of disease activity present. The gelling phenomenon, stiffness after prolonged periods of inactivity, is so named because fluid in the joint and surrounding tissues sets up like gelatin.[73]

Because pain is often the primary clinical manifestation of arthritis, it should be closely evaluated. Pain that interferes with the client's ability to engage in occupations should be of primary concern. The presence and location of joint pain should be noted. The therapist should ask questions to elicit important details ("When does the pain occur?" "What tends to make the pain worse?" "What seems to make the pain better?"). An attempt should be made to distinguish between articular (joint) pain and periarticular (soft tissues surrounding the joint) pain. Secondary conditions such as tendonitis and bursitis are frequent causes of pain. Pain has different meanings for individuals and is often difficult to describe.[100] The therapist can obtain measurements of pain intensity by asking the client to rate the pain on a numeric scale of "1" (no pain) to "10" (greatest pain) or on a visual analog scale in which the client places a mark along a 10-cm line.[54] These scales can also be used to measure other subjective symptoms, including fatigue and degree of stiffness.[48] Because pain related to arthritis is fluctuant, the client may be asked to rate pain at its current level, at its best, at its worst, and at various times of the day or to compare pain at rest versus pain with motion or activity. Interestingly, pain caused by acute inflammation in the early stages of RA tends to be greater than pain at the end stages, when severe deformities are present.[9] The presence and location of joint tenderness should also be noted. Tenderness is assessed by applying manual compression to the medial/lateral aspects of the joint (see Chapter 28 for additional information).[72]

Sensation should be evaluated if the potential for peripheral nerve damage or compression caused by swelling exists. The therapist should obtain a subjective report from the client with regard to the presence of numbness or tingling. This report can be followed by screening of the touch/pressure threshold of the fingertips with monofilaments.[10] If sensory impairment is noted, further assessment may be indicated. This may include provocative tests to replicate or aggravate symptoms so that areas of compression can be localized. Examples of these tests are the Phalen and Tinel tests in individuals with suspected median nerve compression at the carpal tunnel.[92] When cervical spine involvement is known or suspected, dermatomal light touch, sharp-dull sensation, and proprioception should be evaluated (see Chapters 23 and 39 for additional information).

The examiner assesses **joint laxity** (instability) by applying stress to individual joints in the medial/lateral and anterior/posterior directions. When testing medial/lateral stability of the MCP joints, the examiner must first place the MCP joints in flexion to tighten the collateral ligaments, which are naturally loose during MCP extension. Unstable joints should be noted. Ligamentous laxity can be described as slight (5 to 10 degrees in excess of normal), moderate (10 to 20 degrees in excess), or severe (20 or more degrees in excess).[72] In the hand joints, instability with medial/lateral motion indicates laxity of the collateral ligaments, whereas excessive anterior/posterior motion is caused by laxity of the joint capsule and volar plate. Normal joint stability is highly variable, and whenever possible, it is helpful to compare it to the client's uninvolved joints.[72]

Evaluation of joint deformities is done primarily by observation and palpation. The location and type of deformity should be noted. Comparison with previous evaluations, if available, allows the therapist to see how the deformities have progressed over the course of the disease. If a deformity is correctable, either actively or passively, it is considered flexible; if the deformity cannot be reduced, it is considered fixed. Patterns of deformity can be different in a client's two hands, and a person with RA can also exhibit deformities caused by osteoarthritic joint damage.

Common hand deformities in persons with arthritis include the following:

- A boutonnière deformity is characterized by flexion of the PIP joint and hyperextension of the DIP joint (Fig. 38.4). This zigzag collapse represents an alteration in muscle-tendon balance. Pathology begins at the PIP joint with secondary changes in the DIP joint. It occurs when synovitis weakens, lengthens, or disrupts the dorsal capsule and central slip of the extensor mechanism and consequently causes incomplete or weak to absent extension at the PIP joint. The lateral bands of the extensor mechanism displace volarly below the axis of the PIP joint and become flexors of that joint. Increased force on the lateral bands at the DIP joint, where they insert, causes hyperextension. Function of the finger is compromised by the inability to straighten the finger and the loss of flexion at the fingertip for pinching.[2,8,9,72]

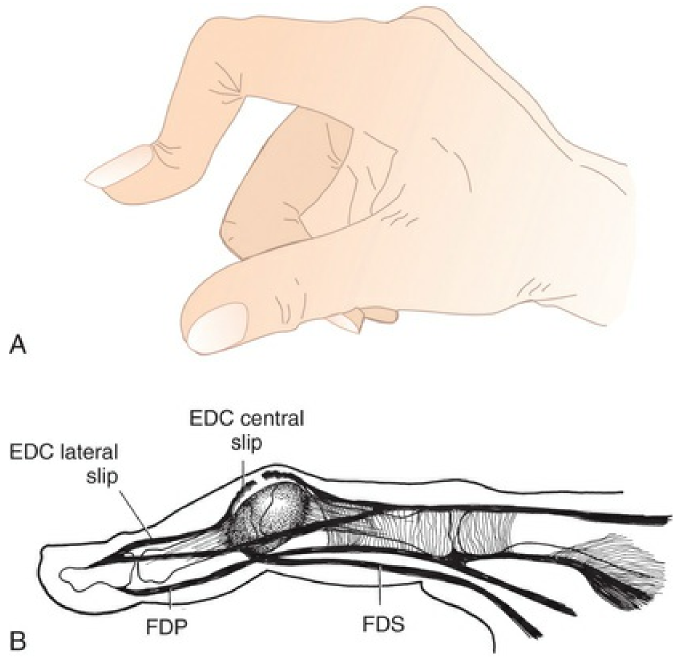

FIG 38.4 **A,** A boutonnière deformity results in distal interphalangeal hyperextension and proximal interphalangeal flexion. **B,** Boutonnière deformity caused by rupture or lengthening of the central slip of the extensor digitorum communis tendon. (A, From Black JM, Hawks JH: *Medical-surgical nursing, clinical management for positive outcomes,* ed 8, Philadelphia, 2009, Saunders.)

- A swan neck deformity is characterized by hyperextension of the PIP joint and flexion of the DIP joint, with possible flexion of the MCP joint (Fig. 38.5). This zigzag collapse is also a result of muscle-tendon imbalance and joint laxity. It can originate from abnormalities at any finger joint. Causes of this deformity include intrinsic muscle tightness, stretching or rupture of the terminal extensor tendon at the DIP joint, and chronic synovitis that leads to stretching of the volar capsular supporting structures at the PIP joint. Here, the lateral bands of the extensor mechanism slip above the axis of the PIP joint, thereby hyperextending the PIP joint and flexing the DIP joint. Function of the finger is compromised by an inability to flex the PIP joint, with loss of the ability to make a fist or hold small objects.[2,8,9]

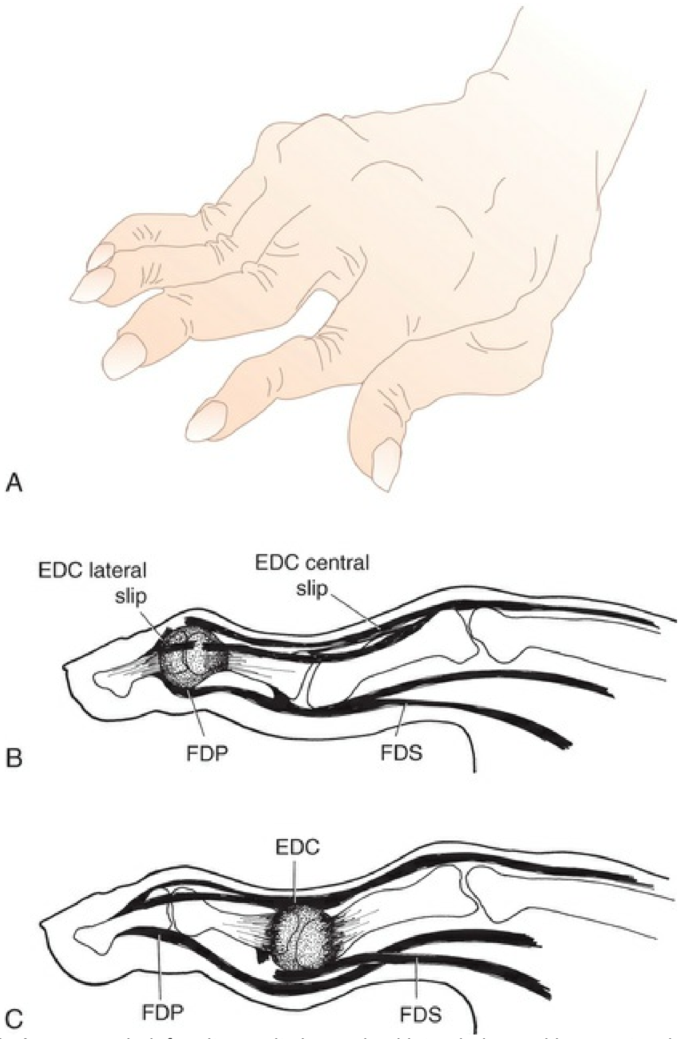

FIG 38.5 **A,** A swan neck deformity results in proximal interphalangeal hyperextension and distal interphalangeal flexion. **B,** Swan neck deformity resulting from rupture of the lateral slips of the extensor digitorum communis tendon. **C,** Swan neck deformity as a result of rupture of the flexor digitorum superficialis tendon. (A, From Black JM, Hawks JH: *Medical-surgical nursing, clinical management for positive outcomes,* ed 8, Philadelphia, 2009, Saunders.)

- A mallet finger is characterized by flexion of the DIP joint. This is caused by rupture of the terminal extensor tendon as it crosses the DIP joint. The finger loses the ability to extend the distal phalanx.
- **Nodes** are bony enlargements that indicate cartilage damage caused by OA. Joints affected by RA can also have degenerative joint disease, so nodes may be seen in clients with RA as well. These osteophytes are hard to the touch and are typically not painful. They are most commonly seen at the DIP joint (Heberden's nodes) and the PIP joint (Bouchard's nodes; Fig. 38.6).[9,16,72,73]

FIG 38.6 Osteophyte formation in the proximal interphalangeal joints (Bouchard's nodes) and the distal interphalangeal joints (Heberden's nodes) is a common finding with osteoarthritis.

- Nodules are granulomatous and fibrous soft tissue masses that are sometimes painful. They usually occur along weight-bearing surfaces such as the ulna or at the olecranon (Fig. 38.7) and can be prognostic of the severity of RA.[9]

FIG 38.7 Rheumatoid nodule present on the extensor surface of the elbow. (From Tilstra JS, Lienesch DW: Rheumatoid nodules, *Dermatol Clin* 33:361–371, 2015.)

- Deviation is characterized by a change in the normal joint position. It is typically described as radial or ulnar. In RA the most common pattern of deviation is radial deviation of the wrist and ulnar deviation (commonly referred to as ulnar drift) of the MCP joints (Fig. 38.8). Deviation is caused by ligament weakening or disruption. Small joints are especially vulnerable because daily activities involving gripping and pinching apply strong forces to them.[9,72]

FIG 38.8 Ulnar drift of the metacarpophalangeal joint. (From Schlenker E, Roth SL: *Williams' essentials of nutrition and diet therapy,* ed 7, St. Louis, Mosby, 2007.)

- **Subluxation** is characterized by volar or dorsal displacement of joints. It is any degree of malalignment in which the articular structures are only in partial contact. In RA the most common sites of subluxation are the wrist and MCP joints.[72] Volar subluxation of the wrist occurs as the carpal bones slip relative to the distal end of the radius as a result of weakening of the supporting ligaments by chronic synovitis. Because of their condyloid nature, the MCP joints have more planes of movement and are inherently less stable than the IP joints. Volar subluxation of the MCP joints occurs frequently and is often accompanied by ulnar drift and lateral displacement of the extensor tendons into the ulnar valleys between the metacarpal heads (Fig. 38.9).[2,8,9,72]

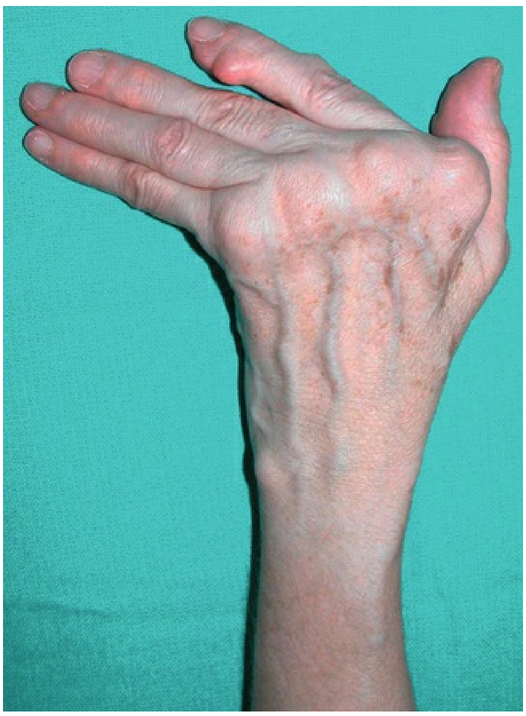

FIG 38.9 Volar subluxation and ulnar deviation of the metacarpophalangeal joints with lateral displacement of the extensor tendons characteristic of rheumatoid arthritis. (From Chung KC: *Hand and upper extremity reconstruction with DVD.* A volume in the Procedures in Reconstructive Surgery Series, Edinburgh, 2009, Saunders.)

- Dislocation is characterized by joints whose articulating surfaces are no longer in contact. In severe cases of RA, volar dislocation of the carpals on the radius or dislocation of other joints can result from complete destruction of ligamentous integrity.[2,72]
- Ankylosis (fusion of the bones of a joint) is characterized by lack of joint mobility. This spontaneous joint fusion can be bony (caused by ossification within or around the joint) or fibrous (caused by growth of fibrous tissue around the joint).[72]
- Extensor tendon rupture is characterized by the inability to actively extend a joint in the absence of muscle weakness (Fig. 38.10). The extensor digiti minimi is often the first to rupture. The extensor pollicis longus and extensor digitorum communis of the third, fourth, and fifth digits are also vulnerable.[2,9] Tendon rupture can occur as a result of rubbing of the tendon over rough bony surfaces or tendon damage caused by direct synovial invasion or increased pressure that decreases blood supply to the tendon.

FIG 38.10 Extensor tendon rupture of the fourth and fifth digits resulting in loss of active extension. Tenosynovitis of the extensor tendons and volar subluxation of the wrist caused by rheumatoid arthritis are contributing factors. (From Evans RC: *Illustrated orthopedic physical assessment,* ed 3, St. Louis, 2009, Mosby.)

- Trigger finger is characterized by inconsistent limitation of finger flexion or extension. It is often caused by a nodule on a flexor tendon or stenosis of a tendon sheath, which impedes the tendon's ability to glide.[8,9,72] The client often experiences “catching” or “locking” of a finger into flexion and has to passively extend the finger out of the flexed position.
- Mutilans deformity is characterized by floppy joints with redundant skin (Fig. 38.11). The cause is unknown, but the result is resorption of the bone ends, which shortens the bones and renders the joints completely unstable. This is most commonly seen at the MCP and PIP joints of the hands and the radiocarpal and radioulnar joints of the wrist.[72]

FIG 38.11 Mutilans deformity. (From Weisman MH, Weinblatt ME, Louie JS: *Targeted treatment of the rheumatic diseases,* Philadelphia, 2010, Saunders.)

- Thumb deformities can be manifested as any of the deformities previously described. Nalebuff has classified six patterns of thumb deformity (Table 38.4).[109] Type I is the most common in RA, followed by type III, seen in both OA and RA.[72,109] A boutonnière deformity (type I) is characterized by MCP joint flexion and IP joint hyperextension. A swan neck deformity (type III) is characterized by CMC joint subluxation, adduction, and flexion; MCP joint hyperextension; and IP joint flexion. Also common in RA and OA is an adduction contracture of the thumb CMC joint caused by subluxation of the first metacarpal, radial deviation of the MCP joint, or shortening or weakness of intrinsic muscles.[72,109] Subluxation causes a characteristic squared appearance of the CMC joint (Fig. 38.12). Disruption of thumb biomechanics often leads to significant loss of hand function, especially given the fact that the thumb is thought to account for as much as 60% of hand function.[46]

TABLE 38.4
Rheumatoid Thumb Deformities

Type	CMC Joint	MCP Joint	IP Joint
I (boutonnière)	Not involved	Flexed	Hyperextended
II (uncommon)	CMC flexed and adducted	Flexed	Hyperextended
III (swan neck)	CMC subluxed, flexed, and adducted	Hyperextended	Flexed
IV (gamekeeper's)	CMC not subluxed; flexed and adducted	Hyperextended, ulnar collateral ligament unstable	Not involved
V	May or may not be involved	Volar plate unstable	Not involved
VI (arthritis mutilans)	Bone loss at any level	Bone loss at any level	Bone loss at any level

CMC, carpometacarpal; IP, interphalangeal; MCP, metacarpophalangeal.

From Terrono AL, Nalebuff EA, Philips CA: The rheumatoid thumb. In Skirven M, et al, editors: *Rehabilitation of the hand and upper extremity,* ed 6, St. Louis, 2011, Mosby, p 1345.

FIG 38.12 Osteoarthritis of the thumb carpometacarpal joint resulting in squaring and subluxation of the base of the thumb. (From Abhishek A, Doherty M: Diagnosis and clinical presentation of osteoarthritis, *Rheum Dis Clin North Am* 39:45–66, 2013.)

Physical endurance can be evaluated by observation during the assessment process and by client report. Pain, weakness, deconditioning, lack of sleep, and emotional stress can all lead to decreased stamina. The pattern and severity of fatigue should be noted.[99] Functional mobility, including ambulation, sitting and standing tolerances, and ability to transfer, should be assessed relative to occupational performance. It is also important to assess for fall risk as increased likelihood of falling has been reported in clients with lower extremity arthritis.[33]

Goal Setting

The goals of therapy should be determined by careful consideration of the client's stated goals, the client's individual needs, and the stage of the disease process. The Canadian Occupational Performance Measure (COPM) is a useful client-centered tool that can be used for setting goals, planning treatment, and measuring outcomes.[58] It is designed to detect change in a client's self-perception of occupational performance over time. It engages the client in defining problems in activity and helps the client more clearly understand the purpose of OT. The COPM involves a semistructured interview in which the client is asked to identify occupations that the client needs to, wants to, or is expected to perform but are not done satisfactorily. Occupational goals in the areas of self-care, productivity, and leisure (based on the Canadian Model of Occupational Performance [CMOP]) are listed, and the client is then asked to rate his or her self-perception of the importance of, current performance of, and satisfaction with performance of each occupation. Through this process of collaboration with the client, occupation-based therapy goals can be identified, priorities determined, and a treatment plan designed to facilitate optimal outcome. The rating process is repeated at time of discharge for outcome purposes. The COPM has been used with people who have arthritis in both inpatient and outpatient settings.[7] COPM goals for Nina were to return to work 20 hours a week, to clean her house independently, and to be able to take her grandchildren to the park after school.

Intervention Objectives and Planning

Treatment of clients with arthritis must take into account the progressive nature of the disease.[27] The overarching goal of therapy is to decrease pain, protect joints, and increase function. General objectives of OT are to (1) maintain or increase the ability to engage in meaningful occupations; (2) maintain or increase joint mobility and strength; (3) maximize physical endurance; (4) protect against or minimize the effect of deformities; (5) increase understanding of the disease and the best methods of dealing with its physical, functional, and psychosocial effects; and (6) assist with adjustment to disability.[72]

The intervention plan should be designed for the individual client and based on the stage of disease, the severity of symptoms, general health status, lifestyle, and mutually agreed goals. Given the limited time for therapy, prioritizing treatment is essential. The therapist should focus on addressing the most important factors by answering the following question: "What are the essential interventions necessary to enable the client to function at an optimal level?" It is important for the client and significant others to be active participants throughout therapy. Everyone involved must understand the disease process and the rationale for the intervention methods. Because therapy intervention will most likely be intermittent throughout the client's course of disease, the client's ability to follow through with and self-manage interventions at home will greatly influence the ultimate success of treatment.

Table 38.5 outlines some common symptoms, general objectives, and OT interventions typically appropriate for each stage of inflammatory disease; it can be used as a starting point for planning treatment.[9,72] Nina was in the subacute stage of her RA flare-up. All six general objectives listed previously were important to address in her OT program.

OT Practice Notes

As always, the occupational therapist's clinical judgment of each client's unique status is crucial for tailoring programs appropriately.

TABLE 38.5

Treatment Objectives by Stage of Inflammatory Disease

Stage	Symptoms	Objectives	Treatment Considerations
I. Acute	Pain; inflammation; hot, red joints; tenderness; overall stiffness; limited motion	Decrease pain and inflammation	Splinting for localized rest day and night, increased bedrest, joint protection, assistive devices, physical agent modalities
		Maintain ROM	Gentle active ROM or passive ROM to point of pain (no stretch), proper positioning
		Maintain strength and endurance	Functional activities to tolerance, isometric exercises
II. Subacute	Inflammation subsiding; warm, pink joints; decreased pain and tenderness; stiffness limited to the morning	Decrease pain and inflammation	Less restrictive splinting during the day, splinting continued at night, joint protection, assistive devices, physical agent modalities
		Maintain ROM	Active ROM or passive ROM with gentle stretch, proper positioning
		Maintain strength and endurance	Increased functional activities to tolerance, isometric exercises
III. Chronic active	Minimal inflammation, less pain and tenderness, increased activity tolerance, low endurance	Decrease pain and inflammation	Joint protection, splinting as needed, assistive devices as needed, physical agent modalities as needed
		Increase ROM	Active ROM or passive ROM with stretch at end range
		Increase strength and endurance	Resistive exercises (isometric or isotonic if no risk of overstressing joints), cardiovascular exercises, increased functional activities
IV. Chronic inactive	No inflammation, pain and stiffness from disuse, low endurance	Decrease pain	Joint protection, splinting as needed, assistive devices as needed, physical agent modalities as needed
		Increase or maintain ROM	Active ROM or passive ROM with stretch at end range
		Increase strength and endurance	Resistive exercises (isometric or isotonic if no risk of overstressing joints), cardiovascular exercises, increased functional activities

Occupational Therapy Intervention

Treatment methods useful in the remediation of clinical or functional problems include rest, physical agent modalities (PAMs), therapeutic exercise and activity, splinting, occupational performance training, and client education. It is important to foster the client's self-efficacy in his or her ability to follow through with treatment at home, given the influences of the home contexts, because building the client's confidence will probably lead to the desired behavior. Asking the client a question such as "How certain are you that you can perform this activity at home as well as you did in the clinic?" can provide feedback on the need for further training and practice.[63] The interventions chosen should reflect the individual client's needs and choices whenever appropriate. General treatment precautions related to arthritis are listed in Box 38.2.

Box 38.2

Treatment Precautions Related to Arthritis

Respect pain.

Avoid fatigue.

Avoid placing stress on inflamed or unstable joints.

Use resistive exercise or activity with caution.

Be aware of sensory impairments.

Be cautious with fragile skin resulting from systemic disease or pharmacologic side effects.

Sleep and Rest

Rest should be considered an active means of reducing inflammation and pain. Rest and relaxation can effectively break the vicious cycle of pain, stress, and depression by allowing the body time to heal itself. Rest can be either systemic or local. Whole-body general rest, including recuperative sleep, is necessary for health. However, individuals with arthritis are at risk for sleep problems because of pain and depression.[97] During periods of active systemic inflammatory disease, at least 8 to 10 hours of sleep at night and half-hour to 1-hour morning and afternoon rest periods are recommended.[11,99] The amount of systemic rest needed varies by individual, from complete bedrest to an extra nap during the day. Localized rest of joints with symptoms of RA and OA may include wearing a splint, avoiding or modifying activity, or positioning during the day or at night to prevent joint stress.[27] Repetitive joint loading or motion with activity should be alternated with rest. The effectiveness of rest will be seen as an improved energy level with less joint swelling, pain, and fatigue.

Nina required both general rest for her body and localized rest for her inflamed wrists and hands. It was important to help her realize the physiologic need for rest during recovery from her flare-up. This assurance permitted her to feel less guilty about tasks left undone and enabled her to understand that taking care of herself in the short term would allow her to return to activity in the long term.

Physical Agent Modalities

Physical agent modalities (PAMs) may help to relieve pain or to maintain or improve ROM. Although modality use alone has not been shown to provide sustained benefits in rheumatic disease, clients do report less pain and stiffness from a clinical standpoint.[9,111,116] The most commonly used PAMs are superficial heat and cold agents. Benefits of heat in clients with arthritis include increased blood flow, pain relief, and increased tissue elasticity, with a negative effect of increasing inflammation also possible.[17,50] Benefits of cold include reduced inflammation and decreased pain threshold, with possible negative effects of increased tissue viscosity and decreased tissue elasticity causing more joint stiffness.[17,50] Heat can be delivered through hot packs, paraffin, fluid therapy, hydrotherapy in a heated pool, and even a warm shower or bath; cold can be delivered through ice packs or gel packs. When selecting the proper modality, the therapist must consider the activity and stage of the disease process. Acutely inflamed joints may be exacerbated by heat, whereas ice may be more helpful in reducing pain and inflammation. In the subacute or chronic stages, heat or cold may be equally effective.[17] Nina preferred the use of heat and found it helpful in loosening her joints and lessening her pain. Even though she was in the subacute phase, some inflammation was still present; therefore her response to heat was closely monitored so that it did not worsen her inflammation. She was educated in the safe use of warm baths and microwave packs at home.

Some medical conditions associated with rheumatic disease contraindicate the use of thermal agents. For example, use of cold is contraindicated in clients with Raynaud's phenomenon, a vasospastic disorder of the digits.[17,50] Clients with RA often have unstable vascular reactions to heat and cold that cause greater than normal heat retention with heat agents or increased coldness and stiffness with cold exposure.[50] Careful monitoring of client responses to PAMs is crucial. Client preference and ease of home application should also be considered before choosing an agent to use. Home paraffin units, microwave packs, and continuous low-level heat wraps are increasingly accessible and affordable in community stores and thus provide clients with more options.[74] Safety should always be a primary concern. Clients and significant others should be carefully instructed in proper application techniques to prevent burns or other tissue damage. Before using any modality, the therapist must fully understand tissue responses and related precautions and be competent in safe delivery of the agent. This typically requires specific education beyond entry-level preparation. Therapists must also adhere to any state licensure or training requirements.

Therapeutic Exercise

The purpose of exercise in the treatment of arthritis is to keep muscles and joints functioning as normally as possible by maintaining muscle strength, preventing disuse atrophy, and maintaining or improving ROM.[119] There is evidence that hand exercise can increase strength, reduce pain, and improve ROM and hand function in OA[111] and that ROM, dynamic, and aerobic exercise can have positive effects in RA.[36,67] Regular physical activity can also alleviate depression.[117] It is helpful to find out what exercises the client may already be performing and whether these exercises were suggested by a professional or a well-meaning family member or friend; many self-initiated exercises can be harmful to a person with arthritis. There is no universal exercise program suitable for all clients with arthritis. Exercise programs should be designed with regard to individual client needs and tolerances. As a good rule of thumb, pain lasting greater than 1 or 2 hours after completion of exercise signals a need to modify or decrease an exercise.[72,119] General guidelines for exercise in clients with arthritis are to avoid undue joint stress, avoid pain and joint swelling, and work within the client's comfortable ROM.[9,61,119] The client should be taught to perform exercises slowly, smoothly, and with proper technique. The client must also understand the rationale behind the prescribed exercises.[119] Exercises to maintain ROM should be performed at least once daily, even during a flare. For RA each major joint should be taken through its full comfortable ROM. This includes the neck and possibly the jaw if symptomatic. The stiffest joints require the most attention. The type of ROM exercise selected depends on the disease activity and location of the joint. Active ROM is typically preferred, with assisted or passive ROM if pain or weakness precludes it. In cases of active synovitis, active ROM can exert more stress on a joint than gentle passive ROM, so passive ROM exercises may be safer.[72] Performing shoulder exercises is often easier in a supine position, which eliminates the effects of gravity. The number of repetitions should be weighed against the potential inflammatory response. On good days, 10 repetitions may be appropriate; on bad days, 3 or 4 repetitions within a smaller arc of motion may be indicated.[119] If the goal of exercise is to increase joint mobility, active or passive stretch can be incorporated. This is appropriate for the subacute or chronic phases of disease but never for the acute phase.[72] Box 38.3 presents general active ROM exercises for RA.

Box 38.3

Range-of-Motion Exercises for Rheumatoid Arthritis

Instructions

1. Start with 5 of each exercise, 1 or 2 times each day.

2. Progress to 10 of each exercise, 1 or 2 times each day.

3. Do all exercises slowly and smoothly.

4. If in a flare, cut down on exercises but do not discontinue them entirely.

Jaw

5. Open your mouth wide and then close it.

6. With your mouth open, move your jaw from side to side.

7. Bring your lower jaw forward and then relax.

Neck

8. Look up toward ceiling and then look down to the floor.

9. Bend your head toward one shoulder and then bend your head toward the other shoulder.

. Slide your chin forward and then relax.

. Slide your chin toward the back of your neck and then relax.

Shoulders and Elbows

. Shrug your shoulders up and down.

. With your hands on your shoulders, make circles clockwise and then counter-clockwise.

. With your hands behind your head (or if unable, on your shoulders), bring your elbows together in front of you and then spread your elbows apart.

. Touch your shoulders with your hands and then straighten your elbows.

Forearms and Wrists

. With your elbows partially bent and kept at your sides, turn your palms up and then down.

. Lift your hands backward, letting your fingers curl, and then bend your hands down, letting your fingers straighten.

Fingers

. Make fists and then open your hands and straighten your fingers.

. Touch your thumb tips to the tips of each finger.

. With your palms on your thigh or a table, move your thumbs away from your fingers and then slide each finger toward your thumbs.

Courtesy Occupational Therapy Department, Rancho Los Amigos National Rehabilitation Center, Downey, California.

Exercises for strengthening can be dynamic (isotonic) or static (isometric) and should be aimed toward recovery of function.[30,72,117] Strengthening must be approached cautiously so that pain is not increased, deforming forces are not created, and joint stability is not compromised. Grip-strengthening exercises, even those using light putty, can impart large forces to unstable hand joints.[19] Additionally, this type of dynamic exercise may aggravate joints or pose a risk for potential deformity and in general should be avoided in clients with rheumatoid hand involvement.[9] Resistive exercise of any kind should never be performed during periods of acute flare or inflammation but may be used at other stages. Isometric exercises are usually the least painful for clients with RA because they eliminate joint motion and can be as effective or more effective in improving muscle strength and endurance.[72] Isometric contractions are generally held for 6 to 12 seconds[30] Programs to maintain strength vary depending on the client's overall activity level. Clients who are sedentary may require a daily program, whereas clients who are active may need to perform only specific exercises once a week.[72] Gradual progression of repetitions or resistance is recommended.[117]

Exercises to promote general health and fitness are recommended for all adults as part of a healthy lifestyle and should be encouraged in clients with arthritis. Current evidence supports the benefits of well-designed aerobic and conditioning exercise for people with hip and knee OA, as well as aerobic and strength training in adults with stable RA.[36,53,67,117] Stationary bicycling, walking, and low-impact aerobic dancing, once thought to cause joint damage, have been found to increase flexibility, strength, endurance, and cardiovascular fitness without aggravation of symptoms. T'ai chi has been reported to have positive effects on self-efficacy, quality of life, general health status, pain, stiffness, and physical functioning in older adults with lower extremity OA[47,98] and is being used for clients with RA as well.

Whether the client is exercising to address ROM, strengthening, or overall conditioning, the occupational therapist should work closely with the client to help ensure that any exercise program can be successfully integrated into the client's typical daily routine with a proper balance of rest and activity. Exercises should ideally be done when the client feels most limber and has the least pain. Community land- and water-based exercise classes specifically designed for people with arthritis are available through the Arthritis Foundation. They offer the added benefits of social interaction and peer support and have been shown to be safe and effective in increasing fitness and strength and decreasing pain and difficulty in daily functioning.[14,36,53,102,106]

Daily upper body active ROM exercises with gentle stretch and isometric exercises for the shoulders and elbows were prescribed to improve Nina's motion and strength. It was decided that the best time to perform these exercises was after her morning shower, when she felt less stiff and least fatigued. The therapist recommended that Nina become involved in an Arthritis Foundation exercise class, once her flare subsided, to build her endurance and cardiovascular conditioning. She was interested in joining and planned to attend classes on the days that she worked fewer hours.

Therapeutic Activity

Performance of therapeutic activities offers many benefits, both physical and psychological. Discussing current and past hobbies or having the client complete an interest survey can help the therapist determine activities that may be most appropriate for the client. New activities may be suggested or previously enjoyed activities reintroduced. A carefully chosen and graded activity can be an effective means of encouraging ROM and strength. When selecting therapeutic activities, the therapist should apply the same principles as with exercise.[72] Activities should be nonresistive, avoid patterns of deformity, and not overstress joints; instead, they should offer enough repetition of movement to help improve ROM and strength. The effect of the activity on all joints should be considered.

It is typically recommended that clients with RA not engage in activities that require use of the hand in prolonged static positions. However, sometimes the psychological benefits of doing activities that one enjoys outweigh the risks involved, especially if the risks can be minimized. Examples of activities that are often frowned on include knitting and crocheting. These activities are truly contraindicated only if there is active MCP synovitis, a developing swan neck deformity, or thumb CMC joint involvement.[72] Potential problems may be averted by having the client wear a hand or thumb splint to support the vulnerable joints while performing the activity. Additionally, educating the client to incorporate frequent rest breaks and stretching exercises for the intrinsic muscles will help limit risks (see Chapter 29 for additional information regarding therapeutic exercise and activity).[31,72]

Splinting

Indications

Splinting is often an integral component of the treatment of arthritis. Splints can be used for numerous reasons, with the fundamental goal of maximizing function. It is important for the therapist to understand the pathomechanics of the disease process when prescribing an appropriate and feasible splinting plan. Inappropriate use of splints can be harmful. Indications for splinting in clients with arthritis include reducing inflammation, decreasing pain, supporting unstable joints, properly positioning joints, limiting undesired motion, and increasing ROM. Although it is generally agreed that splinting has a place in the acute phase of RA,[36] there are few documented or well-established protocols for splinting in later stages.[39] Table 38.6 summarizes the potential splinting indications on the basis of progression of the joint destruction in RA.[9,72]

TABLE 38.6

Splinting Indications by Classification of Progression of Rheumatoid Arthritis

Stage	Symptoms/Radiographic Changes	Splinting Indications
Stage I: Early	No destructive changes; possible osteoporosis	Resting splints to decrease acute inflammation, decrease pain, protect joints
Stage II: Moderate	Osteoporosis with or without slight subchondral bone destruction, slight cartilage destruction, no joint deformities, limited joint mobility possible, muscle atrophy, extraarticular soft tissue lesions possible	Day splints to provide comfort Night splints to relieve pain or protect joints against potential deformity Splints to increase ROM
Stage III: Severe	Cartilage and bone destruction, joint deformity, extensive muscle atrophy, extraarticular soft tissue lesions possible	Day splints to improve function (decrease pain, provide stability, limit undesired motion, properly position joints) Night splints to provide positioning and comfort
Stage IV: Terminal	Criteria for stage III, with fibrous and bony ankylosis	Day splints to improve function (decrease pain, provide stability, limit undesired motion, properly position joints) Night splints to provide positioning and comfort

Ultimately, the individual needs of each client must be determined carefully. What are the primary goals for splinting? What benefits will a splint provide? What limitations will a splint impose? Which joints are involved and should be incorporated into a splint design? What effect will splinting have on unsplinted joints? Is the client receptive to splinting? What splints has the client tried or worn before? When should the splint be worn? These factors should be considered when deciding on an appropriate splinting plan.

Considerations

There are some special considerations for splinting in clients with RA. Because the added weight of a splint puts additional stress on the upper extremity and may cause problems with pain and fatigue, a splint should be as lightweight as possible. Forces are also transferred from splinted to adjacent unsplinted joints. For example, a thumb splint leaving the wrist and IP joints free may cause these joints to become more symptomatic. Skin tolerance can be an issue because skin is often more fragile as a result of the RA disease process and effects of medication. The presence of sensory impairments may also require closer monitoring for signs of pressure. Finally, splint straps may need to be modified to allow increased ease and decreased joint stress during donning and doffing of splints.

Options

If splinting is indicated, the therapist must then determine which type of splint will work best. The growing array of commercial products has led to a greater number of choices. Should the splint be rigid, semirigid, or soft? This will often be decided by the splint's proposed purpose and the client's preference. Rigid splints provide maximal immobilization or stability, soft splints allow more freedom of motion, and semirigid splints combine elements of both. Should the splint be prefabricated or custom made? This decision is based on many splint- and client-related factors, including splint availability, cost to purchase or fabricate, durability, weight, ease of care, ease of donning and doffing, cosmetic appearance, and extent of the client's existing deformity.

Providing the client with choices will enhance splint use and client satisfaction. Studies have shown that the following additional factors may encourage splint wear: flexibility of the splinting regimen and vigorous client education regarding the splint's purpose and wearing schedule, individualized splint prescriptions based on the client's comfort and preference, strong family support, positive attitudes and behaviors exhibited by healthcare providers, and benefits that are immediately obvious to the client.[22,38,43,77,81,104] Rapport, trust, sensitivity to clients' learning styles, splint trial evaluations, and providing clients with the opportunity to voice their concerns and frustrations can also enhance the collaborative process and splinting outcome.[28] The therapist can recommend splinting, but ultimately the client will decide whether the splint's benefits outweigh the limitations that it imposes.

Commonly Used Splints for Arthritis

A resting hand splint is useful for the treatment of acute synovitis of the wrist and hand. Its primary function is to provide localized rest to the involved joints. It can also relieve pain, decrease muscle spasm, and protect joints vulnerable to contracture or deformity from synovitis. Joints are rested in positions that place the least internal pressure on them and are opposite that of potential deformity.[9] The recommended joint positions during rest are slight wrist extension (0 to 20 degrees) and ulnar deviation (10 to 20 degrees), MCP flexion (20 to 30 degrees), slight PIP and DIP flexion (10 to 30 degrees), and slight thumb extension and abduction at the CMC joint with slight flexion of the MCP and IP joints.[39,72] However, the client's comfort should always take precedence, and joints should never be forced into the ideal position. The splint is worn continually for the duration of the flare-up and removed at least once a day for skin hygiene and gentle ROM exercises. Splint use should continue full-time for at least 2 weeks after the flare subsides, with a gradual decrease in wearing time to allow the joints to recover.[39,72] In the later stages of disease, the splint is often used at night only to increase comfort and protect against deforming positions. If bilateral splints are needed, clients may alternate splints or wear the splint on the most symptomatic hand.

Commercial splints, such as those made from wire-foam or a malleable metal frame covered by soft padding (Fig. 38.13), may be used if the limited adjustments that they allow can provide the client with a proper fit. This is often not possible in clients with established joint deformities. A custom-fabricated thermoplastic splint will allow a precise individualized fit. Joints that are asymptomatic may not need to be included in the splint. Modified resting splints with the uninvolved joints left free (Fig. 38.14) may lessen joint stiffness related to splint wear, allow some degree of hand function while the splint is worn, and improve splint wear and comfort.

FIG 38.13 Prefabricated resting hand splint. (Courtesy Occupational Therapy Department, Rancho Los Amigos National Rehabilitation Center, Downey, California.)

FIG 38.14 Prefabricated wrist-hand splint with thumb left free. (Courtesy Occupational Therapy Department, Rancho Los Amigos National Rehabilitation Center, Downey, California.)

Although the benefits of resting hand splints are recognized by healthcare professionals, studies have shown that client adherence to splint wear is moderate at best.[1,38] In a study comparing the use of soft and hard resting splints in clients with RA, pain was significantly decreased with splint wear, with 57% preferring the soft splint, 33% the hard splint, and 10% no splint at all. The rate of compliance was greater for the soft splint than for the hard splint.[20]

A wrist splint is often used to provide wrist stability, decrease pain, and improve function. Supports may be custom-fabricated (Fig. 38.15) or prefabricated. Because they are intended to provide support while allowing functional use of the hand, fit and comfort are crucial. A variety of commercial splints made from many materials that offer a full range of soft to rigid support are available. Aside from support, clients with arthritis frequently report a benefit from the neutral warmth that many fabrics provide. A systematic review did conclude that wrist splints were effective in reducing pain in clients with RA.[85] Studies have shown conflicting results of different splint styles in grip strength, dexterity, pain reduction, hand function, comfort, security during performance of tasks, effects of stiffness, or muscle atrophy related to wearing of wrist splints in clients with RA.[79,85,104] In a study of splint preference, most clients were able to identify their preferred splint within only a few minutes of wear when given three styles to try.[103] These studies illustrate the importance of offering a wide variety of splints for each client to try. When the MCP joints are symptomatic, a splint can be used to support them along with the wrist (Fig. 38.16).

FIG 38.15 Custom-fabricated thermoplastic wrist splint. (Courtesy Occupational Therapy Department, Rancho Los Amigos National Rehabilitation Center, Downey, California.)

FIG 38.16 Prefabricated wrist and metacarpophalangeal joint soft support. (Courtesy Occupational Therapy Department, Rancho Los Amigos National Rehabilitation Center, Downey, California.)

MCP ulnar deviation splints may be beneficial in providing relief of pain, stability, alignment, and reduced stress on painful, subluxed, or deviated joints. They may slow the progression of deformity, but they will not prevent or correct it.[9,71,84] Splints can be fabricated or obtained commercially, with support ranging from soft to rigid (Fig. 38.17). Despite the variety of splint designs and materials, MCP ulnar deviation splints are reported to be infrequently prescribed and used by clients.[75] Immobilization of the MCP joints can impede functional use of the hand or increase pain and stress on adjacent PIP joints.[46,71,83] Bulky or volar-based splints can also interfere with palmar sensation or impair the ability to grasp objects. However, some clients benefit from the pain relief and improved digital alignment. High client satisfaction rates have been reported for a custom dorsal-based design.[86] Soft splints are commercially available or can be custom-fabricated.[42] The client's preference for use and selection of an MCP ulnar deviation support should be the primary factor in decision making.[46,71]

FIG 38.17 Rigid prefabricated wire-foam metacarpophalangeal joint ulnar deviation splint. (Courtesy Occupational Therapy Department, Rancho Los Amigos National Rehabilitation Center, Downey, California.)

A swan neck splint, also known as a PIP hyperextension block, is used to restrict unwanted PIP hyperextension motion. Swan neck deformities often cause difficulty in hand closure because the PIP tendons and ligaments can catch during motion and the finger flexors have less of a mechanical advantage to initiate flexion when the PIP joint is in a hyperextended position. By blocking the PIP joint in slight flexion, the client can flex the PIP joint more efficiently, thus improving hand function. Swan neck splints can be custom-fabricated from thermoplastics for short-term or trial use. For long-term use or for use on adjacent fingers, commercial products made of metal or polypropylene are preferable because they are more durable, less bulky, more easily cleaned, and more cosmetically appealing[112] (Fig. 38.18). Swan neck splints or splints of similar design can also be used to provide lateral stability to unstable IP joints of the fingers or thumb.[9,46]

FIG 38.18 Splints for swan neck deformity: custom-fabricated thermoplastic, commercial custom-sized metal, and prefabricated polypropylene. (Courtesy Occupational Therapy Department, Rancho Los Amigos National Rehabilitation Center, Downey, California.)

Flexible boutonnière deformities may benefit from boutonnière splints to block the PIP joint in extension and leave the DIP joint free to flex. These can be fabricated by the therapist or custom-ordered from the same companies that manufacture swan neck splints. As a result of the direct pressure that they exert over the dorsum of the PIP joint, the skin must be monitored closely.

Clients may reject wearing these splints during the day if limiting PIP flexion impedes function. Night splinting with the PIP joint in maximal extension can be used in an attempt to maintain ROM.[9]

Thumb splinting can provide positioning opposite that of the developing deformity in early stages of disease and a more stable and pain-free pinch for function in later stages.[9] Hand-based short thumb spica splints or opponens splints leave the wrist and IP joints free and can be used for problems at the MCP or CMC joints. Splinting for the CMC joint may sometimes necessitate inclusion of the wrist or MCP joints, but both hand-based and forearm-based (long thumb spica) types have been found to be effective.[46,107,114] Several thermoplastic splint designs exist, as do numerous prefabricated splints made from a variety of materials. Depending on the client's symptoms and stage of disease, a soft support (Fig. 38.19, A) may suffice, or the client may require a rigid support (see Fig. 38.19, B) to counteract the stressors applied to joints during functional use. In studies comparing a short neoprene thumb spica splint and a custom thermoplastic hand-based splint for OA of the CMC joint, both splints improved pain and function and reduced subluxation. The thermoplastic splint reduced subluxation more, but the neoprene splint provided better pain relief and was preferred by clients.[96,115] Systematic reviews found fair evidence of the effectiveness of splinting in relieving pain and improving function in OA of the CMC joint, no evidence of a particular splint superiority, and varying patient preferences.[35,56]

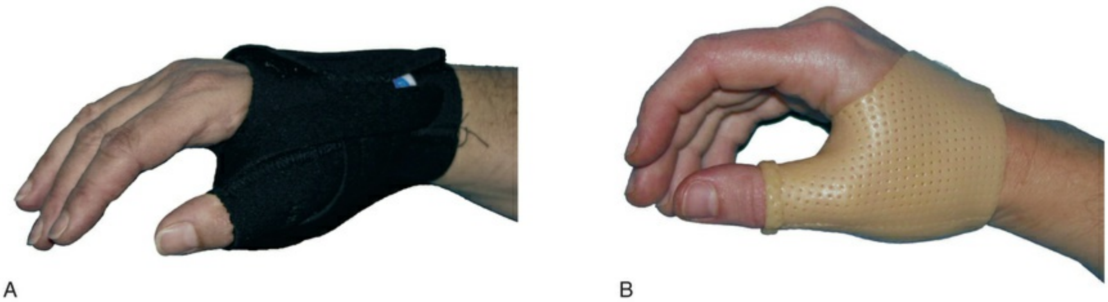

FIG 38.19 **A,** Prefabricated soft thumb support. **B,** Custom-fabricated thermoplastic short thumb spica splint. (Courtesy Occupational Therapy Department, Rancho Los Amigos National Rehabilitation Center, Downey, California.)

Dynamic splints and serial static splints may be used to regain ROM lost by shortening of periarticular structures or to maximize motion after surgical procedures such as joint arthroplasty. If the joint space is preserved (as determined by radiographs), there is a soft end-feel, and no more than minimal inflammation is present, gentle splinting may be indicated. The program should be monitored closely for adverse signs of increased pain and swelling. Static splints are often better tolerated than dynamic ones because they apply lesser amounts of force on the joint.[46]

Finally, silicone-lined digital sleeves and pads (Fig. 38.20) may be helpful in protecting painful nodes or nodules from external trauma.

FIG 38.20 Silicone-lined digital sleeve and pad. (Courtesy Occupational Therapy Department, Rancho Los Amigos National Rehabilitation Center, Downey, California.)

The splinting program for Nina focused on decreasing her inflammation and pain and protecting her vulnerable joints. Because she had no established deformity, prefabricated splints were a viable option, one that she preferred. Bilateral lightweight resting hand splints were selected for use at night. To afford her some ability to function, semirigid wrist splints were prescribed for use during the day. She was taught to monitor her symptoms and intermittently use the resting hand splints as needed if daytime activity led to increased pain or inflammation. Splint straps were modified by attaching loops to one end so that she could more easily manage them (see Chapter 30 for additional information).

Occupational Performance Training

An effective means of maintaining functional motion and strength with arthritis is to have clients perform daily occupations.[72] During active stages of the disease, occupations may be limited to just a few, such as feeding and hygiene. As the client's condition improves, usual life activities should be resumed because this will promote physical status and psychological well-being. An important but sometimes neglected aspect of ADL training is sexual counseling. Given the pain, fatigue, and ROM limitations resulting from arthritis or movement restrictions imposed postoperatively after joint replacement, an open discussion of issues and illustrations of more comfortable and safe positions for intercourse may prove helpful for clients and their partners. Excellent resources for sexual functioning with disabilities are available (see Chapter 12 for additional information).[29,90,95]

Analysis of activity demands and activity contexts is a critical component in helping clients maintain, restore, or enhance their engagement in desired activities and occupations. Environmental modifications, alternative methods, or assistive devices often make a difference by increasing clients' independence, ease, and safety in completing meaningful occupations with less pain and stress on their joints. Creative problem solving with the client as an active participant can lead to solutions for unique challenges. Understanding the client's perspective, the meaning of roles, and the cultural and physical environment will allow the therapist to propose a more effective intervention.[7]

Assistive Devices

Numerous assistive devices can be fabricated or purchased commercially. The therapist should be familiar with the types of devices available and sources where they can be obtained at minimal expense. Many devices that were previously available exclusively from medical suppliers can now be found in retail stores at a much lower cost. Commonly used in arthritis interventions are extended-handle devices (eg, reacher, bath sponge, shoe horn, dressing stick, comb; Fig. 38.21, A), to compensate for loss of proximal ROM and strength, and devices with built-up handles (eg, hairbrush, toothbrush, writing implement, eating utensil, knob turner; Fig. 38.21, B), to compensate for limited hand function (Table 38.7). The therapist should carefully consider the client's goals, factors, activity demands, and contexts when suggesting assistive devices.[72] Most relevant to clients with arthritis are the following: Is the client receptive to using a device? Will the device successfully reduce pain, joint stress, energy demands, or time expenditure? Is the device easy to use? Is the device acceptable to the client in terms of appearance, cost, and maintenance needs? Is the device compatible with the physical environment and others in the environment? Is the device likely to cause any negative effects?

FIG 38.21 **A,** Extended-handle devices. **B,** Built-up handle devices. (Courtesy Occupational Therapy Department, Rancho Los Amigos National Rehabilitation Center, Downey, California.)

TABLE 38.7

Commonly Used Assistive Devices for Arthritis

Activity	Assistive Devices
Dressing	Dressing stick, shoe horn, sock aid, button hook, zipper pull, elastic shoelaces
Bathing	Handheld shower hose, bath bench, grab bars, long-handled sponge
Toileting	Raised toilet seat, grab bars, extended perineal hygiene aid
Hygiene and grooming	Built-up or extended-handle toothbrush, suction denture brush, extended-handle hairbrush or comb, suction nail brush, mounted nail clipper
Feeding	Built-up or extended-handle utensils, lightweight T-handled mug
Meal preparation	Electric can and jar openers, adapted cutting board, utensils with built-up handles, ergonomic right-angled knives, rolling utility cart, knob turner for stove, reacher
Miscellaneous	Doorknob levers, built-up or extended key holder, extended-handle dust pan, built-up pen, loop or spring-loaded scissors, speaker phone

Having sample equipment on hand for the client to try can be helpful in finding the best device for each client. In some cases it may be necessary to modify existing devices before the client can use them successfully. For example, the handle of a dressing stick may be built up for a client with limited grasp. Surprisingly little research has been done on assistive devices for clients with arthritis and on the characteristics of device users and nonusers, but clinical experience shows that clients are less likely to use devices that they perceive as not helpful, too complicated, too expensive, or too bothersome to others sharing the environment.[89,105] A study of device use in frail elderly clients, including some with arthritis, demonstrated that they were willing to use the devices but required assistance in identifying sources for devices.[65,66] Some clients may need to use assistive devices only during a flare or on more symptomatic days. On good days, it may be appropriate to encourage clients to perform tasks without them to promote strength and mobility.

Client and Family Education

Providing clients with as much information as possible regarding their conditions and treatment is a crucial component of OT and should be integrated throughout all phases of the program. Whether it is the client's first visit or one of many therapy encounters, educational needs should always be explored. Health literacy must be considered and fostered as it has been found to be strongly associated with functional status.[23] The client's estimation of the therapist's credibility, the quality of the therapeutic relationship, and whether the client's experience confirms the therapist's statements are important factors tied to success in changing the client's knowledge and beliefs.[63] Client education has been shown to empower clients and lead to positive changes in pain reduction, psychological status, disease management, self-efficacy, and overall health promotion.[18,20,36,45,62,64,67-69]

Ethical Considerations

Information should be presented at a level appropriate for each client and significant other, along with sensitivity to learning styles; socioeconomic status; educational level; cultural implications; and personal values, beliefs, and feelings.

Rather than focusing exclusively on providing basic information and generic skills, encouraging client self-reflection and transformation of client perspectives has been suggested as a helpful part of rehabilitation.[34] Repetition, reinforcement, and real-life application to the client's situation are other keys to education. By focusing on the client's symptoms and concerns, the therapist can capitalize on teachable moments to provide present-oriented and problem-focused learning activities.[15] It may be helpful to provide both verbal and written instructions. The following are some important educational aspects to cover: disease process, symptom management, joint protection and fatigue management, and community resources.

Disease Process

Does the client understand the type of arthritis, basic underlying pathology, medications, and medication side effects? Does the client understand that prolonged synovitis in RA can lead to irreversible joint damage and potential disability? Does the client feel comfortable discussing questions with the physician, nurse, or other treating clinicians? Does the client know of available resources to learn more?

Symptom Management

Does the client know how to monitor for signs and symptoms of inflammation? Does the client understand that pain lasting for more than 1 or 2 hours after an activity signals a need to modify or cease doing that task? Does the client understand the rationale behind, demonstrate appropriate use of, and appropriately integrate rest, exercise, splinting, and PAMs into a daily routine? Do family members understand the client's abilities and when they should or should not assist the client with activities? Does the client know to take a cautious approach to nontraditional arthritis remedies to avoid falling prey to medical quackery?

Joint Protection and Fatigue Management

Does the client understand the rationale and general principles of joint protection and fatigue management? More important, does the client successfully integrate them into daily activities? It can be challenging not just to help the client understand the potential implications but also to translate learning into action. The purpose of joint protection is to reduce internal and external joint stress, pain, and inflammation in the involved joints and preserve the integrity of joint structures during the performance of daily activities.[72] Although it has not been proved that use of joint protection techniques prevents deterioration, knowledge of the disease process and pathomechanics of deformity and clinical experience suggest that joint protection is a sound idea.[27,67] Studies have shown that clients who experience pain relief or improved function may be more receptive to changing their behavior.[31,44,76] Fatigue management, a more contemporary term for energy conservation, is aimed toward saving and expending energy wisely (Box 38.4). Organizing the environment, pacing activity, and resting can successfully moderate fatigue.[31] Instruction of principles should be based on teaching key concepts rather than general rules and should be specifically applied to each client's lifestyle and pattern of occupation with the aim of achieving occupational balance.[72,93,101] Practice in the therapy setting can help with carryover because following these principles often necessitates a change in lifelong habits. General principles for joint protection and fatigue management are especially helpful for clients with RA or clients with OA involving the hands, hips, or knees.[27,31,72]

Box 38.4

Principles of Fatigue Management

Attitudes and Emotions

Remove yourself from stressful situations.

Refrain from concentrating on things that make you tense.

Close your eyes and visualize pleasant places and thoughts.

Body Mechanics

When lifting something that is low, bend your knees and lift by straightening your legs. Try to keep your back straight.

Avoid reaching (use reachers). Avoid stretching, bending, carrying, and climbing. If you have to bend, keep your back straight.

Incorporate good posture into your activities.

Whenever possible, sit when working.

To get up from a chair, slide forward to the edge of the chair. With your feet flat on the floor, lean forward and push with your palms on the arms or seat of the chair. Stand by straightening your legs.

Before you get tired, stop and rest.

Work Pace

Plan on getting 10 to 12 hours of rest daily (naps and nights).

Work at your own pace.

Spread tedious tasks throughout the week.

Do the tasks that require the most energy at the times when you have the most energy.

Alternate easy and difficult activities, and take a 10- to 15-minute rest break each hour.

Leisure Time

Devote a portion of your day to an activity that you enjoy and find relaxing.

Check out what is available in the community.

Work Methods

Keep items within easy reach.

Use good light and proper ventilation and room temperature.

Use joint protection techniques.

Work surfaces should be at a correct height.

Organization

Plan ahead; do not rush or push yourself.

Decide which jobs are absolutely necessary.

Share the workload with family and friends.

How to Begin

Plan ahead by charting your daily routine.

Make a list of tasks, and spread them out in your schedule.

Include daily rest periods and rest breaks during energy-consuming times.

Weekly Schedule

Time	Sun	Mon	Tues	Wed	Thurs	Fri	Sat
7:00							
8:00							
9:00							
10:00							
11:00							
12:00							
1:00							
2:00							
3:00							
4:00							
5:00							
6:00							
7:00							
8:00							
9:00							
10:00							

Check your schedule for the following factors:

Is there 1 day in the week that is longer than the others?

Are heavier tasks distributed through the week?

Is there a long task that could be done in several steps?

Will your plan allow flexibility?

Have you devoted part of your day to a relaxing activity?

Does your plan use the principles of energy conservation?

Joint protection and fatigue management principles are as follows (more detailed information can be found in the sources just cited):

- *Respect pain.* Pain is a signal from the body that something is wrong. Clients often feel that they can ignore and work through pain, but the result is often more pain. If pain is present from an acute episode of inflammation, rest and avoidance of activity are indicated so that the pain and inflammation are not worsened. In chronic stages, pain that lasts for more than 1 or 2 hours after completion of an activity indicates that the activity should be modified or avoided. Clients should be encouraged to be aware of their limits and stop activities before pain occurs. Disregarding pain can lead to joint damage.
- *Maintain muscle strength and joint ROM.* Joints that are less stiff and have balanced strength will be less susceptible to further injury. Limited motion at one joint transmits force to another and may require exaggerated motions at other joints to accomplish a task. For example, loss of MCP motion will affect the PIP joint. Daily functioning and exercise programs should be done with all joint protection principles in mind to ensure that they are as least stressful as possible.
- *Use each joint in its most stable anatomic and functional plane.* This plane is the point at which resistance to motion is provided by muscle rather than ligament. Following this principle minimizes excessive stress on ligaments and allows muscle power to be used with the greatest mechanical advantage. Examples include not leaning to either side when rising from a seated position to lessen rotational forces on the knees and pinching with the pad of the thumb and the IP joint in a flexed position to minimize force on the ulnar collateral ligament.
- *Avoid positions of deformity.* The customary way of performing tasks may cause forces to be applied in directions of deformity. Tasks involving tight squeezing, pinching, or twisting motions are especially stressful. Opening a jar lid, turning a doorknob, cutting food with a knife, and lifting a coffee cup are all activities promoting MCP ulnar deviation. Instead, clients with hand involvement can be encouraged to open lids with the palm of their hand and shoulder motion or with a jar opener; to turn a doorknob with an adapted lever; to cut food with a dagger-type grip,

rolling pizza cutter, or adapted knife; and to lift coffee mugs with two hands. Static positioning should also be considered. For example, clients should be discouraged from leaning their chin on the back of the fingers because this applies considerable force to the flexed MCP joints.

- *Use the strongest joints available.* Using larger, inherently stronger joints reduces the stress on smaller joints. Carrying bags and purses on the shoulder or elbow lessens strain on the wrist and hand. Properly fitting backpacks or waist packs are other good alternatives, as is pushing or pulling a rolling cart instead of carrying items on the body. The palms rather than the fingers should be used to lift, push, or take weight to better distribute the forces.
- *Ensure correct patterns of movement.* The client may adopt incorrect patterns because of pain, deformity, muscle imbalance, or habit. For example, the client may use the dorsum of the fingers to push up from a seated position. This movement places deforming forces toward MCP flexion. A more suitable pattern is to use the flat surface of the palm (Fig. 38.22). In the hand, use of the long extensors during finger movement should be maintained. Finger flexion should be initiated at the DIP joints while maintaining extension at the MCP joints versus leading motion with the intrinsic muscles.

FIG 38.22 Use of palms to push off a chair helps protect finger joints. (Courtesy Occupational Therapy Department, Rancho Los Amigos National Rehabilitation Center, Downey, California.)

- *Avoid staying in one position for long periods.* Prolonged static positions can lead to joint stiffness and muscle fatigue. Positional stress is then transmitted to the joint ligaments, which may already be in a weakened state. Changing body positions and gripping postures, taking frequent breaks, and integrating active motion exercises during activities such as computer keyboarding, writing, gardening, and knitting can prevent fatigue, soreness, stiffness, and resulting poor movement patterns.
- *Avoid starting an activity that cannot be stopped immediately if it becomes too stressful.* This will prevent the load from going to the joint capsule and ligaments if muscles tire. Continuing a task that causes sudden or severe pain is likely to cause joint damage, and severe fatigue can cause poor movement patterns and safety risks. Realistic planning of options can help prevent these situations. For example, clients can keep a bath bench available in case they need to rest while standing in the shower. Clients also can note the location of benches in a mall in relation to the stores where they plan to shop.
- *Balance rest and activity.* Chronic pain and a systemic disease such as RA can drain both physical

and psychological resources. Helping the client understand the physiologic need for proper rest can facilitate this often difficult lifestyle change. The key to increasing functional endurance is to rest before becoming overfatigued, which could mean napping or taking breaks during or between activities. Clients with arthritis often relate similar stories of feeling a need to take advantage of good days by trying to complete as many tasks as possible. These good days are more than likely followed by several bad days as their bodies try to recover. Balancing activities during the day and longer-term across the week or month can be accomplished through planning and establishing priorities.

- *Reduce force and effort.* Less force and effort equate to less joint stress, less pain, and less fatigue. Using built-up handles, levers, more even distribution of loads, alternative methods, and other aforementioned joint protection and fatigue management techniques can help toward this end. For example, rearranging the kitchen environment to have everything within easy reach, planning tasks and gathering all needed items, sitting down while at the sink or stove, and using assistive devices all contribute to easier meal preparation.

Community Resources

Does the client know of and use available resources? Clients should be made aware and encouraged to take advantage of them. Reading materials, exercise and educational programs, and support groups can supplement medical and therapy intervention and promote lasting positive self-management behavior. The Internet, libraries, YMCAs, and senior centers are sources of information and activity or exercise programs. The Arthritis Foundation, a national organization with many local chapters throughout the country, is an excellent resource for clients, families, and clinicians. Among other services, the Arthritis Foundation offers educational pamphlets, exercise programs, self-help tips, and support designed exclusively for persons with arthritis. Box 38.5 highlights some programs and materials of special relevance to persons with RA and OA.

Box 38.5

Selected Arthritis Foundation Resources

Exercise Programs

Walk with Ease

Online tools

Mobile app

Arthritis-friendly exercise videos

Core exercises

Strengthening exercises

Upper body exercises

Lower body exercises

Weight-bearing exercises

Tai chi exercises

Yoga exercises

Written Materials

Arthritis Answers

Arthritis Today magazine

Arthritis Today Drug Guide

Arthritis Today Supplement and Vitamin Guide

Coping with Arthritis

Living with Osteoarthritis

Living with Rheumatoid Arthritis

Managing Your Pain

Tips for Good Living with Arthritis

Support

Arthritis Foundation Community at Inspire (www.inspire.com/groups/arthritis-foundation)

Occupational performance training was an important component of Nina's OT intervention. Her ability to continue working was addressed through a combination of modification of activities, use of assistive devices, and client education. Client education focused on her ability to better understand her disease process, manage her symptoms, and integrate joint protection and fatigue management principles into her life. Nina and the therapist reviewed her typical weekly schedule and together planned one that allowed a more suitable balance of rest and activity given her patterns of fatigue and peak energy. The therapist recommended ways to improve Nina's computer workstation at home, including moving the keyboard and monitor to more appropriate heights, adjusting her chair for optimal body positioning, using a pad to support her wrists, and switching from a standard mouse to a trackball device. Assistive devices were recommended for other occupations, such as cooking and managing her home. Mutual problem solving identified solutions that allowed Nina to gradually return to her previous number of work hours. Among these solutions were having Nina do much more work from her home, where she could rest as needed, and to spread out visits to her contracted businesses over several weeks and only when needed. Planning and taking an afternoon rest before picking up her grandchildren from school gave her the energy to take them to the park more frequently.

Summary

Arthritis is a chronic condition that can impose devastating limitations on a person's ability to engage in meaningful occupations. It is important for the therapist to understand the different disease processes and pathomechanics of the joint destruction found in OA and RA. Through a carefully crafted program based on a thorough evaluation of the physical, psychosocial, and functional barriers, OT can decrease pain, protect joints, foster self-management, and enable increased participation in life skills.

Threaded Case Study

Nina, Part 2

Critical evaluation components in assessing Nina's previous and current functional status were the occupational profile and typical-day assessment; assessment of clinical status included pain, inflammation, stiffness, range of motion, strength, endurance, and functional mobility. The aspects of the disease process most problematic to Nina were inflammation, pain, and fatigue from a flare of her rheumatoid arthritis. Her ability to engage in her employment was affected by her motor and process performance skills; roles and routines performance patterns; physical, social, personal, temporal, and virtual contexts; object, space, body functions, and body structures activity demands; and sleep, energy, attention, joints, and muscle function client factors.

Nina benefited from splinting, exercise, heat, and occupational performance training with activity modification, assistive devices, and client education in symptom management, joint protection, fatigue management, and available resources. A collaborative approach throughout the therapy process was essential in promoting lasting benefits and engagement in meaningful occupations.

Review Questions

1. What are the major differences between osteoarthritis and rheumatoid arthritis?
2. What are three systemic signs of rheumatoid arthritis?
3. What are the clinical signs of joint inflammation?
4. When is resistive exercise appropriate for persons with rheumatoid arthritis?
5. What are the typical indications for splinting in arthritis?
6. What are the purposes and major principles of joint protection and fatigue management?
7. What assistive devices are commonly helpful for clients with arthritis?
8. What are the general treatment precautions related to arthritis?

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Resources

American College of Rheumatology and Association of Rheumatology Health Professionals: <www.rheumatology.org>.

Arthritis Foundation: <www.arthritis.org>.

National Institute of Arthritis and Musculoskeletal and Skin Diseases: <www.niams.nih.gov>.

39

Hand and Upper Extremity Injuries*

J. Martin Walsh, Nancy Chee

CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Discuss the incidence of upper extremity (UE) injuries and their effects on occupational performance.
2. Identify three upper quarter screening tests and explain their significance in developing an intervention plan.
3. Discuss the importance of joint mobility in regaining the motor performance skill of hand

function.
4. Describe the four categories of tests used to evaluate peripheral nerve function and explain how the results would be used in developing an intervention plan.
5. Compare the standardized tests used to assess the motor performance skill of hand function.
6. Describe the sensory and motor innervation patterns of the three major nerves; differentiate between the effects of proximal and distal lesions in each of the nerves; and explain how they might affect occupational performance.
7. Discuss complex regional pain syndrome and the intervention approaches that should be included in the occupational therapy (OT) intervention plan for that disorder.
8. Compare techniques used in the rehabilitation of tendon injuries.
9. Describe the significance of edema with regard to wound healing and joint mobility.
10. Discuss the role of the occupational therapist in the evaluation and rehabilitation of injured workers.

KEY TERMS

Complex regional pain syndrome

Cumulative trauma disorders

Edema

Ergonomic

Functional capacity evaluation

Orthotics

Peripheral nerve injuries

Provocative tests

Tendon injuries

Upper quadrant

Threaded Case Study

Gerry, Part 1

Gerry is a 32-year-old man who is self-employed as a cabinetmaker. He sustained a table saw injury to his nondominant left hand while working. The thumb, index, and middle fingers of Gerry's left hand were amputated at the level of the proximal phalanges as a result of the saw injury and were subsequently replanted by a hand surgeon using microsurgical techniques. Gerry is single, lives with a roommate, and is in business with his father in a small but busy cabinet shop. Gerry is extremely active at work and during his free time. He is very social and has an extensive network of supportive friends and family.

Gerry was referred to hand therapy as an inpatient 5 days after the replantation surgeries, as soon as he was discontinued from the anticoagulation medications. The initial interview between Gerry and his occupational therapist/CHT (Certified Hand Therapist) took place at bedside. He was to be discharged from the hospital the next day with instructions to return for outpatient hand therapy. A protective orthosis was fabricated at the first therapy session, and Gerry was taught about postsurgical precautions, wound care, and dressing changes. During the initial evaluation Gerry said that he was very distressed about the potential loss of function of his left hand and that he wanted to accomplish three of his most valued occupations in the months to come. The first occupation was to return to work with his father, making cabinets in the family business; the second was to resume playing softball with his team; and the third was to play golf again. The first occupation was one he valued not only as a source of livelihood, but also as a profession in which he demonstrated great skill and from which he derived joy. The second two occupations were important to him not only as a source of relaxation but, more important, as a primary venue for social interaction with friends and family.

Gerry initiated hand therapy in the hospital during the acute phase of his recovery. He was followed in hand therapy for 15 months from the date of his injury, and through several additional surgeries and all phases of his rehabilitative process: the acute or immobilization phase, the intermediate (mobilization) phase, and the late or strengthening phase.[17] During the initial evaluation, Gerry clearly expressed a desire to return to three specific occupations of value to him: working as a cabinetmaker, playing golf, and playing softball.

Critical Thinking Questions

1. How will the intervention plan change over the course of Gerry's recovery? What specific intervention approaches will be used during the three phases of his recovery?

2. What specific tools or instruments will be used to assess Gerry's performance skills during the different phases of his recovery?

3. What are some of the specific preparatory methods and purposeful activities that may be used in preparation for Gerry's occupation-based performance activity of golf?

Treatment of the upper extremity (UE) is important to all occupational therapists who work with people with physical disabilities. The incidence of UE injuries is significant; they account for about one third of acute injuries overall[64] and 26% of work-related injuries.[101] In addition, disease and congenital anomalies contribute to UE dysfunction, and it is estimated that only about 15% of those who experience a severe cerebrovascular accident recover hand function.[64]

The hand is vital to human function and appearance. It flexes, extends, opposes, and grasps thousands of times daily, allowing the performance of necessary daily activities. The hand's sensibility allows feeling without looking and provides protection from injury. The hand touches, gives comfort, and expresses emotions. Loss of hand function through injury or disease thus affects much more than the mechanical tasks that the hand performs. Hand injury may jeopardize a family's livelihood and, at the least, affects every daily activity. The occupational therapist with training in physical and psychological assessment, prosthetic evaluation, fabrication of orthoses, assessment and training in the activities of daily living (ADLs), and functional restoration is uniquely qualified to treat UE disorders.

Hand rehabilitation, or hand therapy, has grown as a specialty area of occupational therapy (OT) and physical therapy (PT). Many of the intervention techniques used for clients with a hand injury have evolved from the application of therapy and a knowledge of both specialties, as used by the hand therapist. It is not the purpose of this chapter to instruct the OT student in physical agent modalities; rather, intervention techniques that have been found to be beneficial to clients with hand injuries are presented. It is assumed that the therapists best trained to provide them will provide these techniques.

As used in this chapter *hand therapy* is a term that includes interventions for the entire **upper quadrant**, which includes the scapula, shoulder, and arm. Upper quadrant and UE are used interchangeably. UE rehabilitation requires advanced and specialized training for both occupational and physical therapists. A practice analysis study of the theory and knowledge that serve as the underpinning for hand therapy has been reported.[40] Intervention techniques, whether thermal modalities or specifically designed exercises, are used as a bridge to reach a further goal of restoring functional performance. Thus, some modalities may be used as adjunctive or enabling modalities in preparation for functional use. It is within this context that intervention techniques are presented in this chapter.

Intervention for a UE injury is a matter of timing and judgment. After trauma or surgery a healing phase must occur in which the body performs its physiologic function of wound healing. After the initial healing phase, when cellular restoration has been accomplished, the wound enters its restorative phase. It is in this phase that hand therapy is most beneficial. Early intervention in this restorative phase is ideal and in some cases essential for optimal results.

Although sample timetables may be presented, the therapist should always coordinate the application of any intervention with the referring physician. Surgical techniques may vary, and inappropriate treatment of the client with a hand injury can result in failure of a surgical procedure.

Communication among the surgeon, therapist, and client is especially vital in this setting. A comfortable environment that allows group interaction may increase the client's motivation and cooperation. The presence of the therapist as an instructor and evaluator is essential, but without the client's cooperation, limited gains will be achieved. Treating the psychological loss suffered by the client with a hand injury is also an integral part of the rehabilitative therapy.

OT Practice Notes

Hand therapy is provided in a number of intervention settings, ranging from private therapy offices to outpatient rehabilitation clinics and hospitals or even in the workplace. Reimbursement for services may come directly from the client or through private medical insurance, workers' compensation insurance, or a variety of managed care programs. Changes in reimbursement have driven changes in the marketplace and employment patterns. In the future, OT will be provided in a variety of new settings, and OT intervention will continue to evolve.

In UE rehabilitation, changes have been manifested as changes in the delivery of services. In some cases therapists are not members of the approved provider panel and are no longer able to treat clients who are members of a health maintenance organization. Reimbursement patterns have altered the provision of services by limiting the number of visits authorized. Therapists are being asked to provide functional outcome data that support the need for services. They also need high-quality information on which to base clinical decisions, which points to the need for evidence-based practice.[67]

Evidence-based practice uses the best evidence, in conjunction with clinical expertise and the client's values, to make clinical decisions.[17] It is likely that outcome-based or evidence-based intervention plans with functional goals and analysis of goal achievement will become the standard for reimbursement of OT services. In addition the client's satisfaction and perception of his or her health status have become crucial to the delivery of medical care in a consumer-based economy. Continuous, quality improvement documentation often is required for participation in managed care programs. With fewer authorized visits, the therapist must be more adept in instructing the client in self-management of the condition being treated. Hand therapists and rehabilitation providers are also subject to intense scrutiny and review by multiple regulatory agencies. In addition insurance companies and government agencies review clients' records and billing documentation. Reimbursement for therapy services relies on detailed documentation of services provided and reassessments of the need for ongoing services. The best way to assure compliance with all these agencies is to perform frequent reviews of clients' medical records in the form of chart reviews.[50a]

Presently and continuing into the future, occupational therapists should anticipate a greater need to justify intervention as part of the national challenge to control medical costs. Aides, certified assistants, and other support personnel are being used increasingly, but the quality of services provided must continue to meet all professional and ethical standards. This climate of change also presents unique opportunities for the occupational therapist. Clinical specialists are finding new roles as consultants and trainers. Just as OT teaches the client to adapt to changes in health status, the OT profession will need to continue to adapt to social and economic changes to remain a leader in health management.

Examination and Evaluation

Using a client-centered approach, the occupational therapist must gather information about the client's occupational history, including a detailed description from the client's perspective of how the hand injury may interfere with the resumption of daily life activities that are most important to him or her. Developing this occupational profile includes consideration of a client's performance of daily tasks, interests, values, and needs.[2,3] Armed with this occupational profile the therapist and client continue the evaluation process. The therapist must be able to evaluate the nature of the injury and the limitations it has caused. First, the injured structures must be identified by consulting with the hand surgeon, reviewing operative reports and x-ray films, and discussing the injury with the client. Assessment of the wound, bone, tendon, and nerve function must be performed, using standardized assessment techniques whenever possible.

The client's age, occupation, and hand dominance should be taken into account in the initial evaluation. The type and extent of medical and surgical treatment that has been received and the length of time since such intervention are important in determining an intervention plan. Any further surgery or conservative intervention that is planned should also be noted. A written intervention plan should have the approval of the referring physician. Most physicians welcome observations and evaluation-based recommendations from the therapist regarding the client's care.

The purposes of hand evaluation are to identify physical limitations, such as loss of range of motion (ROM); functional limitations, such as an inability to perform daily tasks; substitution patterns to compensate for loss of sensibility or motor function; and abnormalities, such as joint contracture.

The movement of the arm and hand must be coordinated for maximal function. Shoulder motion is essential for positioning the hand and elbow for daily activities.[22] The wrist is the key joint in the position of function.[11a] Skilled hand performance depends on wrist stability. Although a mobile wrist is preferable, function is possible as long as the wrist is positioned to maximize movement of the fingers. Function also depends on arm and shoulder stability and mobility for fixing or positioning the hand for activity. The thumb is of greater importance than any other digit. Effective pinch is almost impossible without a thumb, and attempts are made to salvage or reconstruct an injured thumb whenever possible. In the hand the proximal interphalangeal (PIP) joint is critical for grasp and is considered the most important small joint. Limitations in flexion or extension result in significant functional impairment.

The hand therapy evaluation should consist of two concurrent stages. One stage consists of assessing the client's occupational profile to help the therapist select an effective intervention that addresses the client's occupational priorities. The other stage consists of assessing specific performance skills, such as coordination and strength, and client factors, such as sensory functions, neuromusculoskeletal and movement-related functions, and the functions of the hand and related structures. Evaluating both the client's occupational profile and the individual's performance skills ensures that the client's priorities are addressed and makes the intervention more meaningful.

Observation and Topographic Assessment

The occupational therapist should observe the appearance of the entire UE. The position of the hand and arm at rest and the carrying posture can yield valuable information about the dysfunction. The therapist should observe the way the client treats the disease or injury. The occupational therapist should note whether the hand and arm are overprotected, carefully guarded, or ignored, and whether the client carries the arm close to the body, in an awkward posture, or even covered.

The cervical and shoulder area posture should be observed for evidence of abnormalities in cervical and thoracic curvature that may reduce the potential for shoulder movement. Muscle atrophy may be evident in the scapular area if the client has had significant long-term weakness or if the rotator cuff is torn. The scapula may appear asymmetric or altered if muscle imbalances of length or strength are present.

The skin condition of the hand and arm also should be noted. In particular the therapist should note any lacerations, sutures, or evidence of recent surgery; whether the skin is dry or moist; whether scales or crusts are present; and whether the hand appears swollen or has an odor. Normally palmar skin is less mobile than dorsal skin. The therapist should determine the degree of mobility and elasticity and the adherence of scars. The therapist also should observe trophic changes in the skin. To assess the vascular system, the therapist should observe the skin color and temperature of the hand and evaluate for the presence of **edema** (swelling). Any contractures of the web spaces should be noted. The therapist should observe the relationship between hand and arm function as the client moves about and performs test items or tasks.

The therapist should ask the client to perform some simple, bilateral ADLs, such as buttoning a button, putting on a shirt, opening a jar, and threading a needle; the occupational therapist observes the amount of spontaneous movement and use of the affected hand and arm. Similar screening tests can be used to determine shoulder mobility, such as reaching overhead or placing the hand behind the back and behind the head, simulating self-care and hygiene activities.

Assessment of Performance Skills and Client Factors

A number of standardized tests can be used to determine physical limitations in the UE. Joint measurement and manual muscle testing are crucial and are described in other chapters (see Chapters 21 and 22). Special tests used by the hand therapist are described here in a general sense, but the student should consult other textbooks for detailed instructions in such areas as assessment of adverse neural tension.[15]

Screening the Cervical Neck and Shoulder

A screening examination of the cervical neck and shoulder regions should be included in evaluation of hand conditions to determine whether these areas are contributing to the client's symptoms or limitations in function.

Active movements of the neck should be conducted, with attention paid to complaints of UE symptoms during cervical extension or lateral flexion to the same side. Complaints during these movements may suggest nerve root irritation. Hand symptoms with opposite side bending may be a sign of adverse neural tension. Few occupational therapists are knowledgeable in the intervention of cervical conditions, and care must be taken not to aggravate an existing condition. The therapist should return the client to the referring physician with recommendations for referral to an appropriate practitioner if the results of this testing are positive.

Assessment of Movement

The effect of trauma or dysfunction on anatomic structures is the first consideration when evaluating hand function. The joints must be assessed for active and passive mobility, fixed deformities, and any tendency to assume a position of deformity. The ligaments must be assessed for laxity or contracture and their ability to maintain joint stability. Tendons must be examined for integrity, contracture, or overstretching; muscles are tested for strength and function.[46]

Limited movement in the shoulder.

Examples of conditions in the shoulder region that lead to reduced strength, reduced ROM, or pain in the shoulder are presented in Table 39.1. Comparing the initial responses with the results of follow-up evaluations helps document a positive response to intervention. Patterns of impairments in UE range of motion and strength, in addition to a positive response to provocative testing, should be reported to the referring physician if these would affect the client's planned intervention or outcome. Therapists must not attempt to treat conditions that are beyond their scope of knowledge. Referral to an appropriate practitioner should be discussed with the physician if indicated.

TABLE 39.1

Clinical Tests for Specific Dysfunction in the Shoulder

Condition	Pattern of Impairment	Characteristic Findings/Special Tests
Adhesive capsulitis	Loss of active and passive shoulder motion with the most pronounced loss in external rotation and, to a lesser degree, abduction and internal rotation	• Capsular end feel to passive motions in restricted planes of movement
Subacromial impingement	Painful arc of motion between approximately 80 and 100 degrees of elevation or at end range of active elevation	• In early stages, muscle tests may be strong and painless despite positive impingement test
Rotator cuff tendinitis	Painful active or resistive use of rotator cuff muscle	• Painful manual muscle test of scapular plane abduction or external rotation • Pain-free passive motion end ranges • Tenderness at tendons of supraspinatus or infraspinatus.
Rotator cuff tear	Significant substitution of scapula with attempted arm elevation	• Positive drop arm test

		• Very weak, less than three-fifths abduction or external rotation

Impingement tests.

The examiner passively overpressures the client's arm into end range elevation; this movement causes jamming of the greater tuberosity against the anterior inferior acromial surface.[26] The test result is positive if the client's facial expression shows pain. An alternative test is described by Hawkins and Kennedy.[56] The examiner forward-flexes the arm to 90 degrees and then forcibly internally rotates the arm. Pain indicates a positive test result.

Drop arm test.

To assess a suspected rotator cuff injury, the client's arm is passively abducted by the examiner to 90 degrees with the client's palm down. The client then is asked to lower the arm actively. Pain or inability to lower the arm smoothly with good motor control is considered a positive test result.[47,73]

Soft tissue tightness.

Joints may develop dysfunction after trauma, immobilization, or disuse. Joint play or accessory motions are described as movements that are abnormal, physiologic, and can be performed only with assistance from someone else. Examples of accessory motions are joint rotation and joint distraction. If accessory motions are limited and painful, the active motions of that joint cannot be normal. Therefore, it is necessary to restore joint play through the use of joint mobilization techniques before attempting passive or active ROM.

Joint mobilization may date back to the fourth century BC, when Hippocrates first described the use of spinal traction.[45] In the 1930 an English physician, James Mennell, encouraged physicians to perform manipulation without anesthesia, a practice that is advocated today by James Cyriax,[33] who explored the use of manipulation of the intervertebral disks. Current theorists include Cyriax, Robert Maigne, F.M. Kaltenborn, G.D. Maitland, Stanley Paris, and John Mennell, son of James Mennell. Although physicians originally practiced manipulation, therapists have adapted the techniques, which are now called joint mobilization.

The techniques used to assess joint play are also used in the treatment of joint dysfunction. During the assessment the evaluator determines the range of accessory motion and whether pain is present by taking up the slack only in the joint. Some practitioners advocate use of a high-velocity, low-amplitude thrust or graded oscillation to regain motion and relieve pain.[57]

Guidelines must be followed in applying joint mobilization techniques, and the untrained or inexperienced practitioner should not attempt to use the techniques. Postgraduate courses are offered in joint mobilization of the extremities, and the therapist must be familiar with the orthokinematics of each joint, in addition to the techniques used.

Joint mobilization is generally indicated with restriction of accessory motions or when pain is present because of tightness of the joint capsule, meniscus displacement, muscle guarding, ligamentous tightness, or adherence. Contraindications to mobilization include infection, recent fracture, neoplasm, joint inflammation, rheumatoid arthritis, osteoporosis, degenerative joint disease, and many chronic diseases.

Limitations in joint motion may also be caused by tightness of the extrinsic or intrinsic muscles and tendons. If the joint capsule is not tight and accessory motions are normal, the therapist should test for extrinsic and intrinsic tightness.

To test for extrinsic extensor tightness, the metacarpophalangeal (MP) joint is passively held in extension and the PIP joint is moved passively into flexion. Then the MP joint is flexed, and the PIP joint is again passively flexed. If the PIP joint can be flexed easily when the MP joint is extended but not when the MP joint is flexed, the extrinsic extensors are adherent.[4]

With extrinsic flexor tightness the PIP and distal interphalangeal (DIP) joints will be positioned in flexion, with the MP joints held in extension. The fingers cannot be pulled into complete extension. If the wrist is then held in flexion, the IP joints will extend more easily because slack is placed on the flexor tendons.

Tightness of the intrinsic musculature is tested by passively holding the MP joint in extension and applying pressure just distal to the PIP joint. This action is repeated with the MP joint in flexion. If more resistance is felt when the MP joint is extended, intrinsic tightness is indicated.[4]

If passive motion of the PIP joint remains the same whether the MP joint is held in extension or flexion and PIP joint flexion is limited in any position, tightness of the joint capsule is indicated. The therapist should assess the joint for capsular tightness if this has not already been done.

Provocative tests used to assess ligament, capsule, and joint instability are summarized in Table 39.2. For more detailed and comprehensive information regarding administration of these tests, the reader is referred to textbooks dedicated solely to hand therapy or to the specific topic.[47,73]

TABLE 39.2

Clinical Tests for Specific Dysfunction in the Wrist

Condition	Pattern of Impairment	Special Tests
Thumb ulnar collateral ligament (gamekeeper's or skier's thumb)	Pain and instability of the thumb metaphalangeal (MP) joint	• Movement greater than 35 degrees when valgus instability stress is applied to the thumb MP joint
Instability of the scaphoid	Pain in the area of the scaphoid bone (anatomic snuffbox) or "clunking" with movement of the wrist	• Watson's test • Pain or sound associated with subluxation of the dorsal pole of the scaphoid while performing test
Instability of the distal radioulnar joint	Pain and tenderness in the wrist	• "Piano keys" test • Hypermobility and pain associated with pressure on the distal ulna
Lunate dislocation	Pain or instability in the central wrist	• Murphy's sign • Head of the third metacarpal level with the second and fourth metacarpals while making a fist
Lunotriquetral instability	Pain or instability in the central or ulnar wrist	• Lunotriquetral ballottement test • Crepitus; laxity or pain with isolated movement of the lunate
Triangular fibrocartilage complex (TFCC) tear	Pain and instability in the ulnar wrist	• Wrist arthrogram or MRI • Piano keys test • Press test • Ulna fovea test

Assessment of Peripheral Nerve Status

Nerve dysfunction can occur at any point from the nerve roots through the digital nerves in the fingers. A good understanding of the peripheral nervous system is essential for appropriate treatment of the UE. Determining the approximate location of nerve dysfunction can assist intervention planning.

Categories of tests.

A variety of tests may be required to assess nerve function adequately. These tests can be divided into four categories: (1) modality tests for pain, heat, cold, and touch pressure; (2) functional tests to assess the quality of sensibility, or what Moberg[79] described as tactile gnosis; (3) objective tests that do not require the client's active participation; and (4) provocative tests that reproduce symptoms.

Examples of functional tests are stationary and moving two-point discrimination and the Moberg Pick-Up Test; objective tests include the wrinkle test, the Ninhydrin sweat test, and nerve conduction studies.[17] Electrodiagnostic testing is the most conclusive and widely accepted method of determining nerve dysfunction.

Provocative tests are highly suggestive of a nerve lesion if the results are positive, but they do not rule out a problem if the results are negative. Tests of nerve dysfunction are summarized in Table 39.3. Instructions for administration of the most common tests are presented in the following sections.

TABLE 39.3

Clinical Tests for Specific Nerve Dysfunction in the Upper Extremity

Condition	Pattern of Impairment	Characteristic Findings/Special Tests
Thoracic outlet syndrome	Nonspecific paresthesias or heaviness with sustained positioning or activity above shoulder level or behind the plane of the body	• Adson's test • Roos test
Adverse neural tension	Nonspecific pain or paresthesias with reaching in positions that place tension on brachial plexus nerves	• Positive upper limb screening test
Carpal tunnel syndrome	Pain and numbness, primarily in the thumb, index, and middle fingers	• Tinel's sign at the wrist • Phalen's test
	Usually worse at night and may be associated with activity	• Reverse Phalen's test • Carpal compression test
Cubital tunnel syndrome	Compression of ulnar nerve at elbow	• Elbow flexion test
Ulnar nerve paralysis	Paralysis of the adductor pollicis muscle	• Froment's sign • Jeanne's sign • Wartenberg's sign

Adson maneuver.

The examiner palpates the radial pulse on the test arm. The client then rotates the head toward the arm being tested. The client extends the head and holds a deep breath as the arm is laterally rotated and extended. Disappearance or slowing of the pulse rate is considered a positive test result, suggesting presence of thoracic outlet syndrome.[1,73]

Roos test.

The client maintains a position of bilateral arm abduction to 90 degrees, shoulder external rotation, and elbow flexion to 90 degrees for 3 minutes while slowly alternating between an open hand and a clenched fist. Inability to maintain this position for the full 3 minutes or the onset of symptoms is considered a positive test result for thoracic outlet syndrome.[73,89]

Upper limb tension test (brachial plexus tension test).

This test is designed to screen for symptoms produced when tension stress is placed on the brachial plexus. The maneuver described primarily stresses the median nerve and C5–C7 nerve roots. Adverse neural tension in the ulnar or radial nerves may also be tested. However, we have found that using the median nerve test as a screening device establishes a marker against which to gauge the success of intervention. Although some authors recommend using the neural tension tests both for intervention and for assessment, this has not been our practice. The occupational therapist should use this screening process to rule out or confirm the involvement of more proximal structures.

The client is positioned supine, and the examiner takes the client's arm into abduction and external rotation behind the coronal plane at the shoulder. The shoulder girdle is fixed in depression. The elbow is then passively extended with the wrist in extension and the forearm in supination. Symptoms of stretch or ache in the cubital fossa or tingling in the thumb and first three fingers indicates tension on the median nerve. Lateral flexion of the neck to the opposite side will amplify symptoms by increasing tension on the dura mater. Elbow extension ROM should be compared with the uninvolved side to indicate the degree of restriction.[15,73]

Tinel's sign.

The examiner taps gently along the course of a peripheral nerve, starting distally and moving proximally, to elicit a tingling sensation in the fingertip. The point where tapping begins to elicit a tingling sensation is noted and indicates the approximate location of nerve compression. This test is also used after nerve repair to determine the extent of sensory axon growth.[73]

Phalen's test and reverse Phalen's test.

Phalen's test is performed by fully flexing the wrists with the dorsum of the hands pressing against each other. Reverse Phalen's test is performed by holding the hands in the "prayer" position for 1 minute. The test results are positive if the client reports tingling in the median nerve distribution (thumb, index, middle and radial aspect of the ring finger) within 1 minute.[73]

Carpal compression test.

The examiner places pressure over the median nerve in the carpal tunnel for up to 30 seconds. The test result is positive if tingling occurs in the median nerve distribution. The combination of wrist flexion and compression of the median nerve for 20 seconds has been found to be more sensitive than other provocative tests used alone.[98]

Elbow flexion test.

The elbow flexion test is used to screen for cubital tunnel syndrome (compression of the ulnar nerve in the cubital tunnel). The client is asked to fully flex the elbows with the wrists fully extended for 3 to 5 minutes. The test result is positive if tingling is reported in the ulnar nerve distribution of the forearm and hand (ulnar ring finger and small finger).[73]

Quick tests for motor function in the peripheral nerves.

The ulnar nerve may be tested by asking the client to pinch with the thumb and index finger and then palpating the first dorsal interosseous muscle. Another test for ulnar nerve paralysis involves asking a client to grasp a piece of paper between the thumb and index finger. When the examiner pulls away the paper, the tip of the thumb flexes because of the absence of the adductor pollicis muscle (Froment's sign). If the MP joint of the thumb extends at the same time, this is known as Jeanne's sign. Wartenberg's sign for ulnar nerve compression is positive if the client is unable to adduct the small finger when the hand is placed palm down on the table with the fingers passively abducted.

The radial nerve may be tested by asking the client to extend the wrist and fingers. Median nerve function is tested by asking the client to oppose the thumb to the fingers and flex the fingers.[73]

Sensory mapping.

Detailed sensibility testing can begin with sensory mapping of the entire volar surface of the hand.[16] The hand must be supported by the examiner's hand, or it may be resting in a medium (e.g., therapy putty) to stabilize it during testing. The examiner draws a probe (usually the eraser end of a pencil) lightly over the skin from the area of normal sensibility to the area of abnormal sensibility. The client must immediately report the exact location where the sensation changes. Directionally this is done from proximal to distal and from radial and ulnar to medial. The areas are carefully marked and transferred to a permanent record. Mapping should be repeated at monthly intervals during nerve regeneration.[7a]

Sympathetic function.

Recovery of sympathetic response, such as sudomotor (sweating), vasomotor (temperature discrimination), pilomotor (gooseflesh), and trophic (skin texture, nail, and hair growth) responses, may occur early but does not correlate with functional recovery.[36] O'Riain observed that denervated skin does not wrinkle.[82] Therefore, nerve function may be tested by immersing the hand in water for 5 minutes and noting the presence or absence of skin wrinkling. This test may be especially helpful in diagnosing a nerve lesion in young children. The ability to sweat is also lost with a nerve lesion. A Ninhydrin test evaluates sweating of the finger.[79]

The wrinkle test and the Ninhydrin test are objective tests of sympathetic function. Recovery of sweating has not been shown to correlate with the recovery of sensation, but the absence of sweating correlates with the lack of discriminatory sensation. Other signs of sympathetic dysfunction are smooth, shiny skin; nail changes; and "pencil pointing," or tapering of the fingers.[43]

Nerve compression and nerve regeneration.

Sensibility testing is performed to assess the recovery of a nerve after laceration and repair; to detect a nerve compression syndrome and the return of nerve function after surgical decompression; and to determine the efficacy of a conservative intervention in reducing compression. Therefore, tests such as vibratory tests may be interpreted differently, depending on the mechanism of nerve dysfunction. In the next section, tests are described and differences drawn as appropriate to assist the therapist in selecting the correct assessment technique and in planning treatment based on the evaluative measures.

During the first 2 to 4 months after nerve suture, axons regenerate and travel through the hand at a rate of about 1 mm per day, or 1 inch (2.54 cm) per month. Tinel's sign may be used to follow this regeneration. As regeneration occurs, hypoesthesias develop. Although this hypersensitivity may be uncomfortable for the client, it is a positive sign of nerve growth. An intervention program for desensitization of hypersensitive areas can be initiated as soon as the skin has healed and can tolerate gentle rubbing and immersion in textures. (Desensitization is discussed further in the Intervention section.)

Vibration.

Dellon was an early advocate of the use of tuning forks with frequencies of 30 cycles per second (cps) and 256 cps to assess the return of vibratory sensation after nerve repair, as regeneration occurs, and as a guideline for initiating a sensory reeducation program.[35-37] However, many clinicians found that use of a tuning fork was not discrete enough to detect sensory abnormalities.

Lundborg et al. described the use of commercial vibrometers to detect abnormal sensation.[71] This method was less subjective and thought to be more reliable. In a study of induced median nerve compression, Gelberman et al. found that vibration and touch perception, as measured by Semmes-Weinstein monofilaments, are altered before two-point discrimination because they measure a single nerve fiber innervating a group of receptor cells.[51,52] Two-point discrimination is a test of innervation density that requires overlapping sensory units and cortical integration. Thus, two-point discrimination is altered after nerve laceration and repair but remains normal if the nerve is compressed, as long as links to the cortex exist. Bell-Krotoski has also found normal two-point values with decreased sensory function.[7]

Vibration and the Semmes-Weinstein test are more sensitive in picking up a gradual decrease in nerve function in the presence of nerve compression where the nerve circuitry is intact. They also correlate with decreases in the potential amplitude of sensory nerve action as measured by nerve conduction studies.[97] Therefore, Semmes-Weinstein and electrical testing are reliable and sensitive tests for early detection of carpal tunnel syndrome and other nerve compression syndromes. The Semmes-Weinstein test can be performed in the clinic; it causes no discomfort for the client, and it is an excellent screening tool when nerve compression is suspected.

Touch pressure.

Moving touch is tested using the eraser end of a pencil. The eraser is placed in an area of normal sensibility and, with application of light pressure, is moved to the distal fingertip. The client notes when the perception of the stimulus changes. Light and heavy stimuli may be applied and noted.[34] Constant touch is tested by pressing with the eraser, first in an area with normal sensibility and then placing the eraser distally by lifting up the pencil before placement. The client responds when the stimulus is altered; again, light and heavy stimuli may be applied.[34]

The Semmes-Weinstein monofilaments are the most accurate instruments for assessing cutaneous pressure thresholds.[7a] The original testing equipment consisted of 20 nylon monofilaments housed in plastic, handheld rods. Many therapists today use the smaller five-pack filaments. These five monofilaments correspond to the categories of light touch sensation (described later). The monofilaments increase in diameter, and when applied correctly, they exert a force ranging from 4.5 mg to 447 g. Markings on the probes range from 1.65 to 6.65 but do not correspond to the grams of force of each rod. Normal fingertip sensibility has been found to correspond to the 2.44 and 2.83 probes.

The monofilaments must be applied perpendicular to the skin and just until the monofilament bends. The skin should not blanch when the monofilament is applied. Probes 1.65 through 2.83 are bounced three times; probes 3.22 to 4.08 are applied three times with a bend in the filament; and probes 4.17 to 6.65 are applied once. The larger monofilaments do not bend; therefore, skin color must be observed to determine how firmly to apply the probe.

The examiner should begin with a probe in the normal range and progress through the rods in increasing diameters to find the client's threshold for touch throughout the volar surface.[7] A grid should be used to record the responses so that varying areas of touch perception can be demonstrated. Two correct responses from three applications are necessary to consider an area as having intact sensibility. Placing the monofilaments randomly, rather than concentrating on an area, is preferable because this allows the nerves a recovery time. When a filament is placed three times, it should be held for a second, rested for a second, and reapplied. Results can be graded from normal light touch (probes 2.83 and above) to loss of protective sensation (probes 4.56 and below). Diminished light touch and diminished protective sensation are in the range reflected by the central probes (probes 3.22 to 4.31).[7]

Two-point and moving two-point discrimination.

Discrimination, the second level of sensibility assessment, requires the client to distinguish between two direct stimuli. Static (or stationary) two-point discrimination measures the slowly adapting fibers. The two-point discrimination test, first described by Weber in 1853, was modified and popularized by Moberg,[79] who was interested in a tool that would assess the functional level of sensation. A variety of devices have been proposed for measuring two-point discrimination. A bent paper clip is inexpensive but often has burrs on the metal tip. Other devices include industrial calipers (Central Tool Company of Germany*; available from Anthony Products) and the Disk-Criminator (available from Smith & Nephew).[72]

A device with parallel prongs of variable distance and blunted ends should produce replicable results. Testing with such a device is performed as follows[70]:

1. The client's vision is occluded.

2. An area of normal sensation is tested as a reference, using blunt calipers or a bent paper clip.

3. The calipers are set 10 mm apart and are randomly applied, starting at the fingertip and moving proximally and longitudinally in line with the digital nerves, with one or two points touching. The caliper should not blanch the skin.

4. The distance is decreased until the client no longer feels two distinct points, and that distance is

measured.

Three to 4 seconds should be allowed between applications, and 4 correct responses out of 5 administrations are required. Because this test indicates sensory function, it is usually administered at the tips of the fingers. It may be used proximally to test nerve regeneration. Normal two-point discrimination at the fingertip is 6 mm or less.

Moving two-point discrimination measures the innervation density of the quickly adapting nerve fibers for touch. It is slightly more sensitive than stationary two-point discrimination. The test is performed as follows[36]:

1. The client's vision is occluded.

2. An area of normal sensation is tested as a reference, using blunt calipers or a bent paper clip.

3. The fingertip is supported by the examining table or the examiner's hand.

4. The caliper, separated 5 to 8 mm, is moved longitudinally from proximal to distal in a linear fashion along the surface of the fingertip. One and two points are randomly alternated. The client must correctly identify the stimulus in 7 of 8 responses before the examiner can proceed to a smaller value. The test is repeated down to a separation of 2 mm.

Two-point values increase with age in both genders; the smallest values occur between the ages of 10 and 30 years. Women tend to have smaller values than men, and no significant difference has been noted between dominant and nondominant hands.[70] (See Chapter 23 for further information on the evaluation of sensation.)

Modified Moberg pick-up test.

Recognition of common objects is the final level of sensory function. Moberg used the term tactile gnosis to describe the ability of the hand to perform complex functions by feel. Moberg described the pickup test in 1958,[79] and it was later modified by Dellon.[36] This test is used either for a median nerve injury or for an injury to a combination of median and ulnar nerves. The tests take twice as long to perform with the vision occluded as with the vision unimpaired. The procedure is as follows:

1. Nine or 10 small objects (e.g., coins or paper clips) are placed on a table, and the client is asked to place them, one at a time, in a small container as quickly as possible while looking at them. The client is timed.

2. The test is repeated for the opposite hand with vision.

3. The test is repeated for each hand with the vision occluded.

4. The client is asked to identify each object one at a time, with and then without vision.

It is important to observe any substitution patterns that may be used when the client cannot see the objects.

Edema assessment.

Hand volume is measured to assess for extracellular or intracellular edema. The volume measurement generally is used to determine the effect of intervention and activities. By measuring the volume at different times of the day, the therapist can measure the effects of rest versus activity, in addition to the effects of orthotics or intervention designed to reduce edema.

A commercial volumeter[31] may be used to assess hand edema. The volumeter has been shown to be accurate to 10 mL[102] when used in the prescribed manner. Variables that have been shown to reduce the accuracy of the volumeter include use of a faucet or hose that introduces air into the tank during filling; movement of the arm within the tank; inconsistent pressure on the stop rod; and use of a volumeter in a variety of places. The same level surface should always be used.[102] The evaluation is performed as follows (Fig. 39.1):

1. A plastic volumeter is filled and allowed to empty into a large beaker until the water reaches spout level. The beaker then is emptied and dried thoroughly.

2. The client is instructed to immerse the hand in the plastic volumeter, being careful to keep the hand in the midposition.

3. The hand is lowered until it rests gently on the dowel rod between the middle and ring fingers. It is important that the hand not press onto the rod.

4. The hand remains still until no more water drips into the beaker.

5. The water is poured into a graduated cylinder. The cylinder is placed on a level surface, and a reading is made.

FIG 39.1 A volumeter is used to measure the volume of both hands for comparison. Increased volume indicates the presence of edema.

A method of assessing edema of an individual finger or joint is circumferential measurement using either a circumference tape (DeRoyal LMB; DeRoyal Industries) or a jeweler's ring-size standards. For combined wrist and hand edema, a tape measure may be wrapped in a figure-eight pattern to measure hand size.[84] Measurements should be made before and after intervention and especially after the application of thermal modalities or orthoses. Although clients often have subjective complaints about swelling, objective data on circumference or volume will help the therapist assess the response of the tissues to intervention and activity. Edema control techniques are discussed later in this chapter.

Grip and Pinch Strength

UE strength is usually assessed after the healing phase of trauma. Strength testing is not indicated after recent trauma or surgery. Testing should not be performed until the client has been cleared for full resistive activities, usually 8 to 12 weeks after injury.

A standard adjustable-handle dynamometer is recommended for assessing grip strength (Fig. 39.2). The client should be seated with the shoulder adducted and neutrally rotated, the elbow flexed at 90 degrees,[50,92] the forearm in the neutral position, and the wrist between 0 and 30 degrees of extension and 0 and 15 degrees of ulnar deviation. Three trials are performed on each hand, with the dynamometer handle set at the second position.[49,77] The examiner should hold the dynamometer lightly to prevent accidental dropping of the instrument. A mean of the three trials should be reported. The uninjured hand is used for comparison. Normative data may be used to compare strength scores.[9,63,76,77] Variables such as age will affect the strength measurements.

FIG 39.2 The Jamar dynamometer is used to evaluate grip strength in both hands.

Pinch strength should also be tested, using a pinch gauge. The pinch gauge has been found to be the most accurate.[77,92] Two-point pinch (thumb tip to index fingertip), lateral or key pinch (thumb pulp to lateral aspect of the middle phalanx of the index finger), and three-point pinch (thumb tip to tips of index and middle fingers) should be evaluated. As with the grip dynamometer, three successive trials should be performed and the results compared bilaterally (Fig. 39.3).[92]

FIG 39.3 A pinch gauge is used to evaluate pinch strength in a variety of prehension patterns of pinch.

Manual muscle testing also is used to test UE strength. Accurate assessment is especially important when the client is being prepared for tendon transfers or other reconstructive surgery.

The student who wishes to study kinesiology of the UE is referred especially to the work of Brand and Hollister.[12] In addition, muscle testing is addressed in Chapter 22.

Maximal voluntary effort during grip, pinch, or muscle testing will be affected by pain in the hand or extremity, and the therapist should note whether the client's ability to exert full force is limited by subjective complaints. Localization of the pain symptoms and consistency in noting pain will help the therapist evaluate the role that pain is playing in the recovery from injury. Pain problems are discussed in more detail later in this chapter.

Functional Assessment

Assessment of hand function or performance is important because the physical assessment does not measure the client's ingenuity and ability to compensate for loss of strength, ROM, sensation or abnormalities.

The physical assessment should precede the functional assessment because awareness of physical dysfunction can result in a critical analysis of functional impairment and an understanding of the reasons the client functions as he or she does.

The occupational therapist should observe the effect of the hand dysfunction on the use of the hand during ADLs. In addition some type of a standardized performance test (e.g., the Jebsen Hand Function Test[49] or the Quantitative Test of Upper Extremity Function[22]) should be administered. The Jebsen test was developed to provide objective measurements of standardized tasks with norms for client comparison. It is a short test that is assembled by the administrator, and it is easy to administer and inexpensive. The test consists of seven subtests, which test writing a short sentence, turning over 3 × 5-inch cards, picking up small objects and placing them in a container, stacking checkers, simulated eating, moving empty large cans, and moving weighted large cans. Norms are provided for dominant and nondominant hands for each subtest and further categorized by gender and age. Instructions for assembling the test and specific instructions for administering it are provided by the authors. This has been found to be a good test for overall hand function.

The Quantitative Test of Upper Extremity Function, described by Carroll, was designed to measure the ability to perform general arm and hand activities used in daily living.[22] It is based on the assumption that complex UE movements used to perform ordinary ADLs can be reduced to specific patterns of grasp and prehension of the hand, supination and pronation of the forearm, flexion and extension of the elbow, and elevation of the arm.

The test consists of six parts: grasping and lifting four blocks of graduated sizes to assess grasp; grasping and lifting two pipes of graduated sizes to test cylindrical grip; grasping and placing a ball to test spherical grasp; picking up and placing four marbles of graduated sizes to test fingertip prehension or pinch; putting a small washer over a nail and putting an iron on a shelf to test placing; and pouring water from pitcher to glass and glass to glass. In addition, to assess pronation, supination, and elevation of the arm, the therapist instructs the client to place his or her hand on top of the head, behind the head, and to the mouth, and to write his or her name. The test uses simple, inexpensive, and easily acquired materials. Details of the materials and their arrangement, test procedures, and scoring can be found in Carroll's work.[22]

Other tests useful in the assessment of hand dexterity are the Crawford Small Parts Dexterity Test, Bennett Hand Tool Dexterity Test,[8] the Purdue Pegboard Test, and the Minnesota Manual Dexterity Test.[49] A number of standardized tests have been developed (Valpar Assessment Systems; Valpar International) that measure an individual's ability to perform work-related tasks. They provide information about the test taker's results as compared with industry performance standards. All these tests include comparison with normal individuals working in a variety of industrial settings. This information can be used to help predict the likelihood of a successful return to a specific job. The tests are especially useful in a work capacity evaluation. They may be purchased, and they include instructions for administering the test and the standardized norms. Further discussion of vocational evaluation can be found in Chapter 14.

Intervention

Fractures

In treating a hand or wrist fracture, the surgeon attempts to achieve good anatomic position through either a closed (nonoperative) or an open (operative) reduction. Internal fixation with Kirschner wires, metallic plates, or screws may be used to maintain the desired position. External fixation may be used in addition to internal fixation. The hand usually is immobilized in wrist extension and MP joint flexion, with extension of the distal joints whenever the injury allows this position. Trauma to bone may also involve trauma to tendons and nerves in the adjacent area. Intervention must be geared toward the recovery of all injured structures, and this fact may influence treatment of the fracture.

OT may be initiated during the period of immobilization, which usually lasts 3 to 5 weeks. The uninvolved fingers of the hand must be kept mobile through the use of active motion. Edema should be carefully monitored, and elevation is required whenever edema is present.

As soon as sufficient bone stability has been achieved, the surgeon allows mobilization of the injured part. The surgeon should provide guidelines for the amount of resistance or force that may be applied to the fracture site. Activities that correct poor motor patterns and encourage use of the injured hand should be started as soon as the hand is pain free. Early motion will prevent the adherence of tendons and reduce edema through stimulation of the lymphatic and blood vessels.

As soon as the brace or cast has been removed, the client's hand must be evaluated. If edema is still present, edema control techniques (described later in the chapter) can be initiated. A baseline ROM should be established, and the application of an appropriate orthosis may begin. An orthosis may be used to correct abnormal joint changes that have resulted from immobilization, or it may be used to protect a finger from additional trauma to the fracture site (e.g., a Velcro "buddy" orthosis [Fig. 39.4]). A dorsal block orthosis that limits full extension of the finger may be used after a fracture or dislocation of the PIP joint. A dynamic orthosis may be used to achieve full ROM or to prevent the development of further abnormal joint changes at 6 to 8 weeks after fracture.

FIG 39.4 A Velcro "buddy" orthosis may be used to protect the finger after a fracture or to encourage movement of a stiff finger. (Courtesy of North Coast Medical & Rehabilitation Products. http://www.ncmedical.com.)

Intraarticular fractures may result in injury to the cartilage of the joint, causing additional pain and stiffness. An x-ray examination will indicate whether the joint surface has been damaged, which might limit treatment of the joint. Joint pain and stiffness after fracture without joint damage should be alleviated by a combination of thermal modalities, restoration of joint play, or joint mobilization and a corrective and dynamic orthosis, followed by active use. Resistive exercise can be started when bony healing has been achieved.

Wrist fractures are common and may present special problems for the surgeon and therapist. Colles fractures (dorsal displacement and angulation of the distal radius) are the most common injury to the wrist from a fall on an outstretched hand (FOOSH).[11] This may result in limitations in wrist flexion and extension, as well as pronation and supination resulting from the involvement of the distal radioulnar joint.

Conservative management (i.e., closed reduction and cast immobilization) may be used if stability of the fracture can be achieved and maintained. A long arm cast extending past the elbow is applied for 2 to 3 weeks to prevent mobility of forearm rotation and wrist. A change to a shorter cast, with the elbow free, is then made, and the cast is worn for an additional 4 to 6 weeks, depending on fracture healing as shown on x-ray films.[59] This approach often is considered in the management of wrist fractures in young children and in situations when surgery is not an option because of a client's medical status.

If a fracture is unstable or not reducible, surgical strategies for repair may include internal or external fixation. With recent improvements in volar plating systems, open reduction and internal fixation (ORIF) of distal radial fractures is more commonly used to help restore the bone alignment and joint anatomy, and to allow for earlier motion of the wrist once that has been cleared with the surgeon.[90] A wrist orthosis is applied upon referral from the surgeon, and active range of motion (AROM) is initiated for forearm rotation to the wrist in all planes and to the unaffected fingers to prevent joint stiffness. Wear of the orthosis is decreased gradually at 3 to 6 weeks, depending on the bone healing seen on x-ray films and the client's progress with motion, strength, and return to ADLs.[24]

Less commonly used, external fixation may be applied with more comminuted fractures to assist with attaining the proper alignment and length of the distal radius. The external fixation framework (the fixator) is anchored by surgical pins in holes drilled into both the distal radius proximally and the index metacarpal distally. Traction then is applied across the wrist to correct length and angulation and/or to reduce any other bony fragments.[90] The therapist should instruct the client in proper care of the pin sites while the fixator is in place. In addition the client should be instructed to perform AROM exercises of the unaffected proximal elbow, distal thumb, and fingers to prevent joint stiffness and contractures. After the fixator has been removed, an orthosis may be fabricated to further support the wrist; the client is gradually weaned from the orthosis as he or she improves in ROM and strength and returns safely to ADLs.[24]

The scaphoid is the second most commonly injured bone in the wrist; it often is fractured when the hand is dorsiflexed at the time of injury.[11] Fractures of the proximal pole of the scaphoid may result in nonunion because of poor blood supply to this area. Scaphoid fractures require a prolonged period of immobilization, sometimes up to several months in a cast, with resulting stiffness and pain. Care should be taken to mobilize uninvolved joints early.

Trauma to the lunate bone of the wrist may result in avascular necrosis of the lunate, or Kienböck's disease, which may result from a one-time accident or repetitive trauma. Lunate fractures are usually immobilized for 6 weeks. Kienböck's disease may be treated with a bone graft, removal of the proximal carpal row, or partial wrist fusion.

Stiffness and pain are common complications of fractures. However, control of edema, coupled with early motion and good client instruction and support, will minimize these complications.

Nerve Injuries

Nerve injury may be classified into three categories:

- *Neurapraxia* is contusion of the nerve without wallerian degeneration. The nerve recovers function without intervention within a few days or weeks.
- *Axonotmesis* is an injury in which nerve fibers distal to the site of injury degenerate, but the internal organization of the nerve remains intact. No surgical intervention is necessary, and recovery usually occurs within 6 months. The length of time may vary, depending on the level of injury.
- *Neurotmesis* is a complete laceration of both nerve and fibrous tissues. Surgical intervention is required. Microsurgical repair of the fascicles is common. Nerve grafting may be necessary when a gap exists between nerve endings.

Peripheral nerve injuries may occur as a result of disruption of the nerve by a fractured bone, laceration, or crush injury. Symptoms of nerve injuries include weakness or paralysis of muscles that are innervated by motor branches of the injured nerve and also sensory loss to areas that are innervated by sensory branches of the injured nerve. Before evaluating the client for nerve loss, the therapist must be familiar with the muscles and areas that are innervated by the three major forearm nerves. A summary of UE peripheral neuropathic conditions can be found in Table 39.4.

TABLE 39.4

Nerve Injuries of the Upper Extremity

Nerve	Location	Affected	Test
Radial nerve (posterior cord, fibers from C5, C6, C7, C8)	Upper arm	Triceps and all distal motors	• MMT
		Sensory to SRN	• Sensory test
Radial nerve	Above elbow	Brachioradialis and all distal motors	• MMT
		Sensory to SRN	• Sensory test
Radial nerve	At elbow	Supinator, ECRL, ECRB, and all distal motors	• MMT
		Sensory to SRN	• Sensory test
Posterior interosseous nerve	Forearm	ECU, EDC, EDM, APL, EPL, EPB, EIP	• Wrist extension; if present, indicates PIN rather than high radial nerve
		No sensory	
Radial nerve at ECRB, radial artery, arcade of Frohse, origin of supinator	Radial tunnel syndrome	Weakness of muscles innervated by PIN	• Palpate for pain over extensor mass • Pain with wrist flexion and pronation
		No sensory loss	• Pain with wrist extension and supination • Pain with resisted middle finger extension
Median nerve (lateral from C5, C6, C7, medial cord from C8, T1)	High lesions (elbow and above)	Paralysis/weakness of FCR, PL, all FDS, FDP I and II	• MMT
		FPL, PT, PQ, OP, APB, FPB (radial head), lumbricals I and II	• Sensory test
		Sensory cutaneous branch of median nerve	
Median nerve	Low (at wrist)	Weakness of thenars only	• Inability to flex thumb tip and index fingertip to palm • Inability to oppose thumb • Poor dexterity
Median nerve under fibrous band in PT, beneath heads of pronator, arch of FDS, origin of FCR	Pronator syndrome	Weakness in thenars but not muscles innervated by AIN	• Provocative tests to isolate compression site
		Sensory in median nerve distribution in hand	
Median nerve under origin of PT, FDS to middle	Anterior interosseous nerve syndrome	Pure motor, no sensory	• Inability to flex IP joint of thumb and DIP of index
		Forearm pain precedes paralysis	• Increased pain with resisted pronation
		Weakness of FPL, FDP I and II, PQ	• Pain with forearm pressure
Median nerve at wrist	Carpal tunnel syndrome	Weakness of medial intrinsics	• Provocative tests
		Sensory	• Tinel's sign • Sensory test
Ulnar nerve at elbow (branch of medial cord from C7, C8, T1)	Cubital tunnel syndrome	Weakness/paralysis of FCU, FDP III and IV, ulnar intrinsics	• Pain with elbow flexion and extension
		Numbness in palmar cutaneous and dorsal cutaneous distribution	
		Loss of grip and pinch strength	
Ulnar nerve at wrist	Compression at canal of Guyon	Weakness and pain in ulnar intrinsics	• Reproduced by pressure at site

AIN, Anterior interosseus nerve; *APB*, abductor pollicis brevis; *APL*, abductor pollicis longus; *DIP*, distal interphalangeal joint; *ECRB*, extensor carpi radialis brevis; *ECRL*, extensor carpi radialis longus; *ECU*, extensor carpi ulnaris; *ED*, extensor digitorum; *EDC*, extensor digitorum communis; *EDM*, extensor digitorum minimus; *EIP*, extensor indicis proprius; *EPB*, extensor pollicis brevis; *EPL*, extensor pollicis longus; *FCR*, flexor carpi radialis; *FCU*, flexor carpi ulnaris; *FDP*, flexor digitorum profundus; *FDS*, flexor digitorum superficialis; *FPB*, flexor pollicis brevis; *FPL*, flexor pollicis longus; *IP*, interphalangeal; *MMT*, manual muscle test; *OP*, opponens pollicis; *PIN*, posterior interosseous nerve; *PL*, palmaris longus; *PQ*, pronator quadratus; *PT*, pronator teres; *SRN*, superficial radial nerve.

Radial Nerve

The radial nerve innervates the extensor-supinator group of muscles of the forearm, including the brachioradialis, extensor carpi radialis longus, extensor carpi radialis brevis, supinator, extensor digitorum communis, extensor carpi ulnaris, extensor digiti minimi, abductor pollicis longus, extensor pollicis brevis, extensor pollicis longus, and extensor indicis proprius. The sensory distribution of the radial nerve is a strip of the posterior upper arm and the forearm, the dorsum of the thumb, the index and middle fingers, and the radial half of the ring finger to the PIP joints. Sensory loss of the radial nerve does not usually result in dysfunction.

Clinical signs of a high-level radial nerve injury (above the supinator) are pronation of the forearm, wrist flexion, and the thumb held in palmar abduction as a result of the unopposed action of the flexor pollicis brevis and the abductor pollicis brevis. Injury to the posterior interosseous nerve spares the extensor carpi radialis longus and brevis. Posterior interosseous nerve syndrome is marked by normal sensation and wrist extension with loss of finger and thumb extension. Clinical signs of low-level radial nerve injury include incomplete extension of the MP joints of the fingers and thumb. The interossei extend the interphalangeal (IP) joints of the fingers, but the MP joints rest in about 30 degrees of flexion.

A dynamic or static orthosis, applied to the dorsum of the hand, that provides wrist extension, MP extension, and thumb extension should be provided to protect the extensor tendons from overstretching during the healing phase and to position the hand for functional use (Fig. 39.5). A dynamic orthosis is commonly provided.

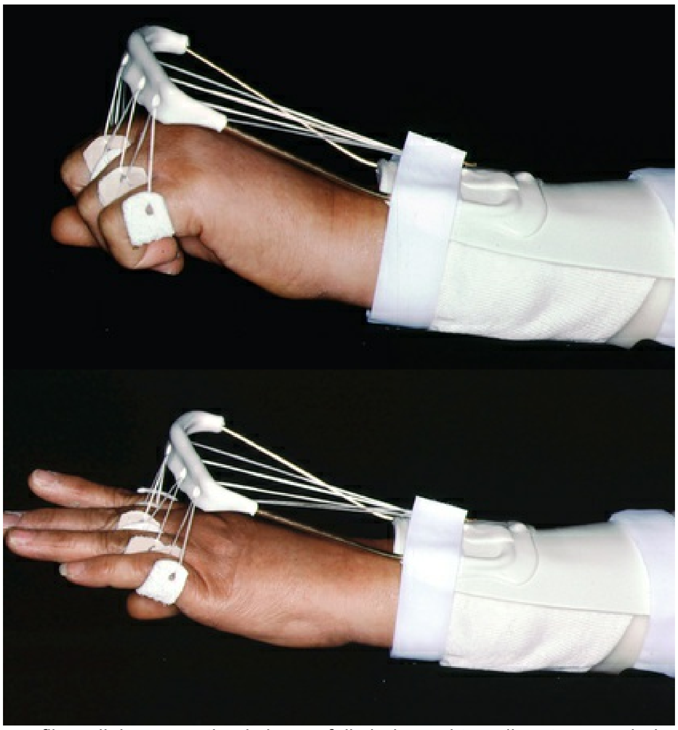

FIG 39.5 A low-profile radial nerve orthosis is carefully balanced to pull metacarpophalangeal (MP) joints into extension when the wrist is flexed, and to allow the MP joints to fall into slight flexion when the wrist is extended; it thus preserves the normal balance between two joints and also joint contracture. (Courtesy of Judy C. Colditz, HandLab.)

Median Nerve

The median nerve innervates the flexors of the forearm and hand. It is often called the "eyes" of the hands because of its importance in sensory innervation of the volar surface of the thumb, index, and middle fingers. Median nerve loss may result from lacerations and also from compression syndromes of the wrist (e.g., carpal tunnel syndrome).

Motor distribution of the median nerve is to the pronator teres, flexor carpi radialis, flexor pollicis longus, flexor digitorum profundus of the index and middle fingers, pronator quadratus, flexor digitorum superficialis, palmaris longus, abductor pollicis brevis, opponens pollicis, superficial head of the flexor pollicis brevis, and first and second lumbricals.

Sensory distribution of the median nerve is to the volar surface of the thumb, index, and middle fingers; the radial half of the ring finger and dorsal surface of the index and middle fingers; and the radial half of the ring finger distal to the PIP joints.

Clinical signs of a high-level median nerve injury are ulnar flexion of the wrist caused by loss of the flexor carpi radialis, loss of palmar abduction, and opposition of the thumb. Active pronation is absent, but the client may appear to pronate with the assistance of gravity. In a wrist-level median nerve injury, the thenar eminence appears flat and a loss of thumb flexion, palmar abduction, and opposition is noted.

The sensory loss associated with median nerve injury is particularly disabling because there is no sensation to the volar aspects of the thumb and index and middle fingers and the radial side of the ring finger. When blindfolded the client substitutes pinch to the ring and small fingers to compensate for this loss. An injury in the forearm that involves the anterior interosseous nerve does not result in sensory loss. Motor loss includes paralysis of the flexor pollicis longus, the flexor digitorum profundus of the index and middle fingers, and the pronator quadratus. The pronator teres is not affected. Pinch is affected.

Orthoses that position the thumb in palmar abduction and slight opposition increase functional use of the hand (Fig. 39.6). If clawing is noted in the index and middle fingers, an orthosis should be fabricated to prevent hyperextension of the MP joints. Clients report that they avoid use of the hand with a median nerve injury because of lack of sensation rather than muscle paralysis. Nevertheless, the weakened or paralyzed muscles should be protected.

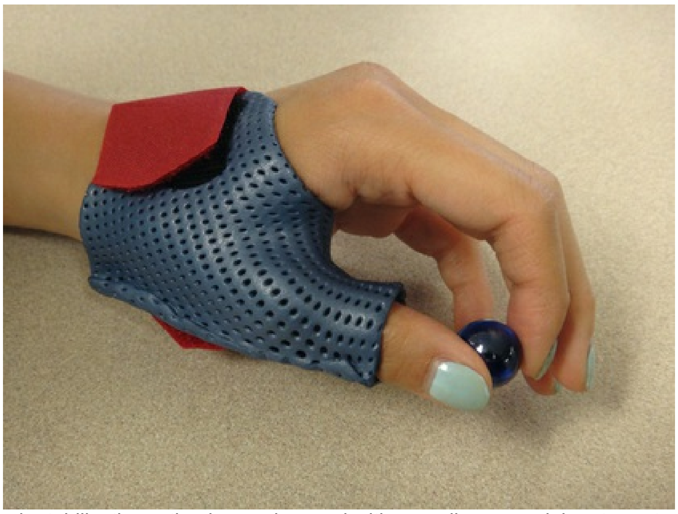

FIG 39.6 A thumb stabilization orthosis may be used with a median nerve injury to protect the thumb and to improve functioning by placing the thumb in a position of pinch. Normal pinch cannot be achieved with a median nerve injury because of paralysis of the thumb musculature.

Ulnar Nerve

The ulnar nerve in the forearm innervates only the flexor carpi ulnaris and the medial half of the flexor digitorum profundus. It travels down the volar forearm through the canal of Guyon and innervates the intrinsic muscles of the hand, including the palmaris brevis, abductor digiti minimi, flexor digiti minimi, opponens digiti minimi, dorsal and volar interossei, third and fourth lumbricals, and medial head of the flexor pollicis brevis. The sensory distribution of the ulnar nerve is the dorsal and volar surfaces of the small finger ray and the ulnar half of the dorsal and volar surface of the ring finger ray.

A high-level ulnar nerve injury results in hyperextension of the MP joints of the ring and small fingers (also called clawing) as a response to overaction of the extensor digitorum communis that is not held in check by the third and fourth lumbricals. The IP joints of the ring and small fingers do not demonstrate a great flexion deformity because of the paralysis of the flexor digitorum profundus. The hypothenar muscles and interossei are absent. The wrist assumes a position of radial extension caused by the loss of the flexor carpi ulnaris. In a low-level ulnar nerve injury, the ring and small fingers claw at the MP joints and the IP joints exhibit a greater tendency toward flexion because the flexor digitorum profundus is present. Wrist extension is normal.

Clinical signs of a high-level ulnar nerve injury may include claw hand deformity (as described previously) with a loss of the hypothenar and interosseous muscles. In a low-level ulnar nerve injury, the flexor digitorum profundus and flexor carpi ulnaris are present and unopposed by the intrinsic muscles. Froment's sign is positive. Longstanding compression of the ulnar nerve in the canal of Guyon results in flattening of the hypothenar area and conspicuous atrophy of the first dorsal interosseous muscle.

With a low-level ulnar nerve injury a small orthosis may be provided to prevent hyperextension of the small and ring fingers without limiting full flexion at the MP joints. Stabilization of the MP joints will allow the extensor digitorum communis to extend the IP joints fully (Fig. 39.7).

FIG 39.7 A static ulnar nerve orthosis blocks the hyperextension of metacarpophalangeal (MP) joints that occurs with paralysis of the ulnar intrinsic muscles; it also allows MP flexion, which maintains a normal range of motion for the MP joints.

Sensory loss of the ulnar nerve results in frequent injury, especially burns, to the ulnar side of the hand. Clients must be instructed in visual protection of the anesthetic area.

Postoperative Management of Nerve Repair

After nerve repair the hand is placed in a position that minimizes tension on the nerve. For example, after repair of the median nerve, the wrist is immobilized in a flexed position. Immobilization usually lasts 2 to 3 weeks, after which protective stretching of the joints may begin. The therapist must exercise great care not to put excessive traction on the newly repaired nerve. A repaired digital nerve will also be protected with flexion of the PIP joint.

Correction of a contracture may take 4 to 6 weeks. Active exercise is the preferred method of gaining full extension, although a light dynamic orthosis may be applied with the surgeon's supervision. The use of **orthotics** to assist or substitute for weakened musculature may be necessary for an extended period during nerve regeneration. Orthoses should be removed as soon as possible to allow active exercise of the weakened muscles. However, it is important to instruct the client in correct patterns of motion so that substitution is minimized.

Intervention is initially directed toward the prevention of deformity and the correction of poor positioning during the acute and regenerative stages. Clients must be instructed in visual protection of the anesthetic area. ADLs should be assessed, and new methods or devices may be needed for independence. Use of the hand in the client's work should be assessed, and the client should be returned to employment with any necessary job modifications or adaptations of equipment.

Careful muscle, sensory, and functional testing should be done frequently. As the nerve regenerates, orthoses may be changed or eliminated. Exercises and activities should be revised to reflect the client's new gains, and adapted equipment should be discarded as soon as possible.

As motor function begins to return to the paralyzed muscles, a careful program of specific exercises should be devised to facilitate the return. Proprioceptive neuromuscular facilitation (PNF) techniques (e.g., hold-relax, contract-relax, quick stretch, and icing) may assist a muscle with fair strength and increase ROM. Neuromuscular electrical stimulation (NMES) can also provide an external stimulus to help strengthen the newly innervated muscle. When the muscle has reached a good rating, functional activities should be used to complete the return to normal strength.

Sensory reeducation.

The assessment of sensibility is described in some detail earlier in this chapter. This information should be used to prepare a program of sensory reeducation after nerve repair.

When a nerve has been repaired, regeneration is not perfect and results in fewer and smaller nerve fibers and receptors distal to the repair. The goal of sensory reeducation is to maximize the functional level of sensation, or tactile gnosis.

Dellon et al. reported a highly structured sensory reeducation program in 1974.[34] They divided their program into early- and late-phase training, based on vibratory sensation for early phase retraining and perception of moving and constant touch sensation for late-phase reeducation. The researchers also used localization of stimuli and recognition of objects. Higher cortical integration was achieved by focusing attention on the stimuli through visual clues and by using memory when vision was occluded. The clients were taught to compensate for sensory deficits by improving specific skills and generalizing them to other sensory stimuli. Daily repetition appears to be a necessary component of reeducation.

Callahan outlined a program of protective sensory reeducation and discriminative sensory reeducation for clients in whom protective sensation is present and touch sensation has returned to the fingertips.[16a] Waylett-Rendall described a sensory reeducation program using crafts and functional activities, in addition to desensitization techniques. All these programs emphasize a variety of stimuli used in a repetitive manner to bombard the sensory receptors. A sequence of eyes-closed, eyes-open, eyes-closed is used to provide feedback during the training process. Sessions are limited in length to prevent fatigue and frustration. To prevent further trauma, objects must not be potentially harmful to the insensate areas. A home program should be provided to reinforce learning that occurs in the clinical setting.

Researchers have found that sensory reeducation can result in improved functional sensibility in motivated clients.[36,43] Sensation after reeducation must be measured objectively and the findings compared accurately with the initial testing results to assess the success of the program.

Graded Motor Imagery, as described by Moseley and Butler,[80] consists of three sequential exercise phases that are used to retrain the brain for clients who have pain, difficulty moving or initiating movement, or a fear of moving. The three stages involve left/right discrimination (also called laterality recognition), motor imagery, and mirror therapy.[80] The clinical approach of Graded Motor Imagery reduces threatening input, reduces or decreases the pain neuromatrix, targets activation of specific components of the neuromatrix without activating the unwanted parts, and upgrades physical and functional tolerance by graded exposure to threatening inputs across sensory and nonsensory domains.[80]

The exercises in stage I, Left/Right discrimination, consist of identifying right and left positions by showing the individual pictures of hands in various positions, either with flashcards or photographs. "Research has shown that people in pain often lose the ability to identify left or right images of their painful body parts. This ability appears to be important for normal recovery from pain."[81] Stage II, Explicit Motor Imagery, involves thinking about movement without actually moving. It is thought that these imagined movements start firing the "mirror neurons" in the brain, which can be affected by pain. Stage III, Mirror Therapy, involves looking into a mirror and viewing the reflection of the uninvolved extremity in the mirror, which gives the appearance of being the involved hand[86] and creates the illusion that the injured extremity is moving without pain. Mirror therapy is thought to work by providing false, but congruent, visual feedback for the unaffected limb, restoring the normal pain-free relationship between sensory feedback and motor intention.[94] The three treatment techniques are delivered sequentially, starting with activation of the cortical areas involved in thinking about movement and progressing to movement.

Tendon transfers.

If a motor nerve has not reinnervated its muscle after a minimum period of 1 year after nerve repair, the surgeon may consider tendon transfers to restore a needed motion. The rules of tendon transfer are to evaluate what is absent, what is needed for function, and what is available to be transferred.[87]

Some muscles, such as the extensor carpi radialis longus and the flexor digitorum sublimis (FDS) to the ring finger, are commonly used for transfers because their motions are easily substituted by the extensor carpi radialis brevis (ECRB) and flexor digitorum profundus (FDP), respectively, to the ring finger. An example in a high radial nerve injury, multiple tendon transfers may be needed to substitute for lost motor function. As median and ulnar nerve innervated-muscles are intact, common transfers may include pronator teres (PT) for wrist extension (ECRB), palmaris longus (PL) to EPL for thumb extension and flexor carpi radialis (FCR) to EDC for finger extension.[42]

Choices for transfers are variable, and a surgeon may request assistance from the therapist in evaluating motor status to determine the best motor transfer. Therapy before tendon transfer is essential if the motor to be used is not of normal strength. A muscle loses a grade of strength when transferred; therefore, a strengthening program of progressive resistive exercises, NMES, and isolated motion will help ensure the success of the transfer. All joints must have full passive ROM before tendon transfer can be attempted.

After transfer an initial period of immobilization of 3 to 5 weeks is required to protect the surgical repairs. This may be achieved with casting (for those who are not reliable in protecting these repairs) or with fabrication of a thermoplastic orthosis. Once cleared with the surgeon, the client begins activation of the tendon transfers through instruction to perceive the correct muscle during active use. Use of surface electromyography (EMG), biofeedback, muscle reeducation, and supervised activity (to note any substitution patterns during active use) can help the client use the transfer correctly. Therapy must be initiated before the client has time to develop incorrect use patterns. NMES may be used to isolate the muscle and strengthen it postoperatively.

Tendon Injuries

Flexor Tendons

Tendon injuries may be isolated or may occur in conjunction with other injuries, especially fractures or crushes. Flexor tendons injured in the area between the distal palmar crease and the insertion of the flexor digitorum superficialis are considered the most difficult to treat because in this area the tendons lie in their sheaths beneath the fibrous pulley system, and any scarring causes adhesions. This area is often referred to as zone 2, or "no-man's-land."[14]

Primary repair of the flexor tendons in zone 2 is most frequently performed after a clean laceration. Improvements in surgical techniques have been accompanied by advances in the postoperative management of tendon repairs. Choices for treatment will vary, based on the strength of the surgical repair, quality of the tendon, tension of the repair, or whether the tendon sheath or pulleys also were restored. Working closely with the surgeon is vital to understanding the delicacy of these repairs.

Other factors to consider are the client's age, cognition level (i.e., ability to follow instructions), financial or family supports, motivation, and compliance with the therapy program.

With the ongoing research and improvements in flexor tendon surgeries,[96] postoperative management continues to evolve[85]; the common goals of all approaches are to protect the repaired structures, restore strength, promote gliding of the tendons, and minimize the formation of scar adhesions.

Immobilization.

Although early mobilization is preferable, immobilization after tendon repairs may be necessary if the conditions and circumstances are not optimal to allow safe, early controlled movement. Young children, noncompliant clients, and those with cognitive dysfunction may require cast immobilization or a thermoplastic orthosis initially for 3 to 4 weeks. The wrist is positioned at 10 to 30 degrees of flexion, the MP joints at 40 to 60 degrees of flexion, and the PIP/DIP joints in extension. No exercises for the fingers are done by the client alone. Passive range of motion (PROM) and protected active extension may be done in therapy. AROM and tendon gliding exercises may begin after the immobilization period.[25]

Good results have not been consistently achieved with immobilization, and this technique may increase the risk of tendon rupture after repair because a tendon gains tensile strength when submitted to gentle tension at the repair site.[95]

Early passive mobilization.

Early passive motion may be considered when the conditions of a tendon repair are not optimal. For example, an injury may involve other structures that require additional surgical repairs, as can happen with fractures and soft tissue injuries. This may prolong inflammation and edema during the healing phase. Other factors may include a delay in repair, a frayed repair or one that is under tension, or a client who is unable to begin treatment early, resulting in a treatment delay of longer than 1 week. The tensile strength of the tendon is diminished for 5 to 21 days during the fibroblastic collagen-producing phase and may be at risk with tension or rupture from early motion.

Duran et al. suggested the use of controlled passive motion to achieve optimal results after a primary repair, allowing 3 to 5 mm of tendon excursion.[44] They found this amount sufficient to prevent adherence of the repaired tendons. On a client's first visit for therapy, a dorsal blocking orthosis is made with the wrist positioned at 20 degrees of flexion, the MP joint in relaxed flexion, and the PIP and DIP joints in extension.

On the third postoperative day, the client begins a twice-daily exercise regimen of passive flexion and extension of 6 to 8 motions for each tendon. The wrist is kept flexed and the MPs in 70 degrees of flexion during passive exercise. Between exercise periods the hand is wrapped in stockinette. At 4.5 weeks the protective orthosis is removed and rubber band traction is attached to a wristband. Active extension and passive flexion are performed for an additional week and gradually increased over the next several weeks.[44]

In a modified Duran approach, the position of the dorsal blocking orthosis changes to wrist extension between 0 and 20 degrees of flexion, 40 to 50 degrees of MP joint flexion, and the IPs in extension (Fig. 39.8). Additional exercises of passive flexion and active extension into the dorsal blocking orthosis are performed. A strap is applied to keep the fingers in the orthosis at all times except during exercises, and the rubber band traction wristband is eliminated. Another approach, less often used, is the Kleinert technique, which uses dynamic traction after flexor tendon repairs in zone 2.[65a,69] Rubber band traction is applied, bringing the fingers into flexion passively and then allowing the client to bring the IP joints actively into full extension within a dorsal blocking orthosis. The client wears the orthosis 24 hours a day for 3 weeks and performs these exercises hourly. This movement of the tendon through the tendon sheath and pulley system helps minimize scar adhesions while enhancing tendon nutrition and blood flow.

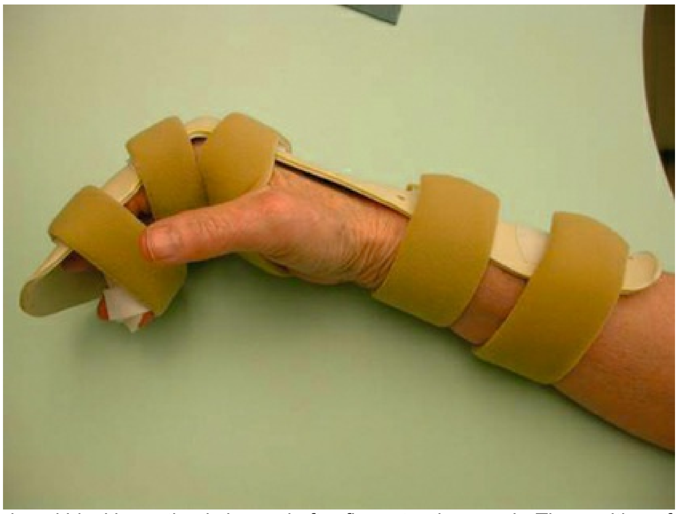

FIG 39.8 A dorsal blocking orthosis is used after flexor tendon repair. The position of the wrist and fingers in the orthosis is determined by the postoperative approach chosen by the surgeon and therapist.

The dorsal blocking orthosis is removed at 3 weeks; the rubber band is attached to a wristband, and this is worn for several more weeks, depending on the return of finger motion. The primary disadvantage of this technique is that contractures of the PIP joints frequently occur as a result of excessive tension on the rubber band traction or incomplete IP extension in the orthosis.

Early active mobilization.

As methods of tendon suturing and the suture materials themselves have evolved, many clinicians have begun to initiate active movement of the repaired tendon within days of surgery. These techniques should be used only when an experienced surgeon and therapist work closely together. The condition of the tendon and the repair technique must be communicated to the therapist, and the client must be closely monitored. With stronger and more sophisticated repairs, the rate of rupture decreases and improved results are increased after tendon injury.

Several early active motion protocols have been well documented, but all the protocols share important common factors. First, the tendon repair must be strong enough to withstand the forces of active mobilization. A strong core suture repair should be performed, with a minimum of four strands crossing the repair[96] and addition of a peripheral suture.[39,93] Second, the timing and the initiation of therapy must be considered. Some have suggested that the therapist start early active motion between 2 and 4 days after repair, to allow inflammation to subside, and that the therapist also reduce the amount of force on the tendon during active flexion. Third, the client must be able to comprehend the exercise program and must be compliant with it for the tendon rehabilitation to be successful; this also prevents rupture of the tendon caused by overstressing of the repair site.

An early passive place and active hold approach using two orthoses has been described by Cannon.[20] A dorsal-based blocking orthosis is made and worn at all times except during exercises. An exercise orthosis is fabricated with a hinged wrist and the MP joints blocked at 50 degrees. Exercises in this orthosis allow for full flexion of the wrist with simultaneous extension of the IP joints, followed by protected wrist extension limited by a dorsal block to 30 degrees (a tenodesis movement). As the wrist is moved into extension, the fingers are passively placed into flexion and the client is asked to actively hold this flexed position by contracting the muscles gently. Silfverskiöld and May[93] adapted this approach by changing the wrist position to neutral.

An active mobilization approach by Gratton[54] applies a dorsal blocking orthosis with the wrist at 20 degrees of flexion and the MP joints in more extreme flexion (between 80 and 90 degrees). In this protective orthosis, clients perform exercises every 4 hours, 2 repetitions each, of the following: (1) full passive flexion of the IP joints, (2) full active extension in the blocking orthosis, and (3) active flexion of the PIP joint to 30 degrees and DIP flexion to 5 to 10 degrees in the first week. Active flexion in this protective position is increased gradually in subsequent weeks to optimally achieve flexion of the PIP joint to 80 to 90 degrees and the DIP to 50 to 60 degrees.

Because early active mobilization of newly repaired flexor tendons involves a higher risk of rupture, close monitoring and practice with the client, especially those with poor compliance, is required. It is strongly recommended that all these early mobilization approaches be used in close collaboration with the surgeon and that they be used with caution by less experienced therapists.

Post-acute flexor tendon rehabilitation.

When active flexion is begun out of the orthosis, after any of the postoperative management techniques described previously, the client should be instructed in exercises to facilitate differential tendon gliding.[108] Wehbe has recommended three positions – hook, straight fist, and fist – to maximize isolated gliding of the flexor digitorum superficialis and the flexor digitorum profundus tendons, in addition to stretching of the intrinsic musculature and gliding of the extensor mechanism.[107] Tendon gliding exercises should be done for 10 repetitions of each position, 2 or 3 times a day.

Isolated exercises to assist tendon gliding may also be performed using a blocking orthosis (Fig. 39.9) or the opposite hand (Fig. 39.10). The MP joints should be held in extension during blocking so that the intrinsic muscles that act on it cannot overcome the power of the repaired flexor tendons. Care should be taken not to hyperextend the PIP joints and overstretch the repaired tendons.

FIG 39.9 A blocking orthosis can be used to isolate tendon pull-through and joint range of motion by blocking out proximal joints. This orthosis is being used to facilitate motion at the distal interphalangeal joint after repair of the flexor digitorum profundus tendon.

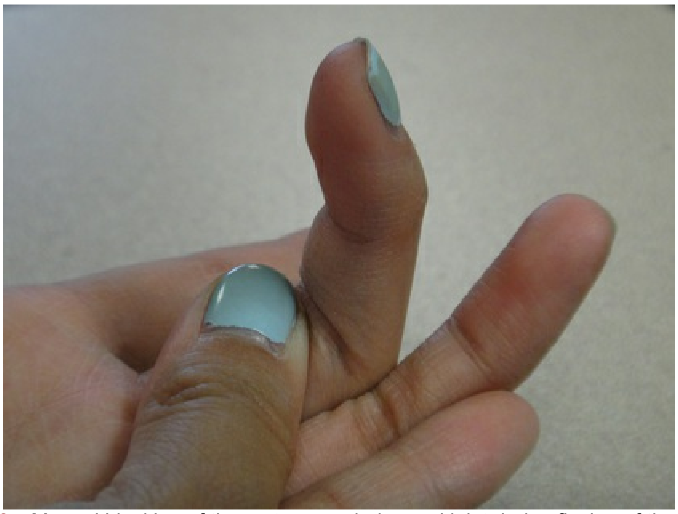

FIG 39.10 Manual blocking of the metacarpophalangeal joint during flexion of the proximal interphalangeal joint.

After 6 to 8 weeks, passive extension may be started, and the use of orthoses may be necessary to correct limitations in PIP joint motion.[27] A cylindrical plaster cast may be fabricated to apply constant static pressure for a flexion contracture, as described by Bell-Krotoski (Fig. 39.11A).[6] Serially casting into extension requires that the client be able to attend treatment every 2 to 3 days initially so that skin tolerance to casting can be checked and the cast changed as the client makes gains. A serial static PIP extension orthosis may be fabricated; when used according to the proper instructions, this orthosis allows the client to make adjustments gradually and independently[27] (Fig 39.11B). A finger gutter extension orthosis may be made using $\frac{1}{16}$-inch (0.16 cm) thermoplastic material and worn at night to help maintain extension gains made during the day. Gentle dynamic traction also may be considered using a commercial orthosis such as a spring finger extension assist (Fig. 39.12) or one fabricated by the therapist (Fig. 39.13). Use of a dynamic flexion orthosis may be necessary if the client has difficulty regaining passive flexion.

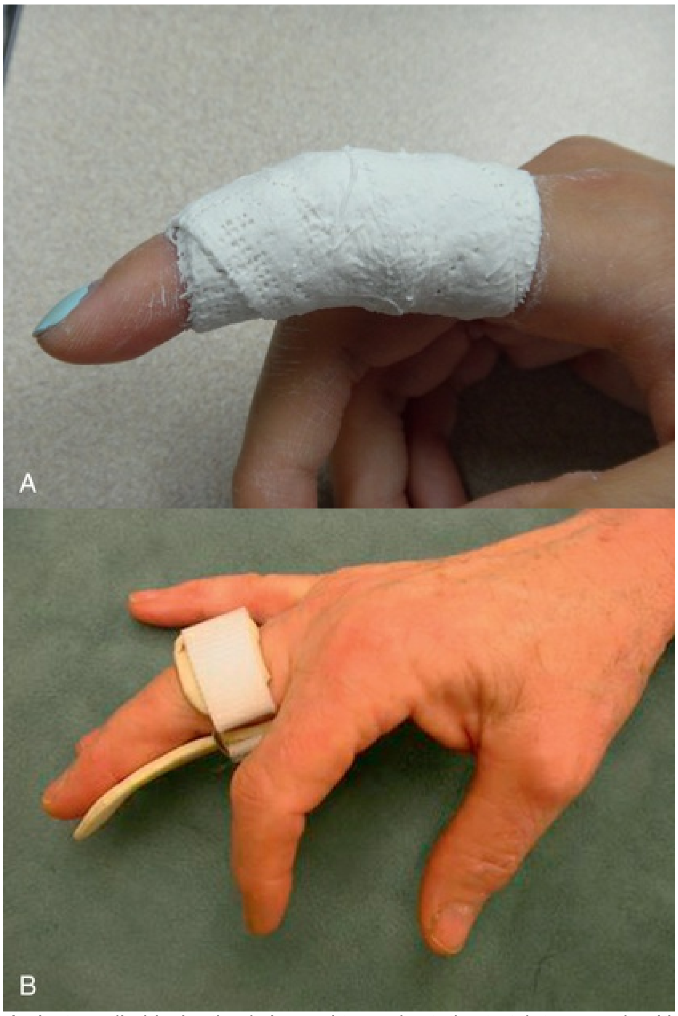

FIG 39.11 A, A plaster cylindrical orthosis is used to apply static stretch to a proximal interphalangeal (PIP) joint contracture. It is not removed by the client and must be replaced frequently by the therapist, with careful monitoring of the skin's condition. B, A static progressive extension orthosis may be fabricated to correct a flexion contracture, allowing the client to make gradual adjustments into PIP joint extension.

FIG 39.12 A finger orthosis with dynamic tension is used to increase the extension of the proximal interphalangeal joint. (Finger orthosis manufactured by DeRoyal Industries, Inc. www.deroyal.com.)

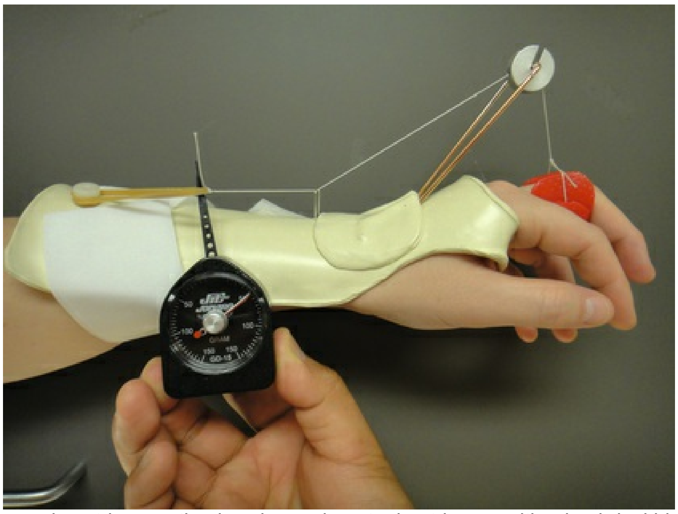

FIG 39.13 A dynamic outrigger orthosis using spring-steel outriggers with a lumbrical block can be used to assist proximal interphalangeal (PIP) joint extension, stretch against scar adhesions of extrinsic flexors, or reduce PIP joint contractures. The therapist must frequently assess the orthosis for proper fit and for tension of the rubber bands.

At 6 weeks after surgery the hand may be used for light ADLs, such as hygiene, grooming, feeding, and tabletop activities such as writing and using a computer. The client should continue to avoid heavy lifting with the affected hand or excessive resistance. At about 8 weeks the client may begin light resistive exercises and progress toward normal activities. Activities such as clay work, woodworking, and macramé are excellent for encouraging return of motion, strength, and coordination. Full resistance and normal work activities can be started 3 months after surgery. Sports activities should be discouraged until cleared with the surgeon.

After a hand has sustained a tendon injury, passive versus active limitations of joint motion must be evaluated. Limitations in active motion may indicate joint stiffness, muscle weakness, or scar adhesions.[83] If passive motion is greater than active motion, the therapist should consider that tendons may be caught in the scar tissue. The therapist should be able to determine whether a tendon is adhering and causing a flexion contracture or the tendon is free but the joint itself is stiff. Intervention should be based on this type of evaluation.

ROM, strength, function, and sensibility testing (if digital nerves were also injured) should be performed frequently, with orthoses and activities geared toward progressing the client. Performance of ADLs should continually be assessed and addressed to help maximize a client's return to his or her occupations. Assessments may include use of an ADL checklist or through simulations and observations during treatment. An example of disuse or neglect of an index finger may occur as a client becomes protective of the injured finger. This should be addressed early and prevented.

Gains in flexion and extension may continue to be recorded for 6 months postoperatively. A finger with limber joints and minimal scarring preoperatively will function better after repair than one that is stiff and scarred and has trophic skin changes. Therefore, it is important that all joints, skin, and scars be supple and movable before reconstructive surgery is attempted. A functional to excellent result is obtained if the combined loss of extension is less than 40 degrees in the PIP and DIP joints of the index and middle fingers and less than 60 degrees in the ring and small fingers[95] and if the finger can flex to the palm.

Flexor tendon reconstruction.

If the tendon is damaged as a result of a crush injury or if the laceration cannot be cleaned up enough to allow for a primary repair, delayed or staged reconstruction may be needed to provide return of tendon function. Repairs by the surgeon may include tendon transfers, lengthening, or grafting.[10,38] In severe tendon loss a staged flexor tendon reconstruction may be performed. At the first operation a Silastic rod is inserted beneath the pulley system and attached to the distal phalanx. Other reconstructive procedures (e.g., pulley reconstruction) are performed at the same time. In the postoperative recovery phase, a pseudosheath lined with mesothelial cells forms around the rod, and a fluid similar to synovial fluid forms.[66] The second stage of the repair is performed about 4 months later, when the digit can be moved passively to the palm. A tendon graft is inserted and the Silastic rod removed. The postoperative program is carried out in the same manner as for a primary tendon repair.[38]

After a two-stage tendon reconstruction or a primary repair, a tenolysis may be performed if the client's progress appears to have plateaued and if a substantial difference is noted between active and passive motion. Surgery may also be considered if motion is equal but strength is not sufficient for function. Tenolysis may be considered as early as 3 months after tendon repair, depending on the degree of limitation of the client's progress.

At the time of tenolysis surgery scar adhesions are removed from the tendon and gliding of the tendons is assessed. If local anesthesia has been used, the client is asked to move the fingers in the operating room at the time of lysis to determine the extent of scar removal.[32] If general anesthesia has been used, a proximal incision at the wrist is made and the tendon is pulled there to determine mobility from adhesions. Active motion is begun within the first 24 hours with tendon gliding exercises[108] and passive flexion of the finger, followed by active holds.[53] Gentle blocking exercises of specific joints may also be performed to help improve excursion of the tendon.[21] Transcutaneous electrical nerve stimulation (TENS)[19] and medications may be used to control pain.

LaSalle and Strickland have recommended a system for evaluating the results of tenolysis surgery by comparing the preoperative passive IP joint motion with the postoperative IP joint motion.[66] Using this comparison these researchers found that in one group of clients undergoing tenolysis, 40% had an improvement in motion of 50% or better compared with their preoperative status.

Extensor Tendons

Treatment of extensor tendon injuries requires a thorough knowledge of the extensor anatomy and biomechanics of the hand. The extensor mechanism of the hand is a highly sophisticated and complicated system. It is divided into seven zones for the fingers and five for the thumb. The level of injury dictates the intervention regimen. Timelines for immobilization, initiation of motion, and resistive exercise depend on the level of injury and the unique healing time frames for the structures in the different zones.

Four zones are distal to the MP joint, and three zones are proximal to it. Zones I and II consist of the structures at the DIP joint and middle phalanx, and injuries to this area are treated similarly. Zones III and IV are the areas over the PIP joint and proximal phalanx; injuries in these zones, too, are treated similarly, depending on the structures repaired. Zone V is the area over the MP joint; zone VI is the area over the dorsal hand; and zone VII is the area over the wrist.

In the thumb, zone T1 is the area over the DIP joint, T2 the middle phalanx, T3 the MP joint, T4 the proximal phalanx, and T5 the area over the carpometacarpal (CMC) joint and wrist.

Dorsal scar adherence is the most difficult problem after injury to the extensor tendons because of the tendency of the dorsal extensor hood to adhere to the underlying structures, thus limiting its normal excursion during flexion and extension. Overstretching of the extensor tendon, another common problem, can result in an extensor lag, or lack of full active extension.

Extensor tendon injuries distal to the MP joint (zones I to IV) generally require a longer period of immobilization, usually 6 weeks. As with flexor tendon injuries, controlled mobilization is being used with increasing frequency for zones III and IV. A protocol developed by Evans, called the short arc motion protocol (SAM protocol),[48a] allows for immediate active flexion of the PIP joint to 30 degrees, followed by full passive extension. Complete immobilization for 6 weeks or longer is necessary for injuries in zones I and II.

Several abnormal changes in the finger joint are associated with injuries distal to the MP joints. An injury to zone I or zone II, when a traumatic disruption of the terminal extensor tendon occurs, is called a mallet finger. This joint change is characterized by flexion of the DIP joint and inability to actively extend the joint. A swan neck posture is seen with dorsal displacement of the lateral bands (part of the extensor mechanism) in zone III; this results in hyperextension of the PIP joint and flexion of the DIP joint. Another abnormal joint position originating from zone III is known as the boutonnière deformity. This deformity results when the common extensor tendon is ruptured and the lateral bands sublux volarly; volar subluxation of the lateral bands results in flexion of the PIP joint and hyperextension of the DIP joint.

Extensor tendons in zones V, VI, and VII (proximal to the MP joints) become adherent because they are encased in paratenon and synovial sheaths; they respond to injury in a way similar to flexor tendons, resulting in either incomplete extension (extensor lag) or incomplete flexion caused by loss of gliding of the extensor tendon.

Evans studied the normal excursion of the EDC in zones V, VI, and VII to formulate guidelines for early passive motion of extensor tendons.[48,48a] She concluded that 5 mm of tendon glide after repair was safe and effective in limiting tendon adhesions, and she designed a postoperative orthosis that allows slight active flexion while providing passive extension.[48,48a] The orthosis is worn for 3 weeks, with initiation of active motion between the third and fourth weeks. A removable volar orthosis is used between exercise periods to protect the tendon for 2 additional weeks. If needed, use of dynamic flexion orthoses may be started at 6 weeks after surgery to regain flexion.

Injuries to extensor tendons proximal to the MP joint may be immobilized for 3 weeks. After this period the finger may be placed in a removable volar orthosis that is worn between exercise periods for an additional 2 weeks. Progressive ROM is begun at 3 weeks, and if full flexion is not regained rapidly, dynamic flexion may be started at 6 weeks.

Dynamic flexion orthoses may include an orthosis with rubber band traction individualized for the affected fingers, or a traction glove that provides tension to all fingers. For isolated fingers PIP-DIP strapping may be used (Fig. 39.14). This orthosis is made from 1 inch–wide pajama elastic, and tension is applied and adjusted by repositioning a safety pin.

FIG 39.14 A proximal interphalangeal (PIP)–distal interphalangeal (DIP) orthosis may be used to increase flexion of both the PIP and DIP joints. Made with pajama elastic tension, the orthosis can be adjusted by changing the position of a safety pin. The therapist should determine the tension and wearing

time.

Early motion may also be used in an immediate controlled active mobilization (ICAM) program for zones IV through VII. This requires at least one uninjured extensor tendon that can provide support to the injured tendons. A yoke orthosis is fabricated, and the repaired digit is placed in 15 to 20 degrees more extension than the adjacent fingers, thus taking tension off the repair. An additional wrist orthosis is fabricated that holds the wrist at 20 to 25 degrees of extension. Initially the client must wear both orthoses at all times.

In phase 1 after surgery (postoperative days 1 to 21) both passive and active motion are performed, with the client wearing both orthoses. The client is encouraged to perform light activities using the affected hand and must still wear both orthoses. In phase 2 (postoperative days 22 to 35) the client continues to wear the yoke orthosis at all times but can take the wrist orthosis off for light hand function. However, both orthoses must be worn for heavier gripping and lifting activities. During phase 3 (postoperative days 36 to 49) the client may be discharged from the wrist orthosis. The yoke orthosis may be gradually weaned or replaced with a less restrictive buddy strap as the client returns to increasing his or her normal hand function.[58]

Total active motion and total passive motion.

Total active motion (TAM) and total passive motion (TPM) are methods of recording joint ROM that are used to compare tendon excursion (active) and joint mobility (passive). They represent the measure of flexion minus extensor lag in three joints. The American Society for Surgery of the Hand has recommended that TAM and TPM be used to report joint motion.[4]

TAM is computed by adding the sum of the angles formed by the MP, PIP, and DIP joints in flexion, minus incomplete active extension at each of the three joints. For example: MP joint flexion is 85 degrees with full extension, PIP joint flexion is 100 degrees and lacks 15 degrees of extension, and DIP joint flexion is 65 degrees with full extension; therefore:

$$\text{TAM} = (85 + 100 + 65) - 15 = 235 \text{ degrees}$$

TAM should be measured while the client makes a fist. It is used for a single digit and should be compared with the same digit of the opposite hand or subsequent measurements of the same digit. It should not be used to compute a percentage of loss or impairment. TPM is calculated in the same manner but measures only passive motion.

Complex Injuries

Complex injuries of the hand, or injuries to multiple anatomic structures of the hand, are some of the most challenging injuries for therapists to treat. Complex injuries to the hand differ from other types of hand injuries because they involve trauma to multiple anatomic systems of the hand, resulting in a varied clinical picture. Injuries to these anatomic systems include skin, nerve, tendon, skeletal, and vascular injuries. Because of the complex nature of these injuries and because each injured structure has a unique healing time frame, precautions, and treatment approach, no set protocol has been determined for treating these injuries.

Many of the treatment precautions established for any one of the aforementioned injuries contradict one another; therefore, the therapist's challenge is to determine when the client can safely move forward with treatment without risking injury to healing structures. “The therapist must have a thorough knowledge of anatomy, wound healing, biomechanics, and treatment guidelines of various traumatic injuries,”[23] in addition to a “thorough understanding of the injuries and types of repairs performed. That understanding should include location and quality of repair, types of sutures used, associated injuries, and any structures that were injured but not repaired.”[23] Consequently the therapist must maintain close communication with the treating surgeon.

Types of complex hand injuries include crush injuries, amputations with or without replantation, and avulsion injuries; these may be caused by motor vehicle accidents, explosions, gunshots, and machinery accidents. Gerry, the client in the case study, had a complex injury to his hand. All the anatomic structures of his hand were affected by the saw injury; therefore, as noted earlier, his intervention plan needed to take into account the unique healing time frames and precautions for each of these anatomic structures.

Generally (and in Gerry's case) the rehabilitation process for these types of injuries is divided into three stages: the early, or protective, stage (first 5 to 10 days); the intermediate, or mobilization, stage (postoperative weeks 1 to 6); and the late, or strengthening, stage (postoperative weeks 6 to 8). The therapist and surgeon must be skilled and experienced in the rehabilitation of these injuries.

Ethical Considerations

Inexperienced therapists should not treat these clients without the supervision of a more experienced therapist or without additional training in and familiarization with treatment protocols for the various injured structures. Explore further reading for treating these types of injuries.

Edema

Although edema is a normal consequence of trauma, it must be quickly and aggressively treated to prevent permanent stiffness and disability. Within hours of trauma, vasodilation and local edema occur, with an increase in white blood cells in the damaged area. The inflammatory response to the injury results in a decrease in bacteria to control infection.

Edema should be controlled early through elevation, massage, compression, and AROM. The client is instructed at the time of injury to keep the hand elevated, and a compressive dressing is used to reduce early swelling. Pitting edema appears early and can be recognized as a bloated swelling that creates a pitted appearance when pressed. Pitting may be more pronounced on the dorsal surface, where the venous and lymphatic systems provide return of fluid to the heart. Active motion is especially important to produce retrograde venous and lymphatic flow.

If the swelling continues, a serofibrinous exudate invades the area. Fibrin is deposited in the spaces surrounding the joints, tendons, and ligaments, resulting in reduced mobility, flattening of the arches of the hand, tissue atrophy, and further disuse.[41] Normal gliding of the tissues is eliminated, and a stiff, often painful hand is the result. Scar adhesions form and further limit tissue mobility. If left untreated, these losses may become permanent.

Early recognition of persistent edema through observation and volume and circumference measurement is important. Several of the following edema control techniques may need to be used.

Elevation

Early elevation with the hand above the heart is essential. Slings tend to position the hand below the heart and may reduce blood flow. Resting the hand on pillows while seated or lying down is effective. Resting the hand on top of the head or using devices that elevate the hand with the elbow in extension has been suggested.

The client should use the hand for ADLs within the limitations of resistance prescribed by the physician. Light ADLs that can be accomplished while the hand is in a dressing are permitted.

Manual Edema Mobilization

Manual edema mobilization (MEM) is a method of edema reduction based on activation of the lymphatic system. These methods include the principles of manual lymphedema treatment (MLT) massage, medical compression bandaging, exercise, and external compression adapted to meet the specific needs of subacute and chronic postsurgical and post-stroke UE edema. The goals are to stimulate the initial lymphatics to absorb excessive fluid and large molecules from the interstitium and to move this lymph centrally. “MEM is not indicated for all hand clients but can be highly effective in cases of recalcitrant subacute or chronic edema. MEM is used to prevent or reduce subacute or chronic high-protein edema as seen in postsurgical, trauma, or post-cerebrovascular accident (CVA) hand edema.”[5]

MEM is an advanced skill that requires specialized training of the practitioner. The following overview will acquaint the reader with the techniques involved in MEM.[5]

- Provide light, stroking massage of the involved area. Keep in mind that pressure greater than 40 mm Hg will cause collapse of the lymphatic pathways.
- Incorporate exercise before and after massage in a specific sequence, following the recommended guidelines.

- Massage is done in segments, proximal to distal and then distal to proximal, always following movement of the therapist's hand in the proximal direction.
- Massage follows the flow of lymphatic pathways.
- Massage reroutes around the incision area.
- Recognize that this method does not cause additional inflammation.
- Provide the client with a home self-massage program.
- Guide intervention to prevent increased edema from other intervention techniques.
- Incorporate low-stretch compression bandaging and warmth to soften hardened tissues, especially at night.

Active Range of Motion

Normal blood flow depends on muscle activity. AROM does not mean wiggling the fingers; rather, it means maximal available ROM, performed firmly. Casts and orthoses must allow mobility of uninjured parts while protecting newly injured structures. The shoulder and elbow should be moved through full available ROM several times a day. The importance of AROM for edema control, tendon gliding, and tissue nutrition cannot be overemphasized.

Compression

Light compression using Coban wraps (available from North Coast Medical) of the affected area (Figure 39.15) or light compressive garments such as Isotoner (Isotoner gloves [available from North Coast Medical]) or Jobst[60] (Figure 39.16) will help to control swelling, especially at night.

FIG 39.15 One-inch 3M™ Coban™ LF Latex Free Self-Adherent Wrap with Hand Tear is wrapped, with minimal stretch, from the distal end to the proximal crease of the digit. The client is instructed to be alert for the development of swelling, discoloration, pain, numbness, tingling, or other changes in sensation. Coban™ LF Latex Free Self-Adherent Wrap with Hand Tear may be worn several hours a day to provide compression to reduce edema.

FIG 39.16 A custom-fitted Jobst garment may be used to reduce edema and to decrease and prevent hypertrophic scar formation after burns or trauma. Inserts may be used with the garment to increase pressure over natural curves, such as the dorsum of the wrist.

Wound Healing and Scar Remodeling

The basis of hand therapy is the histology of wound healing. Acute intervention must be planned using the foundation of tissue healing as a guide. Bones, tendons, nerves, and skin follow a progression of healing phases. Intervention must respect healing tissue to promote recovery and prevent further damage. The therapist must take care to do no harm, and that can be accomplished only with a thorough understanding of the physiology of healing.

The first phase of wound healing, the acute inflammatory phase, is initiated within hours, when the tissues are disrupted through injury or surgery, causing vasodilation, local edema, and migration of white blood cells and phagocytic cells to the area. The phagocytes remove tissue fragments and foreign bodies and are critical to healing. The inflammatory process can subside or persist indefinitely, depending on the degree of bacterial contamination.[103]

Fibroblasts, in combination with associated capillaries, begin to invade the wound within the first 72 hours and gradually replace the phagocytes, leading to the second phase – the collagen, or granulation, phase – between the fifth and fourteenth days. The formation of collagen fiber follows the invasion by fibroblasts, so that by the end of the second week, the wound is rich with fibroblasts, a capillary network, and early collagen fibers. This increased vascularization results in the erythema (redness) of the new scar.

During the third to sixth weeks fibroblasts are slowly replaced with scar collagen fibers and the wound becomes stronger and better able to withstand progressive stresses, leading to the last phase of scar maturation. Tissue strength continues to increase for 3 months or longer. The collagen metabolizes and synthesizes during this period so that new collagen replaces old while the wound remains relatively stable. Covalent bonding between collagen molecules leads to dense scar adhesions and the formation of whorl-like patterns of collagen deposits, which may be altered as the scar architecture and collagen fiber organization within the wound change over time.[41]

Myofibroblasts, which are fibroblasts with properties similar to smooth muscle cells, are contractile and cause shortening of the wound.

Tissues in which gliding has been restored have a different scar architecture from those that do not develop the ability to glide. With gliding the scar resembles the state of the tissues before injury, whereas a nongliding scar remains fixed on surrounding structures. Controlled tension on the scar has been shown to facilitate remodeling. Scar formation is also influenced by age and the quantity of scar deposited.

Wound Care and Dressings

Wounds may be described using a three-color concept: red, yellow, or black wounds.[103] This system simplifies wound description and intervention. Guidelines for treating the three wound types help the therapist choose the proper method of cleansing and dressing wounds. The reader is encouraged to review this material and obtain advanced education before treating wounds.

Topical intervention (e.g., antimicrobials) may be used to control bacteria. A variety of dressings can be placed on a wound, including gauze that has been impregnated with petrolatum (e.g., Xeroform gauze or Adaptic). Ointments (e.g., Polysporin or Neosporin) are also commonly applied. N-Terface (Winfield Laboratories; available from North Coast Medical & Rehabilitation Products) is a dry mesh fabric that looks and feels like the interfacing used in sewing. Because it is nonadherent, it can be used directly over wounds. Sterile dressings can be applied directly over the N-Terface without ointments or gels. The selection of materials depends on the amount of exudate and the goal of the dressing (which may include removing debris, absorbing exudate, or protecting new cells).

The wound can be cleaned with sterile saline, and dead tissue then is gently removed with sterile swabs. Sterile saline solution can be used to soak off adherent bandages, rather than pulling them off. The therapist should pour a small amount of saline on the area that is sticking, wait a few moments, and then gently pry off the dressing. Dead skin can be debrided using iris scissors and pickups. Soft surgical scrub sponges may be used to clean and desensitize the wound once it has healed and the stitches have been removed. The client may resume normal hand washing with running water and soap once this has been cleared with the physician.

Pressure

A hypertrophic scar or a scar that is randomly laid down and thickened is reduced by the application of pressure, often by means of pressure garments (available from Bio Concepts) or the application of Cica-Care silicone gel sheets (available from Smith & Nephew).[60] The conformity of the pressure garment can be increased if a neoprene fabric insert (available from Benik Corp.) or silicone gel sheets or molds made from Silastic elastomer (available from Smith & Nephew)[74] are used under the garment. Pressure should be applied for most of the 24-hour period; with a hypertrophic burn scar, this intervention should continue for 6 months to 1 year after the injury. Silicone gel sheets (e.g., Cica-Care) have been found to reduce hypertrophic scarring when worn on a regular basis for 12 to 24 hours a day.

Massage

Gentle to firm massage of the scarred area using a thick ointment rapidly softens scar tissue and should be followed immediately with active hand use so that tendons glide against the softened scar.[33] Vibration applied to the area with a small, low-intensity vibrator will have a similar effect.[33,61] Active exercise, using facilitation techniques and against resistance, or functional activity should follow vibration. Massage and vibration may be started 4 weeks after injury.

Thermal heat, in the form of paraffin dips, hot packs, or fluidotherapy, immediately followed by stretching while the tissue cools, provides stretch to the scar tissue. Wrapping the scarred or stiff digit into flexion with Coban during the application of heat often increases mobility in the area. Heat should not be used on insensate areas or if swelling persists.

Active Range of Motion and Electrical Stimulation

AROM provides an internal stretch against resistant scar, and the benefits of its use cannot be overemphasized. If the client is unable to achieve active motion because of scar adhesions or weakness, use of a battery-operated NMES may augment the motion.[18] Stimulation may be performed by the client for several hours at home and has been shown to increase ROM and tendon excursion.[78]

Some hand therapists use high-voltage direct current as an intervention to increase motor activity of denervated muscles. Ultrasound interventions are often prescribed but may be more effective if done within the first few months after trauma. A continuous passive motion (CPM) device may be used at home to maintain PROM and does not promote too much tendon gliding. It should be used for several hours a day for maximal benefit.

Pain Syndromes

Pain is the subjective manifestation of trauma transmitted by the sympathetic nervous system, and it may interfere with normal functioning. Because pain leads to overprotection of the affected part and disuse of the extremity, it should be treated early.

Desensitization

Stimulation of the large afferent A nerve fibers leads to a reduction of pain by reducing summation in the slowly adapting, small, unmyelinated C fibers, which carry pain sensation. The A axons can be stimulated mechanically with pressure, rubbing, vibration, TENS, percussion, and active motion. Desensitization techniques are based on the amplification of inhibitory mechanisms.

Yerxa et al. have described a desensitization program that "employs short periods of contact with three sensory modalities: dowel textures, immersion or contact particles, and vibration."[110] This program allows the client to rank 10 dowel textures and 10 immersion textures according to the degree of irritation produced by the stimulus. Intervention begins with a stimulus that is irritating but tolerable. The stimulus is applied for 10 minutes, 3 or 4 times a day. The vibration hierarchy is predetermined and based on cycles per second of vibration, the placement of the vibrator, and the duration of the intervention. Complete instructions for assembling the Downey Hand Center desensitization kit can be found in the literature in the References. The Downey Hand Center Hand Sensitivity Test can be used to establish a desensitization intervention program and to measure progress in reducing hypersensitivity.[5a,110]

Neuromas

Neuromas are a complication of nerve suture or amputation. A traumatic neuroma is an unorganized mass of nerve fibers that results from accidental or surgical cutting of a nerve. A neuroma in continuity occurs on a nerve that is intact. Neuromas may be clinically identified by a specific, sharp pain. Stimulation of a neuroma usually causes the client to pull the hand away quickly; many clients report a burning pain that radiates up the forearm. Neuromas are disabling because any stimulation causes intense pain and the client avoids the sensitive area.

A generalized desensitization program may not work because the client never develops a tolerance for stimulation of the neuroma. Injection of cortisone acetate may help break up the neuroma, making desensitization techniques more effective. Surgically excising the neuroma or burying the nerve endings deeper may be necessary.

Complex Regional Pain Syndrome

Complex regional pain syndrome (CRPS) (formerly known as reflex sympathetic dystrophy [RSD]) is a group of disorders that "involve pain and dysfunction of severity or duration out of proportion to those expected from the initiating event."[109]

"Complex" denotes the complex nature of the pain response, which may include inflammation and autonomic, cutaneous, motor, and dystrophic changes. "Regional" refers to the wide distribution of symptoms beyond the area of the original lesion. Pain is the primary characteristic of this syndrome, which includes spontaneous pain, thermal changes, and at times burning pain. CRPS type I corresponds to RSD; CRPS type II corresponds to causalgia, a severe, burning pain first described during the Civil War.[65]

Diagnostic criteria for CRPS must include spontaneous pain beyond the territory of a single peripheral nerve and disproportionate to the inciting event. Generally, edema, an abnormality in skin blood flow, or abnormal sudomotor activity is present in the area of the pain. The diagnosis is excluded by the existence of conditions that otherwise would account for the pain. The hallmarks of CRPS are pain; edema; blotchy, shiny skin; and coolness of the extremity. Sensory changes may occur. Excessive sweating or dryness may occur in clients with associated sympathetic dysfunction. The degree of trauma does not correlate with the severity of the pain, which may occur after any injury. CRPS type I may be triggered by a cycle of vasospasm and vasodilation after an injury. Abnormal edema and constrictive dressings or casts may be a factor in initiating the vasospasm. Vasospasm causes tissue anoxia and edema, and thus more pain, which continues the abnormal cycle.[105] Circulation is reduced, which causes the extremity to become cool and pale.

Fibrosis after tissue anoxia and the presence of protein-rich exudates result in joint stiffness. The client may cradle the hand and prefer to keep it wrapped. He or she may have an exaggerated reaction to touch, especially light touch. By 8 weeks after trauma, osteoporosis may be apparent on x-ray films after active use of the hand. The symptom of burning pain associated with causalgia (CRPS type II) may be alleviated by interruption of the sympathetic nerve pathways.

CRPS progresses through three stages. Stage I (traumatic stage) may last up to 3 months; it is characterized by pain, pitting edema, and discoloration. Stage II (dystrophic stage) may last an additional 6 to 9 months. Pain, brawny edema, stiffness, redness, heat, and bony demineralization are usually found in this stage, and the hand usually has a glossy appearance. Stage III (atrophic stage) may last several years or indefinitely. Pain usually peaks in stage II and decreases in stage III. Thickening around the joints occurs, and fixed contractures may be present. Swelling, if present, is hard and not responsive to techniques such as elevation. The hand may be pale, dry, and cool, and substantial dysfunction of the limb may be seen.

CRPS is treated by reducing sympathetic stimulation. It is most responsive in stage I. The first goal of intervention is reduction of the pain and hypersensitivity to light touch. This goal may be accomplished with application of warm (not hot), moist heat; fluidotherapy; gentle handling of the hand; acupressure; desensitization; and TENS before AROM. Any intervention that increases pain (e.g., PROM) should be avoided. Many clients respond well to gentle manual edema mobilization,[5] which reduces the edema and reintroduces touching of the hand. Stellate ganglion blocks to eliminate the pain are effective early; they should be coordinated with therapy so that the client can perform AROM and functional activities during the pain-free period after the blocks. AROM is crucial. Gravity-eliminated exercise, either in water or on a tabletop, may be better tolerated.

A variety of drugs may be used in the treatment of CRPS, including sympatholytic drugs that reduce the vasoconstrictive action of the peripheral vessels. Neurontin often is effective in reducing pain and increasing temperature in the extremity. Calcium channel blockers are also effective. Narcotics, carefully monitored, may interrupt the pain cycle and allow active use of the hand. A stress-loading program that has been used effectively to reduce symptoms of CRPS type I (RSD) has been described.[106] It can easily be adapted for home use.

Edema control techniques should be started immediately. Elevation, manual edema mobilization, contrast baths, and high-voltage direct current in water have proved effective. Surface electromyography (EMG) biofeedback training for relaxation may help muscle spasms and increase blood flow, in addition to reducing anxiety.

CRPS frequently triggers shoulder pain and stiffness, resulting in shoulder-hand syndrome or adhesive capsulitis of the shoulder ("frozen shoulder"); therefore, AROM and functional activities should include the entire upper quadrant. Skateboard exercises are helpful in the early stages for active-assisted exercise of the shoulder. Orthoses that reduce joint stiffness should be used as tolerated. Orthoses must not cause pain or increase swelling. Reliance on immobilization orthoses should be avoided because clients with CRPS prefer not to move the affected part, which ultimately makes their symptoms worse.

A tendency to develop CRPS should be suspected in any client who seems to complain excessively about pain, appears anxious, and complains of profuse sweating and temperature changes in the hand. Some clients report nausea associated with touching of the hand. Clients tend to overprotect the hand. Early intervention with a structured therapy program of functional activities, group interaction, and exercises that include the hand and shoulder may prevent the occurrence of a fully developed CRPS. This problem is best recognized early and treated with tempered aggressiveness and empathy.

Transcutaneous Electrical Nerve Stimulation

The intervention technique TENS is thought to stimulate both the afferent A nerve fibers in the high-frequency mode and the release of morphine-like neural hormones (enkephalins) in the low-frequency mode. Its efficacy as an intervention for pain control is well documented in medical literature. As with other electrical modalities that may be used by occupational therapists, TENS should be correlated with functional use of the hand.

To achieve pain control TENS should not be used for longer than 60 minutes at a time.[78]A TENS diary should be kept for recording the level of pain on a scale of 1 to 10 before and after intervention, in addition to activities that exacerbate the pain. To prevent overuse, TENS applications may be tapered as the pain-free periods increase. The intervention can be continued as long as necessary to provide pain control.

Joint Stiffness

Joint stiffness has been discussed in other sections of this chapter because it is seen after almost any hand trauma or disease. In the acute phase it may also result from "internal splinting," done unconsciously by the client to avoid pain. It may be prevented by early mobilization, pain control, reduction of edema, AROM and PROM, use of a CPM device, and appropriate orthotic techniques.

Grades I and II joint mobilization are especially helpful in preparing for passive and active motion and providing pain relief.

The treatment of established joint stiffness is more difficult. Thermal modalities, joint mobilization, ultrasound and electrical stimulation, dynamic orthoses, serial casting, and active and passive motion in preparation for functional use should all be included in the intervention regimen.

Cumulative Trauma Disorders

A number of terms are used to describe injuries to the musculoskeletal system, including overuse syndromes, repetitive strain injuries, cervical-brachial disorders, repetitive motion injuries, and **cumulative trauma disorders** (CTDs).[13,104] However, the term cumulative trauma disorder should be viewed as a description of the mechanism of injury, not a diagnosis. Even when the presenting symptoms are confusing, attempts to define a specific diagnosis are necessary because "each disorder has a different cause, intervention, and prognosis."[88] Diagnoses associated with cumulative trauma usually fall into one of three categories: tendinitis (e.g., lateral epicondylitis [tennis elbow] or de Quervain's tenosynovitis), nerve compression syndromes (e.g., carpal tunnel syndrome or cubital tunnel syndrome), and myofascial pain.

Cumulative trauma occurs when force is applied to the same muscle or muscle group, causing an inflammatory response in the tendon or muscle.[88] Muscle fatigue is an important aspect of cumulative trauma. Excessive use of a muscle or body system (overuse or overexertion) is experienced as a muscle cramp. Acute overuse is relieved by rest, but chronic fatigue is not relieved by rest. The degree of fatigue is related to the amount of force and the duration of force application.

The greater the force, the more quickly fatigue occurs. If force is maintained, repetitions must be reduced to allow recovery; therefore, if the force is reduced but the repetitions are maintained and recovery time is adequate, harm is less likely to occur. The combination of repetitions without adequate recovery time and high force establishes an environment that is likely to lead to injury. Byl found that repetitive hand opening and closing may lead to motor control problems and the development of focal hand dystonias by means of degradation of the cortical representation.[16] Applying this research may help therapists develop more effective intervention programs for cumulative trauma and chronic pain.

Intervention for CTDs may be divided into three phases. In the acute phase, intervention is geared toward reducing the inflammation through dynamic rest. Orthoses are used for immobilization to relieve symptoms, and cortisone injections also may be used to reduce symptoms. Icing, ultrasound, iontophoresis (the movement of ions through biologic material under the influence of an electric current), and interferential and high-voltage electrical stimulation have all proved effective in reducing pain and inflammation. Nonsteroidal anti-inflammatory drugs also are used frequently. When orthoses are used, they should be removed often during the day to allow stretching of the affected musculature (e.g., the extensor group in lateral epicondylitis); this maintains or increases muscle length and prevents joint stiffness. Painful activities should be avoided during the dynamic rest phase. Vibration is contraindicated because it may contribute to inflammatory problems.

As the acute symptoms diminish, the client begins the exercise phase of intervention. After slow stretching has warmed up the muscles, the client begins controlled progressive exercise. Resistance should be increased slowly, and the frequency, intensity, and duration of exercises should be monitored and adjusted in response to pain and fatigue levels.

Clients are instructed to continue stretching 3 times a day, especially before activity, for an indefinite time. Proper body mechanics are critical to the long-term control of inflammatory problems, so clients must become aware of what triggers their symptoms and learn early intervention if symptoms reappear. Icing, orthoses, stretching, and modified activities, combined with correct body mechanics, are usually effective. The key is to ensure that the client learns self-management techniques and takes an active role in the interventions.

Work-related risk factors for CTDs include:

- Repetition
- High force
- Awkward joint posture
- Direct pressure
- Vibration

- Prolonged static positioning

An assessment of the job site, tools used, and hand position during work activities may be indicated for a client whose symptoms are related to job demands. Modification of the equipment used and strengthening of the dominant muscle groups and their antagonist muscles may permit continued employment and control the inflammatory problem.

Tendinitis (inflammation of the tendon), tenosynovitis (inflammation of the tendon sheath), and tendinosis (chronic tendon injury with damage to the tendon on a cellular level) are frequently seen in cumulative trauma. The cycle of overuse that leads to microtrauma, swelling, pain, and limitations in movement is followed by rest, disuse, and weakness. Then normal activity is resumed, and the cycle begins again.[68]

Clients usually have a combination of localized pain, swelling, pain with resisted motion of the affected musculotendinous unit, limitations in motion, weakness, and crepitation of the tendons. The symptoms are reproduced with activity or work simulation. Using functional grades to describe the associated symptoms assists in the evaluation and monitoring of improvement (Table 39.5). Although isometric grip strength may be normal, wrist and forearm strength are often decreased and out of balance. Dynamic grip strength may be more limited because tendon gliding is more likely to increase inflammation and pain. Muscle imbalance leads to positioning and substitution patterns that may result in worsening or spread of the symptoms.

TABLE 39.5

Functional Grading of Cumulative Trauma Disorders

Grade	Description
Grade I	• Pain after activity; resolves quickly with rest • No decrease in amount or speed of work • Objective findings usually absent
Grade II	• Pain in one site while working • Pain consistent while working but resolves when activity stops • Productivity sometimes mildly affected • May have objective findings
Grade III	• Pain in one or more sites while working • Persistent pain after cessation of activity • Productivity affected and multiple breaks sometimes necessary to continue working • May affect other activities away from work • May have weakness, loss of control and dexterity, tingling, numbness, and other objective findings • May have latent or active trigger points
Grade IV	• All common uses of hand and upper extremity result in pain, which is present 50% to 75% of the time • May be unable to work or works in limited capacity • May have weakness, loss of control and dexterity, tingling, numbness, trigger points, and other objective findings
Grade V	• Loss of capacity to use upper extremities because of chronic, unrelenting pain • Usually unable to work • Symptoms sometimes of indefinite duration

From Kasch MC: Therapist's evaluation and treatment of upper extremity trauma disorders. In Mackin EJ, et al, editors: *Rehabilitation of the hand and upper extremity*, ed 5, St Louis, 2002, Mosby.

Nerve compression syndromes, especially carpal tunnel syndrome, are frequently seen. Carpal tunnel syndrome is caused by pressure on the median nerve as it travels beneath the transverse carpal ligament at the volar surface of the wrist.[52] The syndrome is associated with increased pressure in the carpal canal because of trauma, edema, or retention of fluids as a result of pregnancy, flexor tenosynovitis, repetitive wrist motions, or static loading of the wrist.

The symptoms are night pain severe enough to waken the client; tingling in the thumb and index and middle fingers; and, if the condition is advanced, wasting of the thenar musculature caused by pressure on the motor branch of the nerve. Early carpal tunnel syndrome may be recognized during a thorough nerve evaluation.

Conservative intervention usually is attempted first and includes orthotics for the wrist in no more than 20 degrees of extension, contrast baths to reduce edema, wearing of Isotoner gloves, and activity analysis. In carpal tunnel syndrome a semiflexible or neoprene orthosis, rather than a completely rigid one, may be used to provide support while allowing a small amount of flexion and extension for greater functional use.

Ultrasound and iontophoresis may be used to reduce inflammation, and icing techniques are beneficial. Specific strengthening exercises of the wrist, fingers, and thumb should be given after the pain and inflammation have been controlled.

Myofascial pain and fibrositis are common pain conditions elicited by activation of trigger points in the muscles, resulting in pain referred to a distal area. Travell and Simons studied myofascial pain and mapped out the traditional trigger points and their referral patterns.[99] Poor posture and positioning of the body out of normal alignment are often the mechanisms of injury in myofascial pain, so careful examination of the client and his or her normal daily activities is indicated. The therapist should observe the client performing the activity rather than rely on a verbal description.

Myofascial pain should be considered if direct intervention applied to the painful area does not relieve the pain. Evaluation for trigger points must be done meticulously, and mapping of the trigger points and the referral areas must be documented. Because the pain is referred, the trigger point must be treated, not the referral area. The interventions used for other inflammatory problems (e.g., ice and ultrasound) can be used, and specific interventions for the trigger points (e.g., friction massage and TENS) also may relieve the pain. Activity analysis is an essential part of intervention because it enables the therapist to identify stresses on the affected tissues caused by functional activities.

Elastic Therapeutic Taping

Kinesio Tape (available from North Coast Medical & Rehabilitation Products) was developed in Japan in the 1970s, Since its introduction in the United States in 1994, it has become increasingly popular with therapists for use in CTD interventions.[62] The technique of elastic therapeutic taping uses tapes such as Kinesio Tape or other elastic or kinesiology tapes (e.g., SpiderTech tape and KT Tape). Unlike athletic taping, which is restrictive and is used to provide stability and restrict joint motion, elastic therapeutic tape is designed to "mimic the elastic properties of muscle, skin, and fascia."[29,30] When elastic tape is properly applied, its elasticity does not restrict the movement of soft tissue, yet it supports weakened muscles and allows for full movement of the joints by reducing abnormal muscle tension or spasms.

A variety of clinical applications for elastic taping techniques have been described. Depending on the problem, the tape is anchored at either the origin or the insertion of a muscle and then gently stretched and taped over or around either a shortened or an elongated muscle; this puts the muscle back into a neutral position. The tape is believed to affect the peripheral somatosensory receptors in the superficial skin, which in turn affects the skin and lymphatic systems (in addition to muscle and joint function) as they relate to pain, proprioception, and motor control. The goals and concepts of elastic taping include[29,30]:

- Reducing pain by increasing the somatosensory system
- Reducing inflammation and edema by stimulating the lymphatic system
- Normalizing muscle tone by reducing overstretching and overcontraction of muscles
- Reducing muscle fatigue by supporting and enhancing the contraction of weakened muscles
- Improving ROM by relieving pain
- Providing support and alignment to joints by supporting weakened ligaments
- Preventing injuries during ADLs by providing support to muscles and ligaments

Strengthening Activities

Acute care is followed by a gradual return of motion and sensibility and by preparation to return the client to his or her normal ADL and instrumental ADL (IADL) routines.

Fear of further injury and pain usually prevent the client from strengthening the injured and neglected extremity at home. Because every hand clinic has its own armamentarium of strengthening exercises and media, only a few suggestions are provided here.

Computerized Evaluation and Exercise Equipment

The BTE Work Simulator (Baltimore Therapeutic Equipment [BTE]) (Fig. 39.17) is an electromechanical device with more than 20 interchangeable tool handles that can be used for both work evaluation and UE strengthening. The resistance level can be adjusted from no resistance to complete static resistance, and tool height and angle also are adjustable. When the device is used for strengthening, the resistance usually is set low and gradually increased. The duration of exercise is increased when a base level of strength has been achieved. The BTE Work Simulator allows for close simulations of real-world tasks that are easily translatable into the physical demands common to manual work.

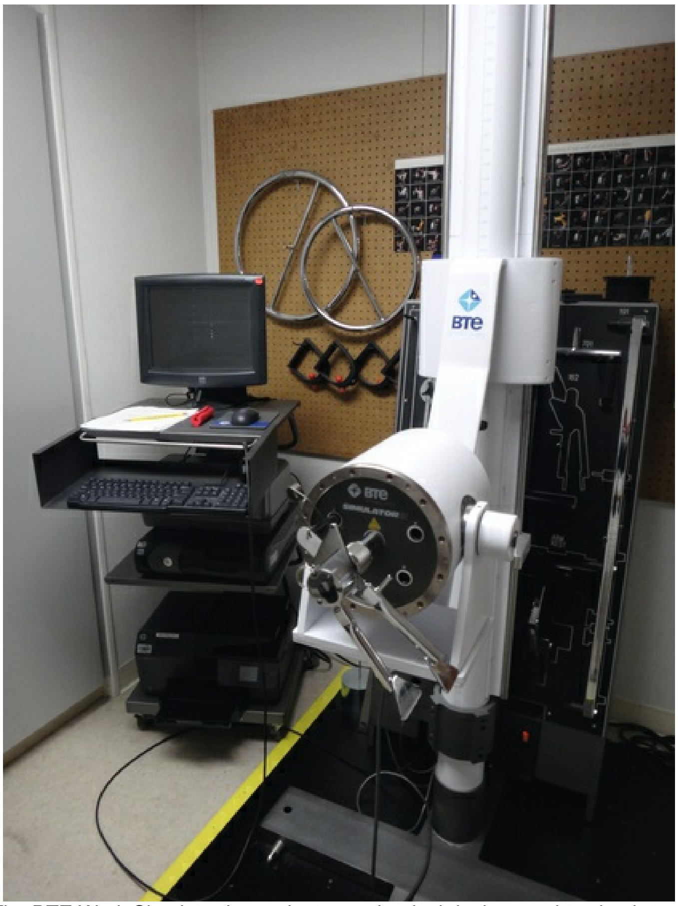

FIG 39.17 The BTE Work Simulator is an electromechanical device used to simulate real-life tasks, thereby allowing evaluation and strengthening of the upper extremity. The client's progress is monitored through a computerized printout, and the program can be modified to increase resistance and endurance. (Courtesy of BTE Tech. http://www.btetech.com.)

Other types of computerized evaluation equipment allow the therapist to record the assessment results and print a report. The percentage of impairment also can be determined electronically. Portable systems are being developed that allow the therapist to record daily interventions and download the information into a computerized network, so that outcome data from many sources can be compared. Technologic advances in rehabilitation are helping therapists to become more efficient and to capture important information not available by traditional means.

Many practitioners use occupation-based interventions, either in the clinic or at the work site, that simulate the actual work done by the client. These methods assist the client toward a return to his or her occupation and are in keeping with the Occupational Therapy Practice Framework.

Weight Well

The Weight Well (Fig. 39.18) was developed at the Downey Community Hospital Hand Center in Downey, California, and is available commercially (Upper Extremity Technology Weight Well [available from North Coast Medical & Rehabilitation Products]). Rods with a variety of handle shapes are inserted through holes in a box, and weights are suspended from them. The rods are turned against resistance throughout the ROM to encourage full grasp and release of the injured hand, wrist flexion and extension, pinch, and pronation and supination patterns. The Weight Well can be graded for resistance and repetitions and is an excellent tool for progressive resistive exercise.

FIG 39.18 The Weight Well is used to strengthen the upper extremity by applying progressive resistance to weakened musculature. It also is useful in retraining prehension of pinch and grip.

TheraBand

TheraBand (available from Patterson Medical) is a 6-inch (15.2-cm) wide rubber sheet that is available by the yard and is color coded according to degrees of resistance. It can be cut into any length required and used for resistive exercise for the UE. The uses for TheraBand are limited only by the therapist's imagination; it can be adapted to diagonal patterns of motion, wrist exercises, follow-up intervention of tennis elbow, and other uses. TheraBand can be combined with dowel rods and other equipment to provide resistance throughout the ROM. It is inexpensive and easy to incorporate into a home intervention program.

Hand-Strengthening Equipment

Handgrips of graded resistance are available from rehabilitation supply companies and sporting goods stores. They can be purchased with various resistance levels and can be used for progressive resistive hand exercises.

Therapists must be especially careful not to use the overly resistive, spring-loaded grippers often sold in sporting goods stores. These devices may be beneficial to the seasoned athlete but are usually too resistive for the recently injured.

Therapy putty can be purchased in bulk; the amount given to the client depends on his or her hand size and strength. This medium also is available in grades of resistance, and some types provide chips that can be added to progressively increase resistance. Therapy putty can be adapted to most finger motions, and it is easily incorporated into a home program.

Household items (e.g., spring-type clothespins) have been used to increase the strength of grasp and pinch. Imaginative use of common objects should present a challenge to the hand therapist.

Purposeful and Occupation-Based Activity

Purposeful and occupation-based activities are an integral part of rehabilitation of the hand. Such activities include crafts, games, dexterity activities, ADLs, and work samples. Several studies have shown that clients are more likely to choose occupationally embedded exercise and that they performed better using this type of exercise than with rote exercise.[26a] Many of the intervention techniques described previously are used to prepare the hand for purposeful activity.

Activities should be started as soon as possible at whatever level the client can perform them, with adaptations to compensate for limited ROM and strength. They should be used in conjunction with other interventions. The occupational therapist must continually assess the client's functional capacities and initiate changes in the intervention plan to incorporate activities as soon as possible in the restorative phase.

Vocational and leisure goals should be established during the initial evaluation and taken into account when the intervention plan is devised. The needs of a brick mason may be quite different from those of a mother with small children, and the environmental needs of the client must not be neglected.

Crafts should be graded from light resistance to heavy resistance and from gross dexterity to fine dexterity. Crafts that have been found to work extremely well with hand injuries include macramé, Turkish knot weaving, clay molding, leather tooling, and woodworking. All these crafts can be adapted and graded to the client's capabilities, and they have been found to have a high level of client acceptance. When integrated into a program of total hand rehabilitation, they are viewed as another milestone of achievement, not as a diversion to fill up empty hours. For example, the pride of accomplishment for Gerry, who was able to complete his first simple woodworking project, is evidence that the purposeful activity of crafts belongs in hand rehabilitation.

Activities that do not have an end product but provide practice in dexterity and ADL skills also fit into the category of purposeful activities. Developmental games and activities that require pinch or grasp and release may be graded and timed to increase difficulty. ADL boards with a variety of opening and closing devices provide practice for use of the hand at home and increase self-confidence. String and finger games are challenging but fun coordination activities that can be done in pairs.

A hobby can often be adapted for use in the clinic. Fly-tying is a difficult dexterity activity, but one frequently enjoyed by an avid fisherman. Golf clubs and fishing poles can be adapted in the clinic; in Gerry's case, therapy with these tools allowed early return to a favorite form of relaxation.

Humor and interaction with other therapists and clients are vital but intangible benefits of hand therapy intervention. The intervention should be planned to promote both.

Functional Capacity Evaluation

The ultimate goal of therapy for an injured worker is to return to full employment. Many weeks or months may elapse between the time of injury and the point at which the physician believes a return to work is appropriate medically. Even though x-ray examinations may show full healing and restored ROM, many clients do not feel that they have the strength, dexterity, or endurance to return to their former jobs. Pain may continue to be a limiting factor, especially with heavy activities. Light duty or part-time positions may not be available, and the physician, therapist, industrial insurance carrier, and especially the client are frustrated by the lack of an objective method of evaluating an individual's physical capacity for work. Occupational therapists with training in evaluation, kinesiology, and adaptation of environmental factors, coupled with a functional approach to the client, may play a key role in the **functional capacity evaluation**.

A renewed interest in evaluation of prevocational factors has brought the OT profession full circle (see Chapter 14). Although regarded as a cornerstone of the profession in its early years, prevocational evaluation was neglected in many centers during the 1960s and 1970s. Since the early 1980s, however, occupational therapists have rediscovered a need that their profession is in a unique position to provide. The term prevocational evaluation ambiguously implied that occupational therapists were involved in assessing the vocational needs of clients they treated. The terms functional capacity evaluation (FCE) and work tolerance screening (WTS) more clearly describe the process of measuring an individual's ability to perform the physical demands of work.

The results of the FCE allow the therapist, worker, physician, and vocational counselor to establish a specific, attainable employment goal using reliable data. This approach relieves the physician of the responsibility of returning the client to work without objective information about the client's ability to do a job. It also allows the client to test his or her own abilities, which may result in increased self-confidence about returning to work.

Many techniques have been proposed for performing an FCE.[91] Some basic steps may be followed regardless of the specific technique adopted. The client should be evaluated for grip and pinch strength, sensation, and ROM. Edema and pain must also be assessed and reassessed during the course of the evaluation.

Job analysis may also be provided by a rehabilitation counselor and through information provided by the client. The therapist should consult the *Dictionary of Occupational Titles* (DOT)[100] to obtain information about the worker traits required for the expected job. This dictionary contains 12,900 job descriptions and 20,000 job titles. If sufficient information about the job is not available through these methods, an onsite job analysis by the therapist may be necessary. Once the physical demand characteristics of work have been documented, the client's ability to perform them can be evaluated. The U.S. Department of Labor sponsors the Occupational Information Network online (http://online.onetcenter.org), which includes job titles and job accommodations and allows the user to search for job information using several criteria.

Schultz-Johnson described an FCE adapted for UE injuries based on the physical demands established by the U.S. Department of Labor.[91] After the evaluation the therapist may recommend a work therapy program,[91] which can include simulated job tasks, to improve job performance.

Matheson has written several manuals and articles describing the work capacity evaluation (WCE).[75] This 8- to 10-day work assessment includes evaluation of the client's feasibility for employment (worker characteristics, such as safety and dependability), employability, work tolerances (e.g., strength, endurance, and the effect of pain on work performance), the physical demand characteristics of the job, and the worker's ability to "dependably sustain performance in response to broadly defined work demands."

Tests with well-accepted reliability (e.g., the Purdue Pegboard Test, the Minnesota Manual Dexterity Test, and the Jebsen Hand Dexterity Test) may be administered as a screening process.[28–90] These tests will give the therapist valuable information through observation, whether the normal tables are used or the test is adapted to an individual worker.

Many assessments and job simulation devices are available, and these should be reviewed before a physical capacity evaluation program is established. To choose appropriate work samples, the therapist should determine the job market in a specific area. This can be done by consulting rehabilitation counselors and representatives from vocational schools and employment agencies in the area.

Work samples (e.g., Valpar work systems) may be used to test specific skills. The therapist may also develop job samples by using information about jobs in the local area. Discarded electronic assembly boards, a lawn mower motor, an automobile engine, or other items from the local hardware store may provide valuable information about the worker's abilities.

Work simulation using job samples or the BTE Work Simulator assess the worker's specific physical capacities, in addition to endurance and symptoms that become cumulative with prolonged use of the injured part (called symptom response to activity [SRA]). Monitoring the client's SRA may prevent loss of time and money spent on training a client for an inappropriate vocational goal. A combination of normed tests, job samples, job simulation, and WCE devices may provide the therapist with the best information about a worker's physical capacity.

Work Hardening

Work hardening is the progressive use of simulated work samples to increase endurance, strength, productivity, and often feasibility. Work hardening may be performed for a period of weeks, and the progressive, ongoing nature of the work usually improves physical capacity. A work hardening program is an important contribution to return to work.

Because an FCE also is performed over time, identifying the difference between an FCE and work hardening may be difficult. An FCE generally is done when the client has stopped improving with traditional therapy methods and may have been released from acute medical care. The client may be unable to return to his or her former employment, or the client's ability to do the former work may be in doubt. A physician, rehabilitation counselor, insurance adjustor, or attorney may initiate an FCE.

Work hardening or work conditioning may be started earlier in the rehabilitation process, perhaps by the treating physician or a therapist who recognizes that an individual may have difficulty returning to his or her former employment. These services are performed before the end of medical care, and the evaluation results may serve as a final checkout before intervention is discontinued.

Standards for work hardening services have been developed by the Commission on Accreditation of Rehabilitation Facilities (CARF)[28] to ensure that injured workers are offered high-quality programs that are maximally effective in returning them to gainful employment. Roy Matheson and Associates[75] offers many publications and resources for therapists interested in establishing WCE, work tolerance screening, or work hardening services.

FCE and work hardening are adjuncts to the vocational rehabilitation process. Occupational therapists are trained to observe behavior, and they have the skills necessary to translate that observation into useful data. FCE and work hardening should not compete with the work of rehabilitation or vocational counselors; instead, they should provide critical information about a worker's physical functioning and foster reentry into the job market.

Consultation With Industry

Occupational therapists may be asked to visit the job site to make recommendations for **ergonomic** adaptations, including tool modification, ergonomic furniture and accessories, and training of workers in proper positioning to reduce the incidence of CTDs. Because prevention substantially reduces the costs to industry, occupational therapists have a unique opportunity to apply their training in activity analysis and adaptation of the environment in a new setting. The Americans with Disabilities Act (ADA) mandates reasonable accommodations for workers with disabilities. Many occupational therapists have become active in helping companies comply with the requirements of the ADA. The American Occupational Therapy Association is an excellent resource for information about the ways therapists can be involved in these efforts in their communities (also see Chapter 15).

Psychosocial Effects of Hand Injuries

After a hand injury a number of psychosocial reactions may occur. To name but a few, these may include a change in body image and self-image, depression, anxiety, and a decrease in self-worth (as experienced by Gerry, the cabinetmaker in the case study whose fingers had been amputated and then surgically replanted). With traumatic hand injuries acute stress disorder and post-traumatic stress disorder are not uncommon and can be problematic for the client, especially if they are not addressed promptly. The hand therapist often is the primary contact for a client after injury and may see the client several times a week on a one-to-one basis. Therefore, the hand therapist plays a very important role in helping the client return to preinjury physical and emotional functioning. Occupational therapists who specialize in hand therapy provide the client with an important source of emotional support. However, they also play a critical role in recognizing psychosocial issues the client may be having; they are educated in evaluating and providing intervention for these issues; and, when necessary because of the severity of the problem, they are capable of facilitating referral to an appropriate mental health professional.

Summary

This chapter has provided an overview of interventions for UE disorders. Evaluation procedures were discussed, in addition to the basic intervention techniques. Management of both acute injuries and cumulative trauma was included, as was information on strengthening and programs for industrial injuries. Most occupational therapists working with physical disabilities should be familiar with the basic UE intervention approaches described because they work with clients who have some limitation in those parts of the body. Specialization in hand therapy requires both advanced academic study and clinical experience. A therapist who specializes in this area of practice and who meets minimum requirements may choose to take the Hand Therapy Certification Examination and become a Certified Hand Therapist (CHT). More information is available from the Hand Therapy Certification Commission (http://www.htcc.org)[55]; and links to educational resources also are available on this website. Another valuable resource is membership in the American Society of Hand Therapists ((http://www.asht.org).

Much of UE rehabilitation involves the use of preparatory methods, such as exercise, orthotics, and physical agent modalities, and these interventions should be used to prepare the client for purposeful or occupation-based activities. The goals always are to help the client become as independent as possible and to use these preparatory methods to achieve the client's occupation-based performance goals. Purposeful activity is used whenever possible in the hand clinic, according to space and time constraints, and clients are encouraged to use their new skills in their own home or work contexts and to bring back to the clinic information about the obstacles they have experienced in achieving their performance goals.

Threaded Case Study

Gerry, Part 2

The case study presented at the beginning of this chapter described Gerry, a 32-year-old cabinetmaker with an acute, complex hand injury involving amputation and surgical replantation of three digits. Gerry progressed through all phases of rehabilitation over the course of 15 months, from the acute hospital stay to return to work and play activities. Based on the case presented, how would the intervention plan change over the course of Gerry's recovery, and what specific intervention approaches could his occupational therapist use?

During the acute phase, one of the therapist's goals was to promote and maintain the health of the client's unaffected joints, which were vulnerable to becoming stiff from protective posturing. Another goal during the acute phase was to prevent further injury or abnormal joint changes to the left hand. ROM exercises were administered to maintain the healthy function of the client's unaffected joints (e.g., the shoulder and the elbow), and a protective orthosis was fabricated to place Gerry's hand in a protective and functional position of mild wrist flexion, MP flexion, and IP extension. During this phase of recovery, education was an important component of Gerry's intervention plan. He was taught appropriate postoperative precautions and orthosis wear and care; his family members were educated in wound care, dressing changes, and signs of infection. Gerry also was given written material about this home program.

During the intermediate phase of Gerry's recovery the intervention approach was to restore AROM and PROM, strength, and coordination to his hand so that he could return to his previous occupations (specifically, cabinetry, golf, and softball). The ROM activities were graded, and motion was progressively added as the tendons, nerves, and vessels healed. Strengthening exercises were added during the late phase of recovery, and at this point Gerry could safely attempt to return to his previous activities. Also at this time purposeful and occupation-based activities were added to Gerry's therapy regimen; Gerry's areas of occupation had to be modified to account for the loss of mobility, strength, and coordination in his hand. He was taught one-handed ADLs during the acute phase of recovery so that he could be self-sufficient until he regained the use of his left hand. Modifications to his activity demands were also implemented, such as enlarging the handles of his golf clubs to compensate for the lack of full finger ROM during the intermediate to late phases of recovery. Gerry was taught to prevent further injury to his hand through visual compensation techniques for loss of sensation, to monitor for signs of infection, and to follow postsurgical precautions during the acute phase of his injury.

Throughout Gerry's rehabilitation a variety of assessment tools were used to review his performance skills so as to identify barriers to performance. A grip dynamometer, pinch meter, and manual muscle tests were used to assess grip, pinch, and muscle strength. A goniometer was used to assess ROM, and Semmes-Weinstein monofilaments were used to assess sensation. A volumeter and circumferential measurements were used to assess edema, and the Jebson Hand Function Test was administered to assess the functional use of Gerry's hand in a standardized format. The evaluation data were then interpreted and the intervention plan modified to achieve the targeted outcomes.

Once the intervention plan had been established, various preparatory methods and purposeful activities were chosen to achieve Gerry's occupational goals. For the occupational performance goal of golfing, orthoses were used as a preparatory method during the intermediate phase of recovery to help Gerry gain PROM in stiff joints and increase overall flexion of the replanted digits, so that he could eventually hold a golf club. Physical agent modalities (e.g., paraffin and ultrasound) were applied before performance of purposeful activity during the intermediate and late phases of recovery. Gerry performed purposeful activities, such as swinging a golf club in the clinic and simulating a golf swing on the BTE Work Simulator, and the physical resistive demands of this golf swing were increased gradually. Gerry also practiced putting in the clinic, using special flexion gloves early on so that he could hold the golf club; later he progressed to wearing no gloves, but instead enlarging the handle of the golf club to facilitate a secure grip.

To address Gerry's occupational goal of returning to work as a cabinetmaker, a volunteer opportunity was arranged for him to participate in the purposeful activity of making wooden sliding/transfer boards and other assistive devices for clients in acute rehabilitation. Not only was this activity goal directed and directly related to his work occupation, but it also fulfilled Gerry's desire to use his talents in carpentry to help other clients in the hospital; this contributed to improving his feelings of self-worth. During the late phase of Gerry's recovery additional occupation-based activity was initiated to address his avocational interests. Outside the clinic, when Gerry actually played golf and softball, he was found to be hypersensitive in his palm over the scars. Desensitization techniques were added to his home program, and he purchased gloves with gel inserts to absorb the shock of hitting the ball.

Review Questions

1. A client is seen for a hand problem and is found to have limited or painful ROM of the shoulder. List three tests that should be performed.
2. Discuss three approaches to postoperative care of flexor tendon injuries and describe how the differences among the methods would influence the initiation of OT.
3. To what does "joint dysfunction" refer? What are its causes?
4. Discuss the three classifications of nerve injury.
5. Define the area referred to as "no-man's-land." What distinguishes injury to this area?
6. What techniques are used to evaluate the physical demand characteristics of work?
7. List three methods of applying pressure to a hypertrophic scar.
8. Which functional activities could be used to restore hand function after laceration and repair of the extrinsic finger flexors?
9. Which assessments should be included in a functional capacity evaluation?
10. List five tests used to assess joint integrity in the hand.
11. List three objectives of the use of orthotics for an injury of the radial, median, and ulnar nerves.
12. What are the characteristics of complex regional pain syndrome type I? What are the intervention goals?
13. Define work hardening. How can work hardening be incorporated into OT?
14. How is the presence of edema evaluated? List three methods used to reduce edema.
15. What are the primary work-related risk factors associated with cumulative trauma? How can the occupational therapist intervene to prevent the development of cumulative trauma?

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Resources

Anthony Products. http://www.anthonyproducts.com/

Baltimore Therapeutic Equipment (BTE). http://btetech.com/

Benik Corp. http://benik.com/

Bio Concepts. http://bio-con.com/

Central Tool Company of Germany (please see Anthony Products).

North Coast Medical & Rehabilitation Products. https://www.ncmedical.com/

Patterson Medical. http://www.pattersonmedical.com/

Smith & Nephew. http://www.smith-nephew.com/

Valpar International. http://valparint.com/

Winfield Laboratories. www.winfieldlabs.com

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[*]The websites for all manufacturers and suppliers mentioned in this chapter are available in the Resources list at the end of the chapter.

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Orthopedic Conditions

Hip Fractures and Hip, Knee, and Shoulder Replacements

Lynne F. Murphy, Sonia Lawson

CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Describe the etiology and medical management of hip fractures and hip, knee, and shoulder joint replacements and their effect on participation in occupations.
2. Identify precautions associated with hip fractures and joint replacements and their effects on intervention plans and occupational performance.
3. Outline client factors, performance patterns, and performance skills that are appropriate to include in the occupational therapy evaluation.
4. Develop occupational therapy goals that promote occupational engagement, utilizing information gained from the occupational profile and evaluation results.
5. Explain intervention procedures that incorporate precautions, ensure safety, and promote occupational performance in daily tasks.
6. Discuss the emotional and social impact of hip fractures and joint replacements on occupational performance and performance patterns.

KEY TERMS

Anterolateral approach

Arthroplasty

Codman's pendulum exercises
Degenerative joint disease
Hip precautions
Knee immobilizer
Minimally invasive technique
Open reduction and internal fixation
Osteoarthritis
Osteoporosis
Posterolateral approach
Shoulder sling and swathe
Weight-bearing restrictions

Introduction to Orthopedic Conditions

Hip fractures and lower extremity (LE) joint replacements are two orthopedic conditions that occur with a relatively high frequency. The Centers for Disease Control and Prevention (CDC) reported that more than 300 million hip fractures occurred in 2010, with the majority in older adults.[41] According to the American Academy of Orthopaedic Surgeons (2014), more than 1 million joint replacements were performed in 2011, with hip and knee replacements making up the majority.[23] Shoulder replacements total approximately 53,000 per year in the United States.[62] Age-related changes in older adults contribute most to falls resulting in hip fractures or the need to have a joint replaced. Persons who have been involved in activities or occupations that put great amounts of stress on their joints, over time, may experience pain and degeneration as they get older. In addition, older individuals are more likely to have orthopedic problems such as **osteoporosis** and arthritic joint changes as a part of the aging process. When joint problems occur at the hip, knee, or shoulder, in particular, temporary or more long-lasting disability may result. When individuals need to have these joints repaired, there is a period of time in which the joint is unstable, which limits an individual's participation in meaningful daily occupations. However, medical and rehabilitative advances continue to make orthopedic conditions easier to manage with less of an impact on occupational performance.

The elderly population is most at risk for hip fractures, primarily due to age-related changes in muscle strength, bone density, postural alignment, sensory function (eg, vision impairment, decreased proprioceptive awareness), and nervous system function.[32] Reduced balance, coordination, and mobility are potential risk factors for falls.[3] Postmenopausal women, in particular, develop osteoporosis to a greater degree than men and thus tend to have more hip fractures when they fall.[20]

Mobility is compromised in the elderly population because of decreased flexibility, diminished strength, reduced vision, decreased proprioceptive awareness, slowed reaction time, and the use of assistive ambulatory aids such as canes and walkers. Many elderly people become more cautious when moving about and are fearful of falling. This fear may contribute to more sedentary behavior, which can lead to further declines in strength and mobility. In some cases, individuals use a cane or walker improperly, which contributes to a fall. Not seeing a step or threshold may also cause a fall, as does tripping over items in the home (eg, throw rugs, cords).[60]

Individuals with a history of **osteoarthritis**, **degenerative joint disease**, or other rheumatic diseases that limit occupational performance are primary candidates for joint replacement. Individuals who elect to undergo these surgical procedures usually have been living with increasing pain in their joints for many months or years, and their ability to perform daily tasks is limited. By having the painful joint replaced, they hope to return to a more active and satisfying lifestyle. Occupational therapy (OT) plays a key role in identifying the many functional problems imposed by these acute and chronic orthopedic conditions and promoting compensatory or remediation approaches to facilitate the return of the orthopedic client to optimal performance of safe, independent, and meaningful occupations.

This chapter is divided into sections that include a discussion of hip fractures; hip, knee, and shoulder joint replacements; the associated medical and surgical management; and occupational therapy evaluation and intervention for these conditions. The *Occupational Therapy Practice*

Framework, Third Edition, is used to discuss the role of occupational therapy for persons with these conditions. Specific areas addressed in the chapter are occupational therapy evaluation of performance skills, occupational therapy interventions addressing specified occupations, the social and emotional implications of hospitalization and decreased functional abilities, and the interprofessional healthcare team approach in both the acute hospital and rehabilitation settings.

Emotional and Social Factors for the Orthopedic Patient

Attention to emotional and social issues is critical in the overall rehabilitation for the orthopedic client. Many clients in this population are faced with a chronic disability (eg, rheumatoid arthritis), a life-threatening disease (eg, cancer), chronic pain, or consequences of the aging process. The loss or potential loss of mobility and physical ability that limits participation in areas of occupation is a major concern for most of these clients. Adjusting to loss is stressful and requires an enormous amount of physical and emotional energy.[35] An awareness of and a sensitivity toward the psychosocial challenges of the person with an orthopedic problem are critical for the delivery of optimal client care.[48]

Clients with a chronic orthopedic disability often experience one or all of the following challenges: disease of a body part, fear, anxiety, change in body image, decreased functional ability, joint deformity, and pain. Interventions for a client with a chronic orthopedic condition must address these issues, especially in a preoperative phase or if a person chooses to decline surgery. The occupational therapy practitioner should be alert for signs of depression, guilt, anxiety, or fear that may impede participation in valued occupations. These emotions inhibit the client's progress and further damage the client's self-image. In a postoperative phase, clients may also experience pain, fear of operated extremity use, fear of falling, or unexpected delays in recovery that can also have detrimental effects on emotional health.[48]

Occupational therapists can help clients acknowledge and express emotional factors related to their condition, which can ultimately enhance the intervention process. One way to ease anxiety and fear is to make sure the client understands procedures and interventions, as well as the likelihood of a positive outcome. Taking time to answer questions and provide additional information can be crucial for successful adjustment. In addition, communication with the entire healthcare team is important to ensure that these emotional needs are considered in all aspects of healthcare management.

The elderly client experiencing disability deals with additional issues specific to the aging process, such as fear of dependence and relocation trauma. With the onset of a disability late in life, the client may be forced to let go of independence and self-sufficiency.[35] This can be a devastating experience for some clients, and prolonged grieving may be necessary before adjustment. Others may use dependence for secondary gain, remaining in the hospital for extra attention or manipulating their support systems to avoid taking responsibility for themselves and others. When individuals are removed from their familiar environment, confusion, disorientation, and emotional lability may result. Practitioners must take these factors into consideration when implementing an intervention plan and provide supports as needed.

Learning to cope and adjust to the changes resulting from chronic disability or the aging process is a critical aspect of recovery. Practitioners must realize that the client has relinquished a great deal of functional independence as a result of disease or disability. The occupational therapist must address the emotional and social issues resulting from this loss while focusing on maximizing the client's ability to participate in areas of occupation that are meaningful.[35]

OT Practice Notes

It is important for the occupational therapist working with clients who have orthopedic impairments or conditions to have a good understanding of the site, type, cause of the condition, any surgical procedures performed, and treatment precautions before starting the evaluation and intervention processes. A basic understanding of fracture healing and medical management procedures or protocols is also necessary to appreciate the risks, cautions, and implications to occupational performance. The occupational therapist is advised to review additional medical resources if more specific information is needed regarding surgical techniques and healing concerns.

Rehabilitation Team

Optimal rehabilitation for the orthopedic conditions discussed in this chapter requires coordination among the interprofessional team. Collaboration, communication, and clear role delineation among members of the interprofessional team are essential for an effective and efficient therapy program. In addition to the client, the team usually consists of a primary physician or surgeon, nursing staff, an occupational therapist or assistant, a physical therapist or assistant, a dietician, a pharmacist, caregiver, and a social worker or case coordinator. Many facilities have a protocol or critical pathway that outlines each team member's responsibilities and a time frame for accomplishing assigned tasks and goals related to the client's rehabilitation. Regular team meetings to discuss each client's ongoing progress and discharge plans are necessary for coordinating individual intervention programs. Members from each service usually attend each meeting to provide information and consultation. Clients are the most important members of the team. They are involved in goal setting and establishing a plan of care, and they must be able to engage in the interventions specified by other team members. Informal caregivers (eg, spouses, partners, significant others) should be considered part of the healthcare team, as they provide a good deal of care at home once the patient is discharged. Oftentimes restrictions and protocols must be followed weeks after joint repair, and the caregiver is responsible for ensuring those directions are followed in the home setting.

The role of the physician or surgeon is to manage medical needs and inform the team of the client's medical status. This includes information regarding medical history, diagnosis and treatment of the present problem, and information regarding the surgical procedure performed. The physician specifies any precautions or contraindications that all members of the team must enforce. Information provided may include the type of fixation or prosthesis inserted, the anatomic approach used in the surgery, weight bearing or other types of precautions, and contraindications such as movements that could endanger the client or impede healing. The physician is also responsible for ordering specific medications, overseeing the client's medication regimen, and directing pain-management approaches. The physician orders specific therapies and approves any change in the therapy program resulting from a change in the client's medical status.

The nursing staff is responsible for the physical care of the client during hospitalization, including care and monitoring of the surgical incision and administering prescribed pain medication according to the established pain management protocol. The orthopedic nurse must have a thorough understanding of the surgical procedures and movement precautions for each client. The nurse takes care of proper positioning using pillows and wedges, especially in the first few days after surgery. As the client's therapy program progresses, the client starts to take more responsibility for proper positioning and physical care. The nurse works closely with occupational and physical therapists and caregivers to carry through self-care and mobility skills that the client is learning in therapy.

The physical therapist is responsible for evaluation and intervention in the areas of musculoskeletal status, sensation, pain, skin integrity, and mobility (especially gait and bed mobility). In most cases involving joint replacement and surgical repair of hip fracture, physical therapy is initiated on the first day after surgery along with occupational therapy. Adhering to the prescribed precautions of the protocol, the physical therapist obtains baseline information, including range of motion (ROM), strength of all extremities, muscle tone, and mobility. A treatment program that includes therapeutic exercises, ROM activities, transfer training, and progressive gait activities is established. The physical therapist is responsible for recommending the appropriate assistive device to be used during ambulation. As the client's ambulation status advances, instruction in stair climbing, managing curbs, and outside ambulation is given.[25,38] In the case of shoulder replacements, the physical therapist implements mobility training that allows the client to protect the shoulder, works with occupational therapy to prevent movement that is not permitted, and may progress the client through the postsurgery protocol gradually increasing ROM and strength of the shoulder.

The dietician consults with each client to ensure that adequate and appropriate nutrition is received to aid the healing process. The pharmacist monitors the client's pain management and medication routine and provides information and assistance to clients and their caregivers regarding any medications to be continued at home after discharge.

The role of the case coordinator is to ensure that each client is being discharged to the appropriate living situation or facility and the availability of durable medical equipment as recommended by physical and occupational therapy practitioners. The case coordinator is usually a registered nurse or social worker with a thorough knowledge of available community resources and nursing care facilities. With input from the healthcare team, the case coordinator works with caregivers to make arrangements for ongoing therapy after acute hospitalization, for admission to a rehabilitation facility or skilled nursing facility for further intensive therapy if needed, or for home healthcare as appropriate. The case coordinator works closely with the interprofessional team and is instrumental in coordinating discharge plans.

The occupational therapist is concerned primarily with improving performance in daily activities and meaningful occupations but may also create exercise programs to address limitations in specific neuromusculoskeletal body functions/client factors as a basis for occupational performance. Focus is placed on safe execution of functional mobility, performance of activities of daily living, and performance of instrumental activities of daily living. The specific role of the occupational therapist will be discussed in detail in each of the following sections.

Section 1 Hip Fractures and Replacement

Threaded Case Study

Mrs. Hernandez, Part 1

Mrs. Hernandez, a 70-year-old Latina grandmother to three small children, fell outside of the senior center that she attends three times a week for exercise. She sustained a femoral neck fracture of her right hip. Prior to the fall, she had been experiencing increasing right hip pain due to osteoarthritis and degenerative joint disease, and she was concerned about increasing weakness in the right leg. She remembers not lifting her right leg high enough to clear the entrance step to the center where she tripped up the steps, and she was unable to catch herself and fell on her right hip. The fracture was repaired with a total hip replacement that was performed using an anterior approach, minimally invasive procedure. Movement precautions include no hip extension or crossing the legs and weight bearing as tolerated on the right lower extremity. Mrs. Hernandez is usually very active; she attends swimming classes twice a week, helps her daughter care for her three children, and heads two committees at her church. These activities became important to her after her husband died 5 years ago. They give her a sense of purpose and help her feel connected with others. Mrs. Hernandez lives alone in an apartment with elevator access. Her daughter and grandchildren live 15 minutes away and often visit and involve her in many of their family activities.

Mrs. Hernandez was referred for occupational therapy because of her difficulty with functional mobility and completing her daily activities. When asked about what bothered her most about her fall and subsequent hip replacement, she said that she was worried that she would no longer be able to participate in the swimming classes she enjoys so much, nor would she be able to drive herself to all of her appointments and church-related activities. This would make her dependent on her children and church friends. She was afraid of losing her independence, which she valued greatly. She is hoping that the occupational therapy she receives will help her drive again as soon as possible and allow her to remain as independent as possible so that she is not a burden to anyone.

Critical Thinking Questions

1. When completing the occupational profile, what additional information would the occupational therapist need to gather during the evaluation to supplement the information already provided in the case scenario?

2. Identify important areas of occupation and performance skills to address first when educating Mrs. Hernandez to safely perform her daily activities.

3. What prerequisite performance skills should be addressed with Mrs. Hernandez before the occupational therapist directly addresses her ability to drive again?

General Medical Management of Fractures

In general, a fracture occurs when the bone's ability to absorb tension, compression, or shearing forces is exceeded.[22] The healing process begins after the fracture. Osteoblasts, cells that form bone, multiply to mend the fractured area. Adequate blood supply is necessary to supply the cells with oxygen for proper healing. The fracture site may be protected during the postsurgical healing process by internal fixation, such as pins, plates, screws, or wires. In rare cases in which extra protection is needed, an external abduction brace may be used for the hip. This metal brace extends around the pelvis and down the thigh of the fractured hip and prevents movement, especially hip abduction, according to settings determined by the orthopedic surgeon. Other types of braces or casts may be used for fractures of other parts of the lower extremity (eg, a **knee immobilizer**). It may take several months for a bone fracture to heal completely. The time needed varies with the age, health, and nutrition of the client; the site and configuration of the fracture; the initial displacement of the bone; and the blood supply to the fragments.

Etiology of Fractures

Trauma is the major cause of fractures. In most cases, the trauma occurs as a result of falling. Poor lighting, throw rugs, and unmarked steps are environmental hazards that can lead to a fall. Osteoporosis is a bone disease that typically results in decreased bone density, most commonly in the vertebral bodies, the neck of the femur, the humerus, and the distal end of the radius. Because the bone becomes porous and therefore fragile, the affected bones are prone to fracture as a result of a fall or other traumatic event. A pathologic fracture can occur in a bone weakened by disease or tumor, as with osteomyelitis and cancers that have metastasized to the bone.[22]

Medical and Surgical Management

The goals of fracture management are to relieve pain, maintain good position of the bone, allow fracture healing, and restore optimal function to the client. Reduction of a fracture refers to restoring the bone fragments to normal alignment.[22] This can be done by a closed procedure (manipulation) or by an open procedure (surgery). The physician performs a closed reduction by applying force to the displaced bone to realign the bone. Depending on the nature of the fracture, the reduction or realignment is maintained by a cast, brace, traction, or skeletal fixation. With open reduction, the fracture site is exposed surgically so that the bone fragments can be aligned. The fragments are held in place with internal fixation such as pins, screws, a plate, nails, or a rod. Further immobilization by a cast or a brace may be deemed necessary by the orthopedic surgeon. Closed reductions and **open reduction and internal fixation** (ORIF) must be protected from excessive forces during bone healing. Therefore **weight-bearing restrictions** may be indicated.[22]

There are several levels of weight-bearing restrictions. The physician indicates at which level the client should be placed based on the surgical technique selected and the stability of the surgical repair. Elderly clients may not have the upper extremity strength to support their body during non-weight-bearing precautions. The surgeon may take this into account and use a more stable procedure to allow the client to bear weight at tolerance (WBAT) through the operated leg, thereby sparing overexertion of the upper extremities. Restrictions are reduced as the fracture site heals and becomes stronger.[15] The levels of weight-bearing restrictions are listed in Box 40.1.

Box 40.1

Weight-Bearing Restrictions

NWB (non–weight bearing) indicates that no weight at all can be placed on the extremity involved.

TTWB (toe-touch weight bearing) indicates that only the toe can be placed on the ground to provide some balance while standing—90% of the weight is still on the unaffected leg. In toe-touch weight bearing, clients may be instructed to imagine that an egg is under their foot.

PWB (partial weight bearing) indicates that only 50% of the person's body weight can be placed on the affected leg.

WBAT (weight bearing at tolerance) indicates that clients are allowed to judge how much weight they are able to put on the affected leg without causing pain that may limit function.

FWB (full weight bearing) indicates that clients are able to put 100% of their weight on the affected leg.[30]

From Early MB: *Physical dysfunction: practical skills for the occupational therapy assistant*, St. Louis, 1998, Mosby.

Types of Hip Fractures and Medical Management

Knowledge of hip anatomy is necessary for understanding the medical management of hip fractures. An anatomy and physiology reference text should be consulted for details. Figs. 40.1 and 40.2 illustrate a normal hip joint and the common locations and directions of fractures (fracture lines). The names of the fractures generally reflect the site and severity of injury and may signal the form of medical treatment that will be used. For example, a femoral neck fracture will typically be treated with femoral neck stabilization.[50]

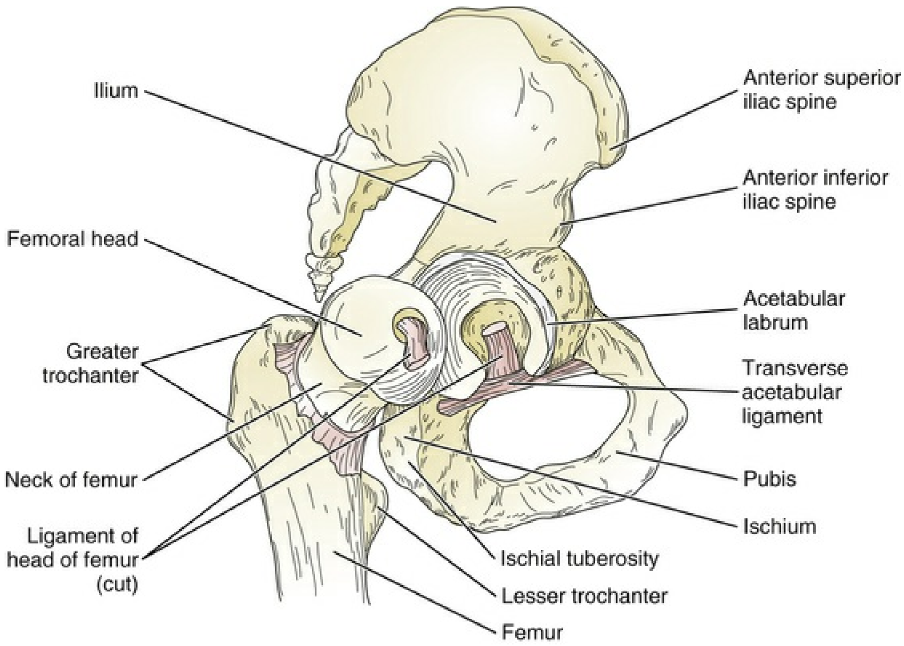

FIG 40.1 Normal hip anatomy. (From Reese NB, Bandy WD: *Joint range of motion and muscle length testing,* ed 3, St. Louis, 2017, Elsevier.)

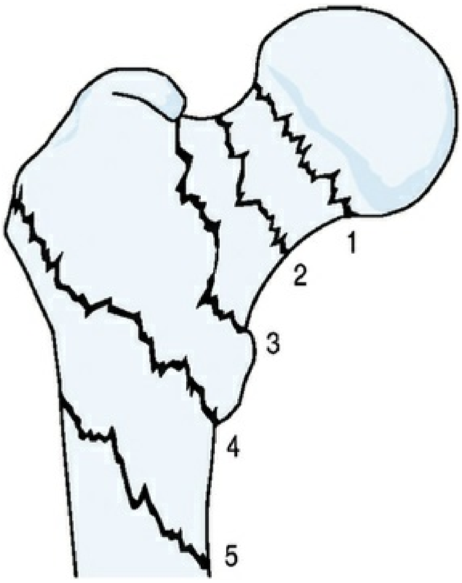

FIG 40.2 Levels of femoral fracture. 1, Subcapital. 2, Transcervical. 3, Basilar. 4, Intertrochanteric. 5, Subtrochanteric. (From Porter S, editor: *Tidy's physiotherapy,* ed 15. 2013, Churchill Livingstone, Elsevier.)

Femoral Neck Fractures

Femoral neck fractures, which include subcapital, transcervical, and basilar fractures, are common in adults over 60 years old and occur more frequently in women. If the bone is osteoporotic, fracture may result from even a slight trauma or rotational force.[35] Treatment of a displaced fracture in this area is complicated by poor blood supply, osteoporotic bone that is not suited to hold metallic fixation, and a thin periosteum covering the bone. The type of surgical treatment used is based on the amount of displacement and the vascular supply in the femoral head as well as the age, health, and activity level of the client.

Internal fixation or hip pinning (application of a compression screw and plate) is generally used when displacement is minimal to moderate and blood supply is intact. With a physician's approval, a client is usually able to begin limited out-of-bed activities 1 day after surgery. Per physician's orders, weight-bearing restrictions may be necessary, with the aid of a walker or crutches for at least 6 to 8 weeks while the fracture is healing. Weight bearing may be limited beyond this time if precautions are not observed or if delayed union occurs.[50]

With severe displacement or in the case of a femoral head with poor blood supply (avascular), nonunion (a poorly healing fracture site where new bone does not form), and degenerative joint disease, the femoral head is surgically removed and replaced by an endoprosthesis (referred to more simply as prosthesis). This joint replacement is called a hemipolar **arthroplasty**, often referred to as a hemiarthroplasty.[38,50] Several types of metal prostheses can be used for a hemiarthroplasty; each has its own shape and advantages to best fit the client's size. Weight-bearing restrictions are sometimes indicated. Surgeons may also choose to perform a total joint replacement depending on the integrity of the joint and anticipated activity level of the client. A total hip replacement may offer better patient satisfaction and functional outcomes for people who are very active.[12] Depending on the surgical procedure used with a hemiarthroplasty or total hip arthroplasty (replacement), posterolateral or anterolateral approach, specific precautions for positioning the hip must be observed to prevent dislocation. These precautions are the same as those advised for a total hip replacement, which will be outlined later in this chapter. Clients with a hemiarthroplasty or total hip replacement can usually begin limited out-of-bed activity, with a physician's approval, about 1 day after surgery.[38,50,56]

Intertrochanteric Fractures

Fractures between the greater and lesser trochanter are extracapsular, or outside the articular capsule of the hip joint, and the blood supply is not affected. Like femoral neck fractures, intertrochanteric fractures occur mostly in women but in a slightly older age group. The fracture is usually caused by direct trauma or force over the trochanter, as in a fall. The preferred treatment for these fractures is an ORIF. A nail or compression screw with a side plate is used. Weight-bearing restrictions must be observed according to the surgeon's orders for up to 6 to 8 weeks during ambulation, with gradual increases in the amount of weight taken through the affected leg over this time.[15] The client is allowed out of bed 1 day after surgery, pending the physician's approval.[50]

Subtrochanteric Fractures

Subtrochanteric fractures 1 to 2 inches below the lesser trochanter usually occur because of direct trauma, as in falls, motor vehicle accidents, or any other situation in which there is a direct blow to the hip area. These fractures make up 10% to 30% of hip fractures and are most often seen in persons younger than 60 years old or in older clients with severe osteopenia (significant bone loss) who have a low velocity fall.[43] These fractures can be the most challenging to repair due to the muscle attachments in this area that can cause forces on the fracture site, impairing proper fracture healing.[17] An ORIF is the usual treatment. A nail with a long side plate or an intramedullary rod is used. An intramedullary rod is inserted through the central part of the shaft of bone to help maintain proper alignment for bone healing.[22]

In all types of hip fractures, the practitioner should observe for and address any subsequent issues from the hip fracture that can impact the rehabilitation process and the client's ability to regain the skills needed to complete daily activities. Such issues can be reactions of the body to the surgery such as soft-tissue trauma, edema, and bruising that occur around the fracture or surgical site.[22,38,50] These issues can greatly affect the amount of pain and discomfort that a client may experience.

Fall Prevention

Another issue that frequently occurs for older adults after hip fracture due to a fall is fear of falling. Frequent falls in older adults can signal to the client and family members that there is a decline in function, which could lead to changes in independence and performance of desired and valued occupations. Psychologically, the client with frequent falls may fear the loss of independence and hide falls from others or under-report the number of falls that have occurred over time. A fear of falling may also lead older adults to reduce their activity level so as not to put themselves in a position to fall in the community. They stay in places that are familiar and risk social isolation and further decreases in strength and mobility. These functional decreases can lead to more falls.[60] It is important for the interprofessional team to be attuned to clues related to fall history for the client and potential negative psychosocial reactions to the fall.

Occupational therapists can work with other team members to provide fall prevention education and training. Occupational therapists can teach adaptive strategies, make environmental recommendations, explore community resources, and teach exercises that address strength, mobility, and balance. Physical therapists can also address fall prevention through therapeutic exercise and teaching correct use of an appropriate assistive device for ambulation. Information regarding local community-based fall prevention programs can be provided to the client and family. These programs, typically held at area senior centers, include education and exercise classes specifically geared to improving the body structures and functions that help reduce the risk of falling.[16] The Stopping Elderly Accidents, Deaths and Injuries (STEADI) Program obtained through the CDC is one example of a comprehensive fall prevention program. Materials and resources for professionals and the community can be accessed from the CDC website.[16]

Hip Joint Replacement

Etiology and Medical Management

Restoration of joint motion and management of pain by total hip replacement, also called arthroplasty or bipolar arthroplasty, is sometimes indicated when a person experiences decreased occupational performance often due to chronic disease processes. Common examples are osteoarthritis, degenerative joint disease, or rheumatoid arthritis, although other rheumatic and systemic diseases may also be present. Osteoarthritis and degenerative joint disease may develop spontaneously in middle age and progress as the normal aging process of joints accelerates. Degenerative changes may also develop as the result of trauma, congenital deformity, or a disease that damages articular cartilage. Weight-bearing joints such as the hip, knee, and lumbar spine are usually affected. In the hip, there is a loss of cartilage centrally on the joint surface and formation of osteophytes on the periphery of the acetabulum, producing joint incongruity. Pain originates from the bone, synovial membrane, or fibrous capsule and from muscle spasm. When movement of the hip causes pain and limited mobility, the muscles shorten, which can result in a hip position of flexion, adduction, and internal rotation that causes a painful limp.[45]

Rheumatoid arthritis (RA) (see Chapter 38) may involve the hip joint but because RA affects smaller joints before larger joints in the body, the hip is typically not affected until later stages of RA. Arthroscopic surgery can be performed early in the disease process to limit fibrotic damage to the joint and tendon structures.[22] However, once there is significant joint damage, a hip replacement may be the only alternative. Other disease processes (eg, lupus and cancer) and some medications (eg, corticosteroids such as prednisone) can compromise the blood flow to the hip joint and lead to avascular necrosis (AVN, a condition in which bone cells die because of poor blood supply) or osteoporosis; either condition results in a painful hip.[45]

When conservative forms of management for the pain and decreased mobility (eg, cortisone injections, modified activity, pain medication) are no longer successful, a total joint replacement is considered to restore an individual's ability to more fully participate in daily occupations. Consideration of the total joint replacement relies on a client's ability to comply with a rehabilitation program, the probability of a positive outcome given other medical issues the client may be facing, and the probability of a significant improvement in functional ability.[38,39] There are two mechanical components to this type of prosthesis. A high-density polyethylene socket is fitted into the acetabulum, and a metallic or ceramic prosthesis replaces the femoral head and neck. Methylmethacrylate or acrylic cement fixes the components to the bone (Fig. 40.3). Hip replacements can last for 15 to 20 years or more before a revision is needed to insert a new prosthesis. Wear and tear on the hip prosthesis is greater for more active people, who may then require a revision sooner than for those who are more sedentary. Those who have their hip replaced at a young age will likely have to undergo a revision in later years.[37]

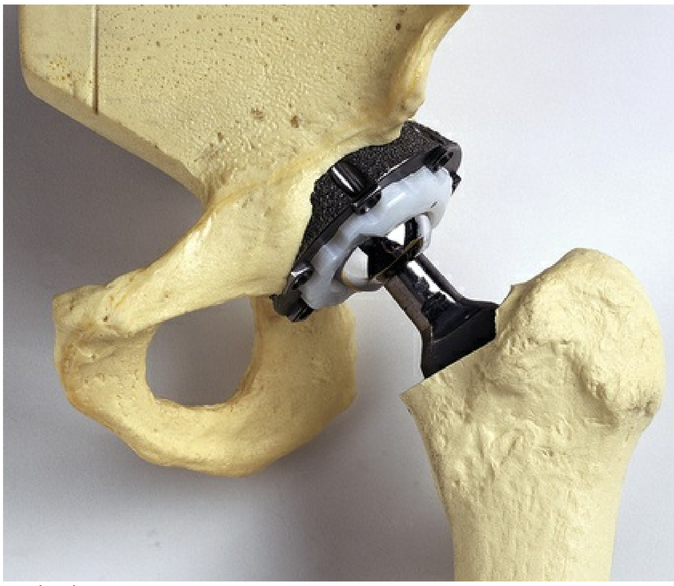

FIG 40.3 Hip prosthesis. (From Black J, Hawks J: *Medical surgical nursing: clinical management for positive outcomes*, ed 8, St. Louis, 2009, Elsevier.)

Various surgical approaches are used with the goal of choosing a technique that will provide the best stability for the client and reduces the occurrence of complications. The specific approach is selected based on the surgical skill or technique of the orthopedic surgeon, severity of the joint involvement, anatomic and biomechanical structure of the client's hip, and history of past surgery to the hip.[13,50] There are two main approaches, anterior and posterior, that indicate from which direction the surgeon opened the hip for the replacement. Both of these techniques have variations that involve the surrounding muscles of the hip to a greater or lesser degree. Muscles that must be displaced during the surgery are not able to support the joint postsurgery. This results in instability in certain directions of movement. With an **anterolateral approach**, the client will be unstable in external rotation, adduction, and extension of the operated hip and usually must typically observe precautions to prevent these movements for 6 to 8 weeks. Hip abduction may be prohibited as well with this surgical approach. It is important for the occupational therapist to carefully read the surgeon's postoperative orders. If a **posterolateral approach** is used, the client will be unstable primarily with hip flexion and must be cautioned not to move the operated hip past specific ranges of flexion (usually 90 degrees) and not to internally rotate or adduct the leg for 6 to 8 weeks. Failure to maintain these **hip precautions** during muscle and soft-tissue healing may result in hip dislocation (Box 40.2).

Box 40.2

Hip Precautions

Posterolateral Approach

- No hip flexion greater than 90 degrees
- No internal rotation
- No adduction (crossing legs or feet)

Anterolateral Approach

- No external rotation
- No adduction (crossing legs or feet)
- No extension

From Early MB: *Physical dysfunction: practical skills for the occupational therapy assistant*, St. Louis, 1998, Mosby.

In younger people, some surgeons may choose to replace the hip using a hybrid technique in which the acetabular socket is not cemented but the femoral component is cemented. In this case,[17] the use of biologic fixation (bony in-growth instead of cement) secures the prosthesis. This can increase the strength of the fixation at the prosthesis interface and can also decrease the possibility of loosening the prosthesis. In other words, new bone grows into openings in the prosthesis, and this secures the prosthesis to the bone. This noncemented approach can be used for both components of the prosthesis. The precautions following the surgery are identical to those of the anterior or posterior hip replacements, but they may involve an additional restriction on weight bearing.[38]

Many orthopedic surgeons use a **minimally invasive technique** to perform the posterolateral and anterior approaches for hip replacement. This technique reduces the amount of trauma to the muscle and soft tissue structures and allows for faster recovery. The traditional posterolateral surgical technique requires that a long (about 10 inches) incision be made and muscles detached to get to the hip joint. In the minimally invasive technique, two incisions of approximately 2 inches are needed and no detachment of muscles is required. Because no muscles are detached, the hip is more likely to remain in a stable position during the healing process. Similarly, for an anterior approach, a small vertical incision is made on the anterior surface of the hip joint with the hip placed in hyperextension. In addition to a faster recovery, this particular technique minimizes the risk of dislocation and postoperative limp.[46,50] The minimally invasive techniques are not appropriate for all total hip replacements or arthroplasties. Persons with severe damage to the hip joint or who have anatomic or biomechanical contraindications will require the traditional surgical method. Hip precautions that are identified for the posterolateral and anterolateral approaches are indicated for persons receiving a minimally invasive technique.[55]

To reinforce use of proper hip precautions during occupational performance and to guide intervention and discharge planning, the occupational therapist must know the type of surgical procedure that was performed. For example, someone with a hip replacement in which the minimally invasive technique was used may tolerate more activity after surgery than someone who underwent the traditional surgical technique. Clients with total hip replacements usually begin out-of-bed activity the same day of the surgery or the day after.

Hip resurfacing is another method of repairing a damaged and painful hip. This technique, less commonly used and with mixed evidence for efficacy over a total hip replacement, is a variation of the total hip replacement.[45] Designed for younger clients, the resurfacing technique preserves more of the bone of the femur should a total hip replacement be needed in later years. The surface of the femoral head is reshaped and then capped by a metallic shell. The acetabular cavity also receives a metallic cup or socket. Both are held in place by methylmethacrylate (acrylic cement). This technique preserves the femoral head and neck. With this technique, no weight-bearing restrictions apply.[18,45]

In summary, the occupational therapist must be informed of the surgical technique, movement precautions, and weight-bearing restrictions before beginning the evaluation and intervention of clients recovering from hip replacement surgery. Restrictions on weight bearing for any of the techniques vary in terms of amount of pressure and length of time, and the orthopedic surgeon will specify these limits. A walking aid, usually a walker or crutches, is necessary for at least the first month while the hip is healing and muscles are becoming stronger.[38] The occupational therapist has the responsibility of working with the inter-professional team to educate clients about their hip precautions and restrictions to allow the surgery to heal optimally without adverse effects such as dislocation. A joint that becomes dislocated may need additional surgery for repair. Strategies for completing daily tasks during the recovery process are implemented that allow the client to retain as much independence as possible while maintaining hip precautions and weight-bearing restrictions.

Special Considerations for Hip Replacements

Individuals with joint changes that increase pain may have multiple joint involvement (ie, both knees or hips, shoulders). With less frequency than for knee replacements, some clients opt to have two hip joints replaced during the same hospitalization, with procedures spaced apart by a few days. This can complicate the rehabilitation process because the client will not be able to rely on the nonoperated leg when walking, transitioning between seated and standing positions, and performing daily occupations.

It is important for the occupational therapy practitioner to be aware of complications or special procedures that occurred during a client's surgery and to verify precautions or risks with the physician. Surgeons will make specific recommendations based on the client's particular situation, surgical procedures used, or postoperative concerns. Common complications that can occur days or months after the surgery include dislocation of the hip joint, degeneration of the components of the prosthesis, fracture of bone next to implanted parts, loosening of prosthetic parts, and infection of the joint after surgery. A special procedure for individuals at high risk for a hip dislocation after surgery involves using an abduction brace to immobilize the hip joint.[22] This brace adds extra movement restrictions to the performance of daily tasks. Worn component parts, bone fractures, and sometimes dislocations must be repaired surgically. Additionally, clients with hip replacements are required to take prophylactic antibiotics for any future dental work or surgery to prevent infection at the joint replacement site.[47] The implantation of metal and plastic parts makes that area more susceptible to infection. Individuals living with a hip replacement must manage this chronic situation for the rest of their lives.

Postsurgical pain is often managed with a regimen of medications, such as epidural or periarticular anesthetics, patient-controlled analgesia, oral analgesics or opioids, or peripheral nerve blocks, although side effects and effectiveness are variable with individual clients. The pain may be caused by the trauma to soft tissues, edema surrounding the hip joint that places pressure on the incision, or improper positioning. Many hospitals that have a coordinated joint replacement program implement a pain management program in which clients receive regular and timely pain medication to allow optimum recovery and participation in their rehabilitation program. Other methods of pain control amenable to use by rehabilitation professionals include the use of superficial cold modalities, proper positioning during transitional movements, and a balance of rest and activity.

Medical Equipment

The OT practitioner should be familiar with the following equipment that is commonly used in the treatment of hip fracture and total hip replacement:

Hemovac. During surgery, a plastic drainage tube is inserted at the surgical site to assist with postoperative drainage of blood. It has an area for collection of drainage and may be connected to a portable suction machine. The unit should not be disconnected for any activity because this may create a blockage in the system. The Hemovac is usually left in place for 1 to 2 days after surgery.

Abduction wedge. Large and small triangular foam wedges (Fig. 40.4) are used when the client is supine to maintain the lower extremities in the abducted position.

FIG 40.4 Abduction wedge. (Courtesy Performance Health, Warrenville, IL.)

Balanced suspension. This is fabricated and set up by an orthopedic technician and can be used for about 3 days after surgery. It balances the weight of the elevated leg by weights placed at the opposite end of the pulley system. Its purpose is to support the affected lower extremity in the first few postoperative days. The client's leg can be taken out of the device for exercise only.[50]

Reclining wheelchair. A wheelchair with an adjustable backrest that allows a reclining position is used for clients who have hip flexion precautions while sitting.

Commode chairs. The use of a commode chair instead of the regular toilet aids in safe transfers and allows the client to observe necessary hip flexion precautions.

Sequential compression devices (SCDs). SCDs are used postoperatively to reduce the risk of deep vein thrombosis. They are inflatable, external leggings that provide intermittent pneumatic compression of the legs.[22]

Antiembolus hose. These are thigh-high elastic hosiery items that are worn 24 hours a day and removed only during bathing. Their purpose is to assist circulation, prevent edema, and thus reduce the risk of deep-vein thrombosis.[22]

Patient-controlled administration IV. Patient-controlled analgesia (PCA) is delivered through an IV; patient-controlled epidural analgesia (PCEA) is delivered through an epidural line. A prescribed amount of medication is programmed by the physician and nursing staff to allow the client to self-administer pain medication by pushing a button to inject a safe amount. When dosages have reached a limit, the machine will not administer medication even if the button is pushed.

Incentive spirometer. This portable breathing apparatus is used to encourage deep breathing and prevent the development of postoperative pneumonia.

Role of Occupational Therapy for Clients With Hip Fracture or Hip Replacement

After a hip replacement or surgical repair of a fractured hip, OT typically begins when the client is ready to start getting out of bed, usually the day of surgery or the following day. The actual time varies, depending on the age and general health of the client and on surgical events or medical complications involved. Before any physical assessment, it is important to introduce and explain the role of OT and complete an occupational profile. This profile involves gathering information regarding the client's occupational history, prior functional status in activities of daily living (ADLs) and instrumental activities of daily living (IADLs), descriptions of performance contexts (eg, home environment and social support available), and the client's goals. The goal of OT is for the client to maximize performance skills in daily occupations, with all movement precautions observed during activities. The role of the occupational therapist and assistant is to teach the client ways and means of performing daily occupations safely.[35]

Evaluation and Intervention

The occupational therapist's role is to assume responsibility for performing any assessments necessary for a complete evaluation. In addition to an occupational profile, an assessment of the psychosocial issues related to the surgery and the surgery's impact on the client's lifestyle is completed via interview. A baseline physical evaluation is necessary for determining whether any physical limitations not related to surgery might prevent functional independence. Performance skills and client factors such as upper extremity (UE) ROM, muscle strength, sensation, and coordination and status of cognitive skills are assessed before a functional evaluation is made, as these can impact the client's ability to fully participate in the rehabilitation program. Evaluation of activities of daily living, instrumental activities of daily living, and functional mobility is necessary for clinical reasoning and holistic intervention planning. During evaluation, it is also important to observe and document any signs of pain and fear at rest or during movement.

Based on evaluation results and a thorough clinical reasoning process, the occupational therapist creates an intervention program of functional activities that gradually enables the client to regain the abilities and skills necessary to participate in identified areas of meaningful occupation. The therapist introduces and trains clients in the use of assistive devices, proper transfer techniques, and ADL and IADL techniques while maintaining hip and weight-bearing precautions. An occupational therapy assistant may play a large role in this training. Both the occupational therapist and the occupational therapy assistant are involved in treatment planning, documentation, and discharge planning (including the recommendation of equipment and home exercise programs).

Client Education

Although hip fractures are never a planned occurrence, hip replacements are usually planned and scheduled to be performed on a specific date. Occupational therapists often provide education classes for individuals at risk for fractures and those planning joint replacement. As mentioned earlier in the chapter, for the person who may be at risk for falling, attending a class on fall prevention is a wise recommendation. Topics may include home modifications (eg, removal of throw rugs, telephone cords, and clutter), safe transfer techniques, use of public transportation, and community mobility tips. The person who is having an elective total joint replacement may benefit from a class offered before surgery that explains the surgical procedures and precautions, introduces assistive devices, describes the therapy process, and describes the typical recovery period so that the client can be best prepared.

Specific Training Techniques for Participation in Occupations

Some common assistive devices are useful for many people with hip fractures or hip replacements (Fig. 40.5). Helpful assistive devices or adaptive aids include a dressing stick, sock aid, long-handled sponge, long-handled shoehorn, reacher, elastic shoelaces, leg lifter, elevated toilet or commode seat, three-in-one commode, and shower chair or bench. Walker bags are helpful for people using walkers who need to carry small items from one place to another. The OT clinic should have samples of these devices that are available for client use during the intervention process.

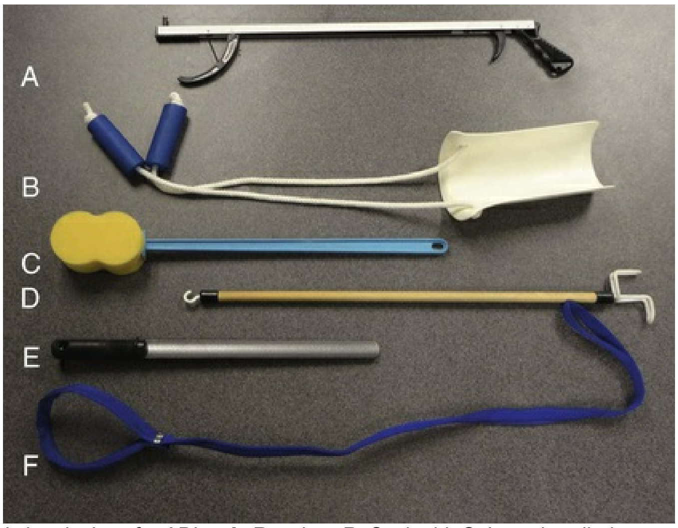

FIG 40.5 Assistive devices for ADLs. **A,** Reacher. **B,** Sock aid. **C,** Long-handled sponge. **D,** Dressing stick. **E,** Long-handled shoehorn. **F,** Leg lifter.

The training procedures outlined in the following sections apply to hip fractures and the different types of hip joint replacement. The positions of hip instability for the specific types of surgical procedures for hip replacement are important to remember. For the posterolateral approach (traditional or minimally invasive), positions of instability include adduction, internal rotation, and flexion greater than 90 degrees. For the anterolateral approach (traditional or minimally invasive), positions of instability include adduction, external rotation, and excessive hyperextension.

Bed Mobility

The supine position with an abduction wedge (see Fig. 40.4) or pillow in place is recommended in bed. If a client sleeps in the side-lying position, sleeping on the operated side is recommended if tolerable. When sleeping on the nonoperated side, the client must keep the legs abducted with the abduction wedge or large pillows supporting the operated leg to prevent hip adduction and rotation. The client is instructed in getting out of bed on both sides, although initially it may be easier to observe precautions by moving toward the nonoperated leg. Careful instruction is given to avoid adduction past midline. It is important to determine the type and height of the client's bed at home. When getting in and out of bed initially, the client may use a leg lifter to help the operated leg move from one surface to another. Some clients have an overhead trapeze bar placed on the bed to assist with bed mobility. It is important to wean the client away from using this device because he or she will most likely not have one at home.

The best procedure for moving from the supine position to sitting on the edge of the bed is to have clients support the upper body by propping up on their elbows, then moving the lower extremities toward the side of the bed in small increments, and following with the trunk and upper extremities (Fig. 40.6). The client should gradually turn in this manner until he or she can lower the legs out of the bed and push the trunk into the sitting position. Following a posterior approach hip replacement, the occupational therapist should observe the client when sitting to ensure that the client is not flexing the hip more than 90 degrees. If so, the client can extend the knee, which will cause the hip to be less flexed and widen the hip angle so that precautions are maintained.

FIG 40.6 Bed mobility.

Transfers

It is always helpful for the client to observe the proper technique for transfers before attempting the movement.

OT Practice Notes

One way to help therapists understand the impact of maintaining the proper hip position during the healing process is for the therapist to tape a goniometer to his or her own hip when positioned at 90 degrees and attempt to do the transfers listed next. Therapists will soon discover the difficulty of maintaining the proper hip position during functional activities!

Chair.

A firmly based chair with armrests is recommended. To move from standing to sitting, the client is instructed to back up to the chair, extend the operated leg forward, reach back for the armrests, and slowly lower to the sitting position. For the person with a posterolateral approach, care should be taken not to lean forward when sitting down (Fig. 40.7). To stand, the client extends the operated leg and pushes up from the armrests. Once standing, the client can reach for an ambulatory aid, such as a walker if it is being used. Because of the hip flexion precaution for the posterolateral approach, the client should sit on the front part of the chair and lean back (see Fig. 40.7). Firm cushions or blankets may be used to increase the height of chair seats and may be especially helpful if the client is tall. Low chairs, soft chairs, reclining chairs, and rocking chairs should be avoided.[1]

FIG 40.7 Chair/commode transfer technique. Client's right hip has the hip replacement. The nonoperated leg is used for weight bearing during sitting and standing from the chair/commode.

Commode chair.

Three-in-one commode chairs with armrests can be used in the hospital and at home (see Fig. 40.7). For the person with a posterolateral approach, the height and angle can be adjusted so that the front legs are one notch lower than the back legs; thus with the client seated, the precautionary hip angle of flexion is not exceeded. A person with an anterolateral approach may have enough hip mobility to use a standard toilet seat safely at the time of discharge. All clients should wipe between the legs in a sitting position or from behind in a standing position and use caution to avoid forward flexion of the hip greater than 90 degrees, or rotation of the hip. The client is to stand up and step to turn to face the toilet when flushing so as to avoid hip rotation.[1] Comfort height toilets (17-inch seat height) can be considered for installation at home as a permanent modification that eases transfers to the toilet.

Shower stall.

Nonskid strips or stickers are recommended in all shower stalls and tubs. When the client is entering the shower stall, the walker or crutches go first, then the operated leg (taking care to avoid active hip abduction if the client is not allowed to perform this motion), and then the nonoperated leg. Installation of a shower chair with adjustable legs or a stool and grab bars is strongly encouraged to prevent the client from losing balance and to maintain weight-bearing precautions. An alternate method to enter the shower stall is to back up to the edge or rim of the shower while using the walker for balance, then stepping into the shower while looking down at the feet and shower rim for safety.

Tub shower (without shower doors).

The client is prohibited from taking a bath sitting on the floor of the tub. This action puts the client at severe risk of causing damage to the impaired joint as well as other types of injuries. A tub chair or tub transfer bench is strongly recommended to preserve hip precautions. The client is instructed to back up to the tub chair or bench using the walker or crutches for support. Then the client should reach for the backrest, extend the operated leg, and slowly lower to a seated position. The legs can then be lifted into the tub as the client leans back, using a leg lifter or bath towel if needed to support the operated leg. A handheld shower is helpful in directing the water for an effective and comfortable bath. Sponge bathing at the sink is an alternative activity,[1] although use of a long-handled sponge or reacher is recommended to avoid hip flexion when bathing the lower extremities.

Car.

Bucket seats in small cars should be avoided. The client is instructed to have a helper move the front passenger seat back as far as it will go and recline the back support in order to observe the hip flexion precaution. Then the client is instructed to back up to the seat, hold onto a stable part of the car, extend the operated leg, and slowly sit in the car. Remembering to lean back, the client then slides the buttocks toward the driver's seat. The upper body and LEs move as one unit to turn to face the forward direction. Firm pillows in the seat may be necessary to increase the height of the seat. Prolonged sitting in the car should be avoided. If transferring to the front passenger seat is a problem, transferring to the back seat of a four-door car is an alternative. The client backs to the seat, extends the operated leg, and slowly sits in the car. Then he or she slides back so that the operated leg is resting on the seat fully supported. Clients should not return to driving until given permission by their surgeon, even if the operated leg is not the leg used for operating the controls. Certain pain medications may cause driving to be unsafe.

Lower-Body Dressing

The client is instructed to sit in a chair with arms or on the edge of the bed for dressing activities. The client is instructed to avoid hip flexion, adduction and rotation, or crossing the legs to dress. The client must refrain from crossing the operated extremity over the nonoperated extremity at either the ankles or the knees. Assistive devices may be necessary for observing precautions (see Fig. 40.5). To maintain hip precautions, the client uses a reacher or dressing stick to put on and remove pants and shoes. For pants and underwear, the operated leg is dressed first by using the reacher or dressing stick to bring the pants over the foot and up to the knee. A sock aid is used to don socks or knee-high stockings, and a reacher or dressing stick is used to doff them. A reacher, elastic laces, and a long-handled shoehorn can also be provided.[1] It is also prudent for the occupational therapist or occupational therapy assistant to discuss clothing choices with the client for ease of dressing. Slip-on shoes with a nonslip sole, for example, may be easier to put on with appropriate adaptive equipment than sneakers with elastic laces.

Lower-Body Bathing

The section on transfers describes the proper method of getting in and out of the shower or tub. Sponge bathing at the sink is indicated until the physician designates that it is safe for the client to shower. Many surgeons use a waterproof bandage over the incision, which protects the site from infection thereby allowing the client to shower before the incision is healed. Care must be taken for clients who are given permission to shower early on in the recovery process. Pain medication and effects from anesthesia may make the patient dizzy when standing or sitting for long periods. The client must be monitored closely. A sponge bath may still be the safest alternative. A long-handled bath sponge or back brush is used to reach the lower legs and feet safely. Soap-on-a-rope is used to prevent the soap from dropping, and a towel is wrapped on a reacher to dry the lower legs.[1] Once showering is approved, a handheld shower head is recommended to direct the water and provide a more comfortable shower.

Hair Shampoo

Until able to shower, the client is instructed to obtain assistance for shampooing hair. The client can have a helper wash the hair while the client is supine, using pillows for back support and a bucket or bowl to catch the water poured from a pitcher to rinse the hair. Another method involves having the client sit in a chair with the back to the sink. The client leans backward to position the head over the sink while the helper washes the hair. The client can also visit a hair salon until he or she is able to perform hair washing independently. If unable to obtain any assistance, the client may shampoo the hair while standing at the kitchen sink with a handheld sprayer, observing hip precautions at all times. Because bending forward at the kitchen sink can be performed with less than 90 degrees of hip flexion, most clients can observe the proper hip precautions using this method.

Homemaking

The client should initially refrain from heavy housework, such as vacuuming, lifting, and bed making. Kitchen activities can be initiated in therapy, with suggestions made to keep commonly used items at countertop level or within easy reach. The client can carry items by using an apron with large pockets, sliding items along the countertop, using a utility cart, attaching a small basket or bag to a walker, or wearing a fanny pack around the waist. Reachers are provided to grasp items in low cupboards or retrieve items from the floor (Fig. 40.8). Items in the refrigerator should be kept on the higher shelves, with only light items that can be obtained with the reacher on lower shelves. For cooking activities, it is recommended that the client use the stovetop or microwave oven rather than placing items in the oven, as it is difficult to maintain hip precautions when reaching in or out of the oven. Washing dishes should be done at the sink or using the top level only of an automatic dishwasher. The occupational therapy practitioner should also instruct the client in relevant energy conservation techniques for instrumental activities of daily living.

FIG 40.8 Functional activities.

Sexual Activity

Persons with a hip fracture or hip replacement will have difficulty performing sexual activities in their usual manner. It is recommended that such persons refrain from sexual activity for a few weeks as specified by their physician so that they maintain the movement precautions applicable to their condition.[38] However, the occupational therapist must create an environment in which the client feels comfortable enough to ask personal questions. The therapist can do this by being open-minded and realizing that sexual activity is an important and meaningful activity of daily living. For clients with a hip replacement, the therapist can suggest participating in sexual activity while side-lying on the nonoperated side when they are allowed to resume this activity. Hip abduction precautions can be maintained by placing pillows between the knees. To prevent excessive external rotation at the hips while in the supine position, the client can place pillows under the knees.[38] Written information with diagrams can be helpful when addressing such a personal issue. The client can read this information privately or with his or her partner.

Caregiver Training

A family member, friend, or caregiver should be present for OT intervention sessions so that any questions may be answered. Appropriate supervision recommendations and instruction regarding activity precautions are given at this time. So that they fully understand the impact of following the hip precautions, caregivers should be encouraged to practice doing the adapted activities as well. Instructional booklets on hip fractures and total hip surgery may be purchased from the American Occupational Therapy Association to supplement training.[1]

Evidence Regarding Occupational Therapy Intervention

A limited number of studies have examined OT intervention for hip joint replacements and hip fractures. Mikkelsen and colleagues examined the effects of reduced (less strict) posterior hip precautions along with the use of assistive devices on patient outcomes versus outcomes for patients who followed strict movement precautions but also used assistive devices.[40] They found that initially there were better outcomes for those patients following the strict movement precautions, but after 6 weeks there was no difference. However, patients with the reduced restrictions returned to work at a higher rate than those who followed the strict movement precautions. It was important for both groups in this study to have been trained properly to use assistive devices for daily activities. Therapists should still be sure to follow the surgeon's directions regarding hip precautions.[40]

Sirkka and Branholm examined life satisfaction in 29 Swedish older adults who suffered a hip fracture. Participants reported a significant decline in their ability to perform hobbies and social activities after their hip fracture and that these activities were more important than self-care activities.[57] Elinge and colleagues also found that social interaction was affected more than other areas of occupation for older adults who have had a hip fracture. Therapists can use the results of these studies to support addressing all areas of occupation and not just ADL.[26] By designing an intervention that targets the client's prior performance patterns and emotional and social needs, the occupational therapist can play a key role in the client's psychosocial adjustment to physical limitations and in maximizing the client's return to participation in meaningful activities.

Threaded Case Study

Mrs. Hernandez, Part 2

1. When completing the occupational profile, what additional information would the occupational therapist need to gather during the evaluation to supplement the information already provided in the case scenario?

Mrs. Hernandez's occupational profile revealed that she has many roles that she finds meaningful: grandmother, church member, and swimmer. She also seems to value being independent. She not only does things with her daughter and her family but also has interests and activities in which she participates on her own. Supporting contextual factors include an accessible home, a daughter nearby who involves her in many activities with her children, and church friends who can offer some assistance. Nonsupportive contextual factors include an inaccessible swimming pool and the fact that she lives alone. Additional information that would be useful to obtain from Mrs. Hernandez for the occupational profile includes but is not limited to specific information about the arrangement of furniture and other items in her home, how willing her daughter is to assist Mrs. Hernandez with her needs or whether the daughter is already assisting with some IADLs, prior surgeries or conditions that would impact the current plan of care or lead to additional falls, history of falls, and equipment or home modifications already established. This information will aid the occupational therapist in planning for discharge and specific equipment recommendations.

2. Identify important areas of occupation and performance skills to address first when educating Mrs. Hernandez to safely perform her daily activities.

Client factors that must be assessed before training Mrs. Hernandez to perform her daily activities safely, including driving, are strength, ROM, sensation, cognition, coordination, and pain. These factors will impact the extent to which she will be able to engage in and learn the prerequisite performance skills needed to optimize her independence in ADLs and IADLs. The occupational therapist must first be sure that Mrs. Hernandez understands the hip precautions and is able to recall them. Then the occupational therapist must address her ability to move herself in and out of bed and perform toileting functions while observing the hip precautions. These prerequisite skills will prepare her for more advanced skills like dressing, bathing, driving, and home management activities. Because she lives alone, she needs to be able to complete all of her ADLs and IADLs independently. The therapist should be sure to address the prerequisite skills first and progress Mrs. Hernandez to more complex ADL tasks that increase her confidence to return home and resume her typical occupations and performance patterns.

3. What prerequisite performance skills should be addressed with Mrs. Hernandez before the occupational therapist directly addresses her ability to drive again?

Because driving allows Mrs. Hernandez to get to her swimming classes, church meetings, and her daughter's home, this is placed as a priority in the list of problems, and she verbalizes that this issue is most important. Mrs. Hernandez should have demonstrated relative independence in different types of transfers, especially car transfers, before she considers driving again. It is important that she obtain medical clearance from her physician or surgeon before resuming driving activities. The occupational therapist can assist her in identifying other community mobility resources available to her until she resumes driving and can complete other assessments directly related to driving, such as an off-road driving assessment.

Section 2 Knee Joint Replacements

Etiology and Medical Management

Knee pain affects the mobility and functional performance of many adults, often due to osteoarthritis in people aged 50 and older. In fact, this knee pain and loss of function are the primary reasons that some people elect to have knee joint replacements.[42] Knee pain is often due to osteoarthritis or degenerative joint disease, trauma or injury to the knee, or other rheumatic conditions and may be compounded by obesity or aging. Surgical knee replacement may be chosen by individuals to alleviate pain, increase motion, and maintain alignment and stability of the knee joint when conservative treatment has failed. Performance in occupations increases the likelihood of the intended result.

The process of knee replacement involves cutting away the damaged bone (as little bone as possible) and attaching prosthetic components of a new joint.[61] Various types of prostheses are used, depending on the severity and region of knee damage (Figs. 40.9 and 40.10). A partial or unicompartmental knee arthroplasty (UKA) is indicated if there is medial or lateral compartmental damage between the femur and tibia. The UKA is often placed with a minimally invasive technique, which allows greater knee flexion (up to 90 degrees) more quickly after surgery.[51] Because limited ligaments and structures of the joint are disrupted, increased stability is obtained immediately.[44]

FIG 40.9 Knee prosthesis. (From Black J, Hawks J: *Medical surgical nursing: clinical management for positive outcomes,* ed 8, St. Louis, 2009, Elsevier.)

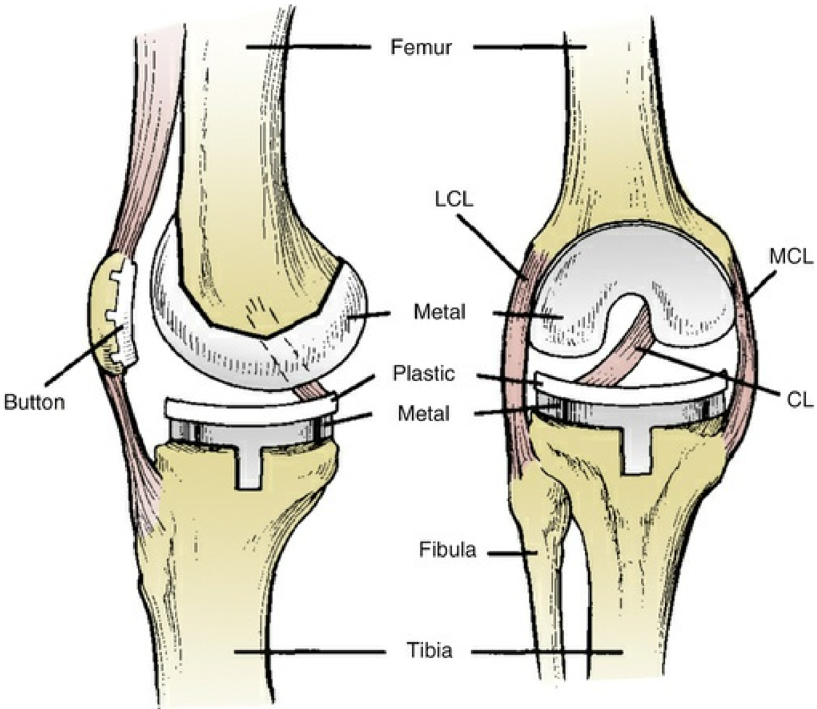

FIG 40.10 Total knee replacement. The metal aspects of the prosthesis cover the distal portion of the femur and the end of the tibia. There is a polyethylene plastic-bearing surface (plastic) between the metallic aspects of the two surfaces. The patella is replaced by a polyethylene button. The medial collateral ligament (MCL), lateral collateral ligament (LCL), and cruciate ligaments (CL) are retained. (From Early MB: *Physical dysfunction: practical skills for the occupational therapy assistant,* ed 3, St. Louis, 2013, Mosby; modified from Calliet R: *Knee pain and instability,* ed 3, Philadelphia, 1992, FA Davis.)

Total knee replacement, or total knee arthroplasty (TKA), is indicated when two or more compartments of the knee are damaged. Various prosthetic devices are chosen based on the medical condition and activities performed by the client.[36] A fixed weight-bearing prosthesis allows only flexion and extension of the knee, as the polyethylene tibia insert is locked into the tibial tray.[54] A rotating platform prosthesis, or mobile weight-bearing prosthesis, allows the slight rotation normally available at the knee, as the tibial component is not locked. This allows for more normal function at the knee, but it has a slightly higher risk of mechanical failure.[54] The rotating platform is typically used for younger, more active people, or for women, as they typically have more rotation available at the knee than men.[31] Both types of prostheses typically decrease pain, improve functional mobility, and enhance quality of life for individuals with degenerative knee conditions. They can be put in place with various surgical techniques, including minimally invasive approaches, in which there is less damage to the quadriceps tendon and the medial collateral ligament, which may improve range of motion at the knee and lead to faster postoperative recovery.[59] The prosthesis can be cemented to the bone with acrylic cement or not cemented. With a cemented prosthesis, clients are usually able to bear weight as tolerated on the operated leg. With a noncemented prosthesis, initial weight bearing is usually avoided or restricted. The choice to use cement to hold the prosthesis in place is typically based on the preference of the surgeon. However, the noncemented procedure requires that the client does not have any other health issues that would slow bone growth, which would extend the time frame for restricted weight bearing.

Clients typically start out-of-bed activities on the first day after surgery, pending the physician's approval and with appropriate assistance or supervision. An ambulatory device, such as a walker or crutches, may also be used for greater stability. If the knee joint is unstable following surgery for any reason, the physician may indicate that a knee immobilizer or other brace should be used to preserve knee joint alignment (Fig. 40.11). The client should avoid excessive rotation at the knee for up to 12 weeks after surgery. There is usually no restriction on flexion and extension of the knee. In fact, maintaining the mobility of the knee is important to ensure adequate mobility during healing, and to regain normal motion and function.[14,25,38,50] Some surgeons recommend the use of a continuous passive motion (CPM) device to provide slow, controlled movement with the intent of improving functional range of motion and reducing postsurgical edema, although there is limited evidence of the long-term effectiveness of the CPM machines.[7,10,25]

FIG 40.11 A knee immobilizer is used to support and stabilize the knee joint during mobility. (From Ignatavicius D, Workman ML: *Medical-surgical nursing: patient-centered collaborative care,* ed 8, St. Louis, 2016, Elsevier.)

Special Considerations for Knee Replacements

As with hip replacements, individuals with joint changes that result in increasing pain may have multiple joint involvement (ie, both knees). Some clients opt to have two joints replaced during the same hospitalization, either during the same surgery or with procedures 3 to 7 days apart. This can complicate the rehabilitation process because the client will not be able to rely on the nonoperated leg when walking, transitioning between seated and standing positions, and performing daily occupations. However, it eliminates the need for an additional hospitalization if both knees are affected. The orthopedic surgeon should discuss these options with the client to determine the most appropriate course of action.

It is important for the occupational therapy practitioner to be aware of complications or special procedures that occurred during a client's surgery and to verify precautions or risks with the physician. Surgeons will make specific recommendations based on the client's particular situation, surgical procedures used, or postoperative concerns. Common complications include dislocation of the prosthesis, degeneration of parts, fracture of bone next to implanted parts, loosening of prosthetic parts, and infection of the joint after surgery.[22]

Some clients describe postsurgical pain that is more significant following total knee replacement as compared to total hip replacement. This is often managed with medications, such as epidural or periarticular anesthetics, patient-controlled analgesia, oral analgesics or opioids, or peripheral nerve blocks, although side effects and effectiveness vary with individual clients.[27] Other methods of pain control amenable to use by rehabilitation professionals include the use of superficial cold modalities, proper positioning during transitional movements, use of CPM machines after therapy if approved by the physician, and balance of rest and activity.

As with hip replacement, the emphasis in rehabilitation is on maintaining or increasing joint motion, slowly increasing the strength of surrounding musculature, decreasing swelling, and increasing the client's independence and participation in areas of occupation, particularly ADLs. The occupational therapist's role in this process is primarily to educate the client who has undergone joint replacement about applying adaptive techniques for ADLs and IADLs with limited mobility while maintaining any joint precautions for movement or weight bearing.

Medical Equipment

The OT practitioner should be familiar with the following equipment that is commonly used in the treatment of knee replacement:

- *Hemovac.* During surgery, a plastic drainage tube is inserted at the surgical site to assist with postoperative drainage of blood. It has an area for collection of drainage and may be connected to a portable suction machine. The unit should not be disconnected for any activity because this may create a blockage in the system. The Hemovac is usually left in place for 1-2 days after surgery.
- *Commode chairs.* The use of a commode chair instead of the regular toilet aids in safe transfers and allows the client to limit flexion of the knee during toileting.
- *Sequential compression devices (SCDs).* SCDs are used postoperatively to reduce the risk of deep vein thrombosis. They are inflatable, external leggings that provide intermittent pneumatic compression of the legs.[22]
- *Antiembolus hose.* This elastic hosiery may be extended up to the knee or over the knee and on the thigh, depending on physician preference They are worn 24 hours a day and removed only during bathing. Their purpose is to assist circulation, prevent edema, and thus reduce the risk of deep-vein thrombosis.[22]
- *Patient-controlled administration IV.* Patient-controlled analgesia (PCA) is delivered through an IV; patient controlled epidural analgesia (PCEA) is delivered through an epidural line. A prescribed amount of medication is programmed by the physician and nursing staff to allow the client to self-administer pain medication by pushing a button to inject a safe amount. When dosages have reached a limit, the machine will not administer medication even if the button is pushed.
- *Incentive spirometer.* This portable breathing apparatus is used to encourage deep breathing and prevent the development of postoperative pneumonia.
- *Continuous passive motion (CPM) machine.* This mechanical device supports a joint and can be set to move slowly through a designated range of motion to promote controlled movement in the operated joint.

Role of Occupational Therapy for Clients With Knee Joint Replacement

After a knee replacement, OT typically begins on the first post-operative day, but there may be some variation depending on the general health of the client and on the physiologic response to surgery. Before any physical assessment, it is important to introduce and explain the role of OT and complete an occupational profile. This profile involves gathering information regarding the client's occupational history, prior functional status in ADLs and IADLs, descriptions of performance contexts (eg, home environment and social support available), and the client's goals. The goal of OT is for the client to maximize performance of daily occupations, with all movement precautions observed during activities. This often involves improving activity tolerance, addressing functional mobility, and providing education in the use of adaptive equipment.[21] The role of the occupational therapist and assistant is to teach the client ways and means of performing daily occupations safely.[35]

Evaluation and Intervention

Following the occupational profile, an assessment of the motor, cognitive, social, and emotional factors is recommended, specifically as they relate to occupational performance. Performance of motor skills such as upper extremity (UE) ROM, muscle strength, sensation, and coordination must be assessed to determine if any adaptations should be made to functional mobility or use of adaptive equipment. Mental functions such as memory, problem solving, and sequencing must be considered in light of potential precautions, safety awareness, and performance of occupations. Activities of daily living and other relevant occupations should be evaluated through standardized assessments, direct observation, or interview as the context and client condition allow. The skilled occupational therapist should be able to identify if social or emotional concerns are present, including pain, fear of falling, hesitation to resume normal activities, or concerns about surgical healing.

OT intervention planning requires careful consideration of evaluation data and clinical reasoning skills to determine how the specific client's needs and concerns can be addressed through a program of functional activities that gradually enables a person to resume meaningful occupations. The therapist introduces and trains clients in the use of assistive devices, proper transfer techniques, and ADL and IADL techniques while ensuring safe positioning of the knee and prosthetic components. Discharge planning should be considered early, as many clients are able to return home within a few days if ADL and IADL function can be restored. Clients who need additional rehabilitation to regain occupational performance, who have limited community support, and with inhibitory contexts may be recommended for inpatient rehabilitation after the acute hospital stay.

Specific Training Techniques for Participation in Occupations

Following any type of knee replacement, the occupational therapist should encourage weight bearing as specified by the surgeon, and knee flexion and extension as allowed by pain level and surgical outcomes. It is encouraged that the leg be supported by the occupational therapist when a client is moved from sitting with the legs elevated—for example, in a recliner or geri-chair—to seated with feet on the floor in preparation for transfers or standing. Clients may also be encouraged to participate in deep breathing and relaxation as methods of pain control.

Bed Mobility

The supine position is recommended when the client is resting in bed, with the knee fully extended. Although it is acceptable for a small towel or bolster to be placed under the knee to allow slight flexion for pain control periodically, the client is encouraged to keep the knee extended and the hip in a neutral position when sleeping. This encourages full extension that will be needed for ambulation. A knee immobilizer or other supportive brace can be used if indicated by the physician. As in hip replacement, a pillow or wedge can be placed between the legs if this is necessary for side-lying and if the person lies on the nonoperated side. A CPM machine may be used for several hours a day following surgery to facilitate recovery and increased range of motion,[33] and the client must use this in a supine position. However, use of the CPM machine is often discontinued prior to returning home, when more activities are resumed. To enter or exit the bed, clients can move freely and specific techniques can be identified according to client preferences. There are no restrictions that dictate bed mobility procedures.

Transfers

Typically, the client can bend freely at the hips if only the knee has been replaced, and this motion may compensate for the more painful knee ROM, often in flexion. Armrests are generally helpful and allow better upper extremity support for the transitions between sitting and standing on a postoperative knee.

Chair or commode chair.

To move from standing to sitting, the client is instructed to back up to the chair, extend the operated leg forward, reach back for the armrests, and slowly lower to the sitting position. To stand, the client extends the operated leg and pushes up from the armrests. Once standing, the client can reach for an ambulatory aid, such as a walker if it is being used. As in hip replacement procedures, low chairs, soft chairs, reclining chairs, and rocking chairs should be avoided.[1] If a client has bilateral knee replacements, it may be uncomfortable to flex either knee to promote the sit-to-stand transitions. In this case, to move from standing to sitting, the client again backs up until he or she feels the back of the chair, then takes a small step forward with both feet. Then the client reaches back for the armrests and gently lowers the body onto the chair, slowly advancing the feet forward if necessary until a seated position is achieved. To move from seated to standing, both feet are placed slightly forward and the arms are used to raise the buttocks off the chair. Then the client can flex forward at the hips and slowly move the feet back toward the chair until the lower extremities are fully supporting the body. Only then should the client release the armrests and reach for a walker or other ambulatory device placed in front of him or her. Three-in-one chairs are often recommended for use, as they can be placed over a toilet in order to raise the height and provide armrests, thereby improving safety during transfers. In addition, the three-in-one can be used as a stand-alone commode if necessary when the home environment does not support easy access to a bathroom on all levels of the home. Comfort height toilets (17-inch seat height) can be considered for a permanent modification at home that can allow for easier transfers to the toilet.

Shower stall.

Nonskid strips or stickers are recommended in all shower stalls and tubs. Several methods are possible for movement in shower stalls, and the occupational therapist should problem-solve with the client to determine which method is safest. As in the hip replacement methods, the walker or crutches may go first, then the operated leg, and then the nonoperated leg. An alternate method to enter the shower stall is to back up to the edge or rim of the shower while using the walker for balance, then stepping into the shower while looking down at the feet and shower rim for safety. Installation of a shower chair with adjustable legs or a stool and grab bars is strongly encouraged to help the client maintain balance and preserve endurance.

Tub shower (without shower doors).

As in the method for hip replacements, the client is prohibited from taking a bath sitting on the floor of the tub, as this action puts the client at severe risk of causing damage to the knee when transitioning to or from the tub floor. Although a tub seat can be used as in the hip replacement techniques, it is not necessary, as hip flexion is permitted after a knee replacement. To maintain balance during the transfer, it is recommended that the client stand next to the tub, with the hands placed on the short wall of the head or foot of the tub. Then by flexing the hip and knee, or alternately by extending the hip and knee, the client can side-step into the tub while using the upper extremities to maintain balance (Fig. 40.12). A grab bar may be added for safety as needed.

FIG 40.12 Tub transfers following knee replacement.

Car.

Bucket seats in small cars should be avoided. Bench-type seats are recommended. The client is instructed to have a helper move the front passenger seat back as far as it will go. Then the client is instructed to back up to the seat, hold onto a stable part of the car, extend the operated leg, and slowly sit in the car. The client is able to lean forward at the hip for clearance of the upper body and head as they move into the car. The upper body and LEs move as one unit to turn to face the forward direction. Prolonged sitting in the car should be avoided. If transferring to the front passenger seat is a problem, transferring to the back seat of a four-door car is an alternative. The client backs to the seat, extends the operated leg, and slowly sits in the car. Then he or she slides back so that the operated leg is resting on the seat, fully supported. Clients should not return to driving until given permission by their surgeon, even if the operated leg is not the leg used for operating the controls. Sports utility vehicles, vans, or trucks typically have higher seats and may make the transfers easier for some clients.

Lower-Body Dressing and Bathing

The dressing of lower extremities presents a problem only if the client is unable to reach his or her toes, which is usually done by leaning forward at the hips or raising the feet onto a footstool. If necessary, the techniques described for hip replacement can be used, including the use of adaptive equipment. The client should also be instructed in donning and doffing the knee immobilizer or other brace, if used. The client should be cautioned to prevent torque or rotation at the knee joint when dressing by not twisting the body or leg while bearing weight on the operated leg. Clients can take a sponge bath in the initial stages of recovery and typically are not approved to shower until the margins of the incision have healed,[2] approximately 7 to 10 days after the surgery. Showering may be permitted if a waterproof dressing covers the incision.

Homemaking

Homemaking and caregiver training follow the same procedures as for hip replacement techniques, although hip movement is not restricted. Care should be taken when standing or sitting for extended periods of time, to avoid prolonged static positioning of the knee and for pain management.

Sexual Activity

Much like those with hip replacements, persons with a knee replacement will have difficulty performing sexual activities in their usual manner. It is recommended that they refrain from sexual activity for a few weeks so that they maintain the movement precautions applicable to their condition.[38] For clients who have questions about the level of sexual activity allowed during the healing process, the therapist may need to suggest ways for the client to position the operated leg during sexual activity to maintain precautions or to minimize discomfort. Side-lying on the nonoperated side is one option. Clients with knee replacements or weight-bearing precautions should refrain from kneeling.[38] Written information with diagrams can be helpful when addressing such a personal issue.

Evidence Regarding Occupational Therapy Intervention

Occupational and physical therapies are typically initiated in inpatient settings as soon as permitted by surgeons following knee replacements. In fact, a greater intensity of post-op rehabilitation has been proved to enhance patient outcomes, including improved scores on standardized ADL assessments (ie, Functional Independence Measure) in the areas of self-care, transfers, locomotion, and cognition.[5] Home care and outpatient rehabilitation are also important for the client who needs continued support during recovery. Fewer days between discharge from the inpatient setting and the initiation of outpatient services are associated with greater return of function and lower pain levels.[10]

Section 3 Shoulder Joint Replacements

Threaded Case Study

Mrs. Green, Part 1

Mrs. Green is an 80-year-old with degenerative joint disease that is affecting many of the joints in her body. She's already had bilateral knee replacements, and now her orthopedic surgeon says she would benefit from a reverse shoulder replacement of her dominant right arm. Mrs. Green lives alone and manages her self-care and most housekeeping tasks independently. She has a housekeeper to do the heavy cleaning once a month. She has made some modifications to her home so that she does not need to reach very far—for example, she has moved the microwave oven and most frequently used dishes and glasses to the countertop. Additionally she moved her hanging clothes to the doorknobs in her bedroom and has a handheld showerhead. She uses a reacher and long shoehorn when dressing. Mrs. Green drives and just recently stopped working part-time. She keeps herself busy by visiting with friends and knitting. She is an avid knitter, known to make beautiful scarves and Christmas stockings for family members. This is the activity that is most meaningful to her and the reason she has decided to go ahead with the surgery.

The reverse shoulder replacement technique was chosen because the muscles supporting the shoulder girdle were weak due to prior rotator cuff problems. Mrs. Green received home-based therapy 2 days after the surgery when she was discharged home. She had to rely on her adult children to help care for her as well as her sister who came to live with her for 2 weeks. Because of the postsurgery pain and movement precautions, Mrs. Green had great difficulty completing self-care tasks, bed mobility, and transfers. This frustrated her greatly, especially her inability to perform toilet hygiene with her nondominant hand. The majority of the therapy sessions were spent figuring out compensatory strategies for Mrs. Green.

Eventually, Mrs. Green became stronger, and after 6 weeks the movement precautions were lifted and she was able to progress faster in her physical rehabilitation. After about 4 months Mrs. Green was able to resume all of her prior occupations, including knitting and driving. She reports a lot less pain during activity but still has some range-of-motion limitation, which she had been informed prior to surgery might not improve to normal limits.

Critical Thinking Questions

1. What could Mrs. Green have done to better prepare for the surgery knowing that her dominant hand/arm would be immobilized for 6 weeks?

2. How could the therapist utilize caregiver training in this case?

3. Identify self-care tasks that would pose a particular problem due to her movement and weight-bearing precautions (no passive or active shoulder extension or external rotation; no active movement in any direction; only passive shoulder flexion and abduction to about 80 degrees allowed, non–weight bearing)

4. Mrs. Green did not have any movement precautions with her right hand, wrist, or forearm. How could you enable Mrs. Green to use her right hand as an assist (while it was still in the sling) during daily activities without breaking her movement precautions at the shoulder?

The shoulder complex is not a single joint, as functional upper extremity use relies on consideration of the glenohumeral, acromioclavicular, sternoclavicular, and scapulothoracic joints (Fig. 40.13). Musculature acts upon the joints to allow complex movements of the shoulder in elevation and depression, retraction and protraction, and rotation of the scapula, as well as flexion, extension, rotation, and horizontal movements typically measured at the glenohumeral joint. The occupational therapist must carefully analyze shoulder dysfunction to determine the potential deficits, to develop interventions, to protect the joints, and ultimately to promote and facilitate upper extremity function during occupations.

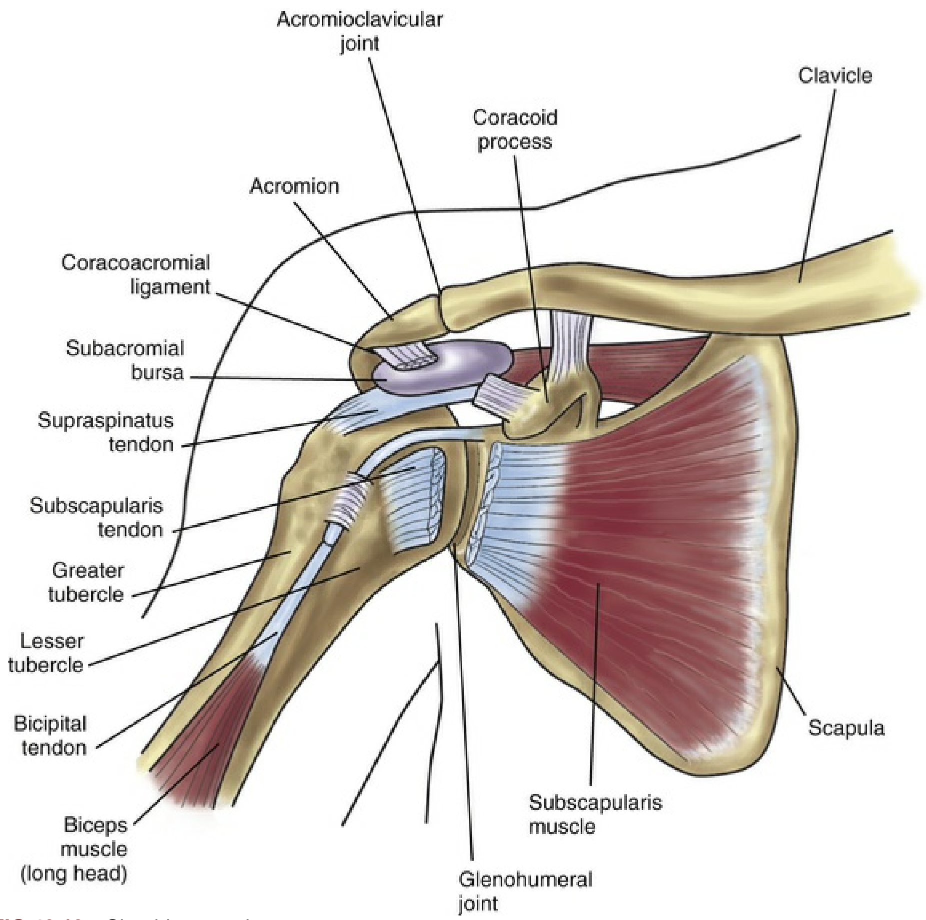

FIG 40.13 Shoulder complex. (From Miller MD, Hart J, MacKnight JM: *Essential orthopaedics.* Philadelphia, 2010, Saunders. Adapted with permission from Anna Francesca Valerio, MD.)

Just as osteoarthritis has been described as a contributor to pain that often leads to hip or knee replacement, this orthopedic condition can also contribute to shoulder pain and dysfunction. Other inflammatory or anatomic conditions, biomechanical forces that may cause damage to the shoulder complex, or proximal humerus fractures are often sources of shoulder pain and dysfunction.[11,28] Conservative medical treatments may include oral or injected drugs designed to decrease pain and inflammation.[34] In addition, therapeutic exercise and activity modifications may be used to control pain and promote function. In this chapter, only conditions that may result in various types of shoulder replacements will be considered due to the need for rehabilitation following these surgical interventions.

Etiology and Medical Management

The type of damage to the shoulder complex typically dictates the type of medical intervention by the orthopedic physician. People who suffer a humeral fracture typically undergo a hemiarthroplasty or humeral head replacement. In this procedure, the humeral head and fractured area are removed and replaced with an endoprosthesis. A total shoulder arthroplasty (TSA), also referred to as a total shoulder replacement (TSR), is more often performed for a person with degenerative or inflammatory conditions such as osteoarthritis (Fig. 40.14). In this procedure, the humeral head is replaced by a ball-shaped prosthesis and the glenoid is resurfaced or replaced with a prosthetic component.[34] A reverse total shoulder arthroplasty (RTSA), also referred to as a reverse total shoulder replacement (RTSR), is indicated for patients with a degenerative or inflammatory condition present in the shoulder complex, but also with some involvement or deficiency of the rotator cuff. In some cases, this procedure is also used when a revision of a traditional TSA is required. When the rotator cuff is extremely weak or damaged, the muscles are unable to effectively support the newly repaired joint so a reverse technique is indicated. In the RTSA, the ball and socket of the glenohumeral joint are reversed; the semicircular ball is placed in the glenoid and a polyethylene cap is implanted into the humerus. In this procedure, good deltoid function is needed to stabilize the joint without as much reliance on rotator cuff muscles for support.[6,34,53]

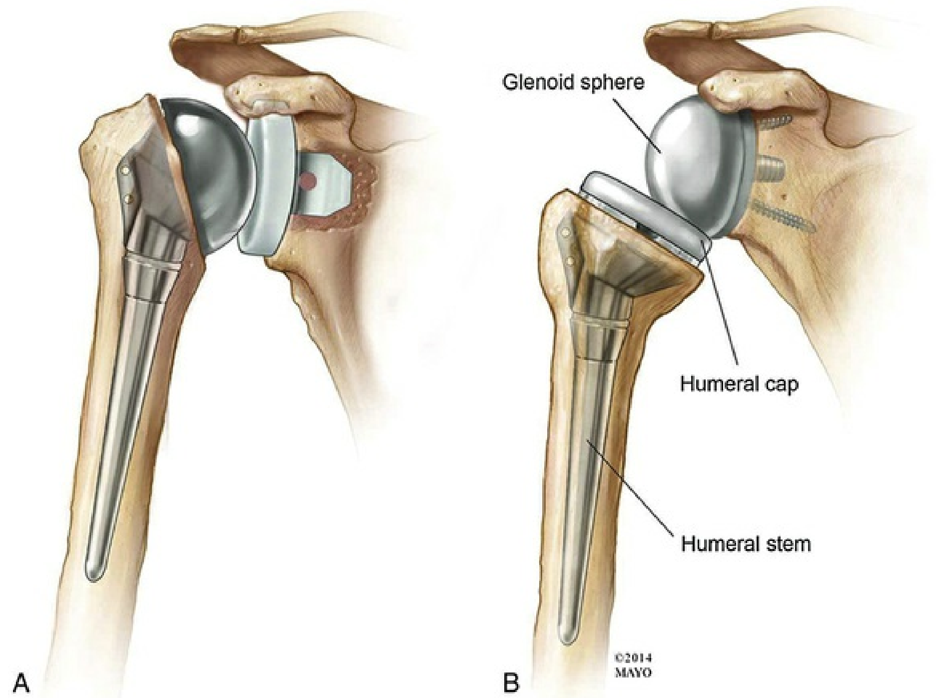

FIG 40.14 **A,** Total shoulder arthroplasty. **B,** Reverse shoulder arthroplasty. (By permission of Mayo Foundation for Medical Education and Research. All rights reserved. Copyright The Mayo Clinic, 2014.)

All of these procedures are expected to eventually decrease the patient's pain, improve functional use of the shoulder over time, and enhance quality of life.[34] However, when compared with the hemiarthroplasty or replacement of the humeral head, the TSA typically has greater range of motion results and higher patient satisfaction ratings as well as a decreased need for revisions, as further glenoid wear is not a factor.[49] The most common postoperative complications for any of the shoulder surgeries is loosening of the glenoid component, loosening of the humeral component, glenohumeral joint instability, or rotator cuff tears. These complications have an incidence of only about 10% to 16% in the 3 to 5 years after surgery and approximately 22% in the 10 to 15 years after surgery.[29,58] Full shoulder ROM is not typically achieved with shoulder replacements, but the pain relief and moderate increases in ROM make the surgery worthwhile for many individuals. A typical prosthesis will last 15 to 20 years in the majority of patients, depending on the particular conditions of the patient and how the joint is used or protected.[34]

Special Considerations for Shoulder Joint Replacements

Because orthopedic concerns and surgical techniques may vary among surgeons, so also will the particular postoperative precautions. The occupational therapist should be familiar with the procedures and should communicate openly with the surgeon to ensure movements of the shoulder that promote patient safety, prevent complications, and progress function as efficiently as possible.

In the initial postoperative phase, soft tissues that surround and support the joint must be preserved for healing, and the glenohumeral joint must be maintained in the appropriate anatomic position. Pain and inflammation are controlled as prescribed by the physician. As with those who have had total hip and knee replacements, the client is provided with a pain medication regimen that provides a consistent level of pain relief to allow full participation in the rehabilitation program. Although active range of motion is encouraged in the joints of the elbow, wrist, and hand, only passive range of motion is permitted in the shoulder joint and only for motions specified by the surgeon. Activities of daily living should be restored, but typically in compensatory or adaptive patterns as the operative shoulder should not have undue resistance placed on it. A **shoulder sling** is typically used for 3 to 4 weeks following shoulder surgery, which is worn when the patient is moving or sleeping (Fig. 40.15). A **swathe** (a long, wide strap that encircles the arm in the sling and the trunk) may also be prescribed to provide extra support and protection for the arm and to prevent prohibited movement. These may be removed for therapeutic activities and when seated with the upper extremity in a supported position (with the humeral head approximated in the glenoid fossa). The sling (and swathe) should be worn during functional activities, during ambulation, and when sleeping to preserve the shoulder joint position. For approximately 6 to 8 weeks, patients may not bear weight on the operated upper extremity, may not lift items weighing more than 1 to 2 pounds with the operated upper extremity, and should avoid the following motions: shoulder extension past neutral, shoulder abduction past 45 degrees, external rotation past approximately 30 degrees, and internal rotation past approximately 60 degrees. They may not participate in any resistive activities in internal or external rotation. When sleeping, a pillow or towel roll should be placed under the scapula or elbow as needed for comfort to ensure that the shoulder in supported in the front of the body and in adherence to the precautions (Box 40.3).

FIG 40.15 Sling with the swathe. (Courtesy North Coast Medical, Inc., Gilroy, CA.)

Box 40.3

Total Shoulder Replacement Precautions

No weight bearing through surgical upper extremity

No lifting more than 1 to 2 lbs with surgical upper extremity

Avoid shoulder extension past neutral

Avoid shoulder abduction past 45 degrees

Avoid shoulder external rotation past 30 degrees

Avoid internal rotation past 60 degrees

Limit shoulder PROM in flexion to approximately 90 to 100 degrees

Pain management is usually achieved in the postoperative phase with patient-controlled anesthesia, which can be administered through an epidural line or a pump with a line inserted into the surgical site. This can be supplemented with superficial cold therapies, movement restrictions and sling wear, and activity modification. After a few days, the anesthesia lines are replaced with oral analgesics or anti-inflammatory medications.

Role of Occupational Therapy for Clients With Shoulder Joint Replacement

As in the other types of joint replacement, occupational therapy typically begins on the first postoperative day if there is no adverse response to the surgery. Introduction of the role of OT and expected types of interventions should precede the gathering of data for the occupational profile. In shoulder replacements, it is vital to understand hand dominance and how this may influence occupational performance, especially if the dominant hand is on the side of the surgical intervention. The goal of OT is for the client to maximize performance of daily occupations, but therapeutic exercise and activities must be advanced carefully in consideration of movement precautions and typical patterns of upper extremity use in occupations. Shoulder use is carefully advanced in the 12 weeks following surgery, but full recovery of function may take up to 9 months.[4,9,19,63]

Evaluation and Intervention

Following the occupational profile, an assessment of the motor, cognitive, social, and emotional factors is recommended, specifically as they relate to occupational performance. Upper extremity assistive range of motion (AROM) and muscle strength can be tested in joints of the elbow, wrist, and hand. However, movement, weight bearing, and resistance precautions must be observed in the shoulder in the postoperative phase. Only gentle, controlled passive range of motion (PROM) should be conducted in all shoulder movements. Sensory function and coordination are assessed distally as well, although analgesics inserted through joint or epidural catheters may mask sensory abilities for a few days after surgery. Mental functions such as memory, problem solving, and sequencing must be considered in light of precautions, safety awareness, and performance of occupations. Activities of daily living and other relevant occupations should be evaluated through standardized assessments, direct observation, or interview as the context and client condition allow. Social or emotional concerns may include fear of participation in appropriate therapeutic exercise, hesitation to resume normal activities, or concerns about surgical healing.

OT intervention planning will focus on the following two primary areas: (1) appropriate therapeutic exercise and resuming normal occupations and (2) primarily routines involving activities of daily living and instrumental activities of daily living. Therapeutic exercise must be designed to promote controlled movement within precautions so that eventual return of full upper extremity function is possible, avoiding long-term complications of adhesive capsulitis, soft tissue contractures, or bony abnormalities such as heterotopic ossification. Occupations may need to be modified during healing to promote the client's active participation while advancing shoulder use appropriately. Performance in both of these areas will be used to determine discharge planning and consideration of inpatient rehabilitation or home and outpatient care.

Therapeutic Exercise Considerations

Total Shoulder Replacement

In the immediate postoperative phase, patients are permitted to perform active assistive range of motion (AAROM) and PROM only of the shoulder in protected ranges. Passive range of motion is typically limited to 90 degrees of shoulder flexion, 45 degrees of shoulder abduction, and extension only to neutral. Specific surgical precautions should be followed related to internal and external rotation, but clients are typically permitted to lay the hand across the abdomen in internal rotation, to about 30 degrees of external rotation. **Codman's pendulum exercises** may be initiated on the first postoperative day. After removal of the sling, the client is instructed to bend forward by flexing at the hips, allowing up to 90 degrees of passive shoulder flexion, with the arm hanging perpendicular to the floor. The nonoperated upper extremity should rest on a counter or tabletop surface, and a wide base of support with the feet should be maintained to avoid a risk of falls. By shifting the body weight, the arm may passively move in anterior-posterior motions, lateral motions, small clockwise circles, and small counter-clockwise circles (Fig. 40.16).[52] Depending on the surgeon's preference, distal AROM should also be performed several times daily to avoid distal edema and to promote functional hand use. Over the next 2 to 4 weeks, larger PROM ranges may be initiated at the shoulder. These may include table slides, in which the client sits next to a table with the operated UE supported on the table, and he or she slowly leans forward and allows the shoulder to passively flex. Some physicians allow dowel exercises (the client holds a wooden dowel with both hands) so that the nonoperated UE can be used to assist movement of the operated UE.

FIG 40.16 Codman's (pendulum) exercises.

Approximately 4 to 6 weeks following the surgery, and if PROM is gradually increasing and normal movement patterns are observed, precautions related to movement may be relaxed. Greater PROM is expected, but weight bearing and lifting are still restricted. Active-assisted therapeutic exercise and carefully executed overhead pulley exercises may be initiated. The therapist should assess glenohumeral and scapula-thoracic mobility to ensure normal movement patterns. Light strengthening can be initiated in the elbow, wrist, and hand joints in preparation for greater functional use. Some physicians will allow for a light weight to be added to Codman's pendulum exercises. Shoulder strengthening and full movement through all planes is typically initiated 6 weeks postoperative. Monitored therapeutic exercise to ensure return to full AROM and strength may continue from the 6 weeks through several months as indicated.[4,63]

Reverse Total Shoulder Replacement

As for patients with a traditional total shoulder replacement, these patients are permitted to perform AAROM and PROM only of the shoulder in protected ranges in the immediate postoperative period. Passive range of motion is typically limited to 90 degrees of shoulder flexion, 45 degrees of shoulder abduction, and extension only to neutral (see Box 40.3). Because there is limited support of the rotator cuff, there should be no actions that require reaching behind the back, which consists of combined shoulder adduction, extension, and internal rotation.[6] Specific surgical precautions should be followed related to internal and external rotation, but it is typically permitted for the client to lay the hand across the abdomen in internal rotation, to about 30 degrees of external rotation if the shoulder is slightly flexed. Although therapy begins post-op day 1, Codman's pendulum exercises (see Fig. 40.16) may only be performed with the permission of the surgeon due to rotator cuff instability. PROM only may be performed for the first 5 to 7 days post-op. Active movement of the distal extremity should be delayed until all anesthesia or nerve blocks that may have been used during surgery for pain control have cleared the patient's system and good motor control returns. Approximately 5 to 7 days after surgery, the patient may begin isometric exercise in the scapula and shoulder and AAROM, up to 90 degrees of flexion and abduction and up to 30 degrees of external rotation. AROM may be initiated approximately 2 weeks post-op, as long as the glenohumeral joint remains stable and pain is managed. Table slides, dowel exercises, and pushing items up an incline board may assist in moving from AAROM to AROM. From weeks 2 to 6, gains are expected in AROM, isometric control, and shoulder stability. Light strengthening may begin in about week 6, although the occupational therapist should carefully monitor progression, and moderate strengthening may begin around week 12.[9]

Specific Training Techniques for Participation in Occupations

Regardless of the type of surgical procedure performed, the occupational therapist must ensure that the client is able to safely and effectively participate in occupations. Basic activities of daily living are typically addressed first within the parameters of precautions and allowed movements. Ambulation is generally not affected by the shoulder replacement if balance is functional and there are no other lower extremity problems; however, significant adaptations may be needed for bed mobility, ADLs, and other areas of occupation. The occupational therapist can encourage the patient to use the hand on the side of the operated shoulder as a stabilizer or assist for light activities that do not require weight bearing or strength (eg, holding toothpaste, buttoning lower buttons, stabilizing paper for writing, or holding a washcloth while soaping it up with the other hand).

Sleeping Positions and Bed Mobility

The sling (and swathe) is worn during sleeping, usually for the first 4 to 6 weeks following the shoulder replacement. A pillow or towel roll should be placed under the scapula or elbow as needed for comfort to ensure that the shoulder is supported in the front of the body, in slight flexion, and in adherence to the precautions. When entering or exiting the bed or when changing positions in bed, the client may roll over the nonoperated shoulder only. The client may need to adjust sleep arrangements to allow for optimal bed mobility that protects the operated shoulder. Core and lower extremity strength and positioning may support movement to and from the bed, but for clients who do not have this level of strength, care must be taken that clients do not use the operated arm to push themselves up. Bed ladders or pulls, bed rails, or leg lifters may be needed to assist with bed mobility. Bed mobility routines including those associated with going to the bathroom at night should be addressed to anticipate problems that might arise around providing a safe path to the bathroom, managing clothing and hygiene at the toilet, getting back into bed, and adjusting the aforementioned pillows or towel rolls. (See Chapter 10 for additional ADL and IADL suggestions.)

Functional Mobility

If a cane was required prior to the surgery, it should be used with the nonoperated UE only. Physical therapy practitioners typically address balance, ambulation, and gait with the client. If a cane is needed, the occupational therapist should ensure its safe use during homemaking tasks or other instrumental activities of daily living. Use of the operated UE should also be avoided during transfers to avoid weight bearing.

Upper-Body Dressing and Bathing

Clothing should be chosen for ease of dressing and with consideration of sling wear. Button front shirts will be easiest to use for dressing, though oversized tops made of stretchy material may also be suitable. The client should sit while dressing and bend forward at the waist to promote passive flexion of the shoulder while extending the elbow to put the operated arm in the sleeve first. Once this sleeve is pulled onto the upper extremity and the client returns to sitting upright, he or she can reach around the back to pull the shirt to the other side and to reach to slide the nonoperated arm into the other sleeve. The client can use the hand of the operated shoulder to stabilize and assist in buttoning the shirt. Women should use a bra with the closure in the front so it can be managed like the button-front shirt. The occupational therapist should also ensure that the client is aware of how to put the sling on and off over the clothing. Additional adaptations to clothing or technique may be needed for the client who also has limited shoulder motion on the nonoperated side, as there typically is bilateral joint involvement with osteoarthritis.

For bathing, the sling is removed and a sponge bath can be completed when the client is seated. A rolled towel can be used to support the arm when bathing while seated. A waterproof dressing should be placed over the surgical site if the client will shower during the first week after the surgery. Once sutures or staples are removed, the client can shower normally. Precautions should be maintained during bathing, no matter what method is used. A long-handled sponge may help the client reach the back using the nonoperated arm.

Lower-Body Dressing and Bathing

It is recommended that the client sit to pull on pants and underclothes in order to maintain balance and avoid the need to use the operated arm to brace the body during a potential fall. Leaning forward in the seated position will also ensure that precautions are maintained. Again, clothes should be chosen for ease of dressing; for example, slip-on shoes will prevent the necessity of tying shoes.

Homemaking

Following shoulder replacements, ambulation is typically unaffected. However, homemaking will need to be done with the shoulder in the sling for the first few weeks. The nonoperated arm can be used primarily for cooking and homemaking, and lifting should be limited in accordance with precautions. A few pieces of adaptive equipment may be helpful, such as a rocker knife or pan stabilizer. The occupational therapist should analyze how the client typically performs household activities to determine if adaptive equipment or compensatory techniques should be used to protect the operated shoulder.

Evidence Regarding Occupational Therapy Intervention

Limited evidence exists that examines specific occupational therapy interventions for people with a shoulder replacement. However, researchers have examined the quality-of-life and return-to-prior-activity levels for this population. Zarkadas and colleagues collected data from patients on their activity level after having their shoulder replaced with a total replacement technique or a hemiarthroplasty. Patients reported having the most difficulty with overhead activities, combing/curling their own hair, washing/drying the back, sleeping on the operated side, and dressing/undressing, as well as other leisure activities.[64]

Boardman and colleagues evaluated the effectiveness of a home-based exercise program for 77 individuals after shoulder replacement.[8] Because most patients return to the home setting within a few days of the surgery, much of the rehabilitation occurs either at home or in an outpatient therapy program. The researchers found that a sequence of exercises, progressing from active hand, forearm, elbow motion, and passive shoulder motion to using a pulley, then a wand or cane exercises, isometric exercises, and ending with Thera-Band exercises, produced good outcomes, with 70% of patients maintaining motion gained during the surgical procedure without causing soft-tissue healing complications.[8]

These studies support intervention priorities that address participation in daily activities, especially self-care tasks, and provide thorough training in home exercises that will help the patient maintain movement precautions and prevent soft-tissue complications while allowing for the maximum functional ability during the healing process.

Threaded Case Study

Mrs. Green, Part 2

1. What could Mrs. Green have done to better prepare for the surgery knowing that her dominant hand/arm would be immobilized for 6 weeks?

It is likely that Mrs. Green was seeing either an occupational therapist or a physical therapist before deciding to have her shoulder replaced. The therapist was aware of her prior knee replacements and the assistive devices she already used. Mrs. Green could be directed to practice using the assistive devices she already had with her nondominant arm for completing ADL and IADL tasks. Additionally, the therapist could have provided her with information or suggested she attend a preoperative class to learn tips for postsurgery activity.

2. How could the therapist utilize caregiver training in this case?

Unlike lower extremity joint replacements, when an individual's arm is immobilized, especially the dominant arm, the ability to perform daily activities can become impossible and a caregiver is needed. It is important to prepare clients for shoulder replacement surgery so that a caregiver can be identified before the surgical procedure in order to best prepare him or her for assisting the client. Caregivers can be taught the movement and weight-bearing precautions as well as any home exercises that should be performed daily. Caregivers need to learn ways to assist the client during mobility (eg, bed mobility, transfers, and ambulation) so that he or she uses proper body mechanics and ensures movement precautions are maintained. If the caregiver cannot be trained prior to the surgery, it is important to incorporate this training during postsurgery rehabilitation.

3. Identify self-care tasks that would pose a particular problem due to her movement and weight-bearing precautions (no passive or active shoulder extension or external rotation; no active movement in any direction; only passive shoulder flexion and abduction to about 80 degrees allowed, non–weight bearing).

Mrs. Green would have problems with upper body dressing/bathing because she might be tempted to actively move her arm to manage clothing or to wash under her arms. Pulling up her pants/underwear might be difficult if she is unable to pull up both sides evenly without rotating her trunk and potentially extending her operated shoulder. Because Mrs. Green is unable to use her dominant arm for self-care tasks, she would likely use many compensatory movements with her nondominant arm in her efforts to complete tasks that she did in a more coordinated way with her dominant arm. This increases the potential of performing active movement or passively moving the shoulder in directions that are not permitted.

4. Mrs. Green did not have any movement precautions with her right hand, wrist, or forearm. How could you enable Mrs. Green to use her right hand as an assist (while it was still in the sling) during daily activities without breaking her movement precautions at the shoulder?

Mrs. Green could use her right hand to stabilize objects (eg, small food packages) while using her left hand to open the package and perform some fine motor tasks (eg, screwing on the toothpaste top, buttoning lower buttons). She could hold very lightweight objects (eg, pen, paper, toothbrush) during transport.

Summary

Hip fractures and hip, knee, and shoulder replacements are orthopedic conditions in which OT intervention may speed the client's return to optimal participation in daily activities safely and comfortably. OT evaluation and intervention begin with obtaining the client's occupational profile and an assessment of the emotional and social issues related to the surgery and the surgery's potential impact on the client's lifestyle. Awareness of and a sensitivity to the psychosocial challenges of the person with an orthopedic problem are critical for the delivery of optimal occupational therapy.

The protocol for other areas of OT intervention is determined by the surgical procedure performed and by the precautions prescribed by the physician. Clients who have weight-bearing precautions must be trained to observe these safety measures during all ADL and IADL routines. A simulation of the home environment or a home assessment will prepare the client for potential problems that may arise after discharge. Areas to assess include the entry, stairs, bathroom, bedroom, sitting surfaces, and kitchen. Recommendations to remove throw rugs and slippery floor coverings and obstacles are made because the client will most likely be using an assistive device for ambulation. A kitchen stool or utility cart may be indicated. It is important to assess and instruct the client and caregiver regarding ADLs and IADLs with adaptive equipment, as well as any movement precautions. Home therapy may be indicated after a hospital stay to ensure safety and independence in daily occupations if these goals were not met during hospitalization.

In addition to the ADL and IADL strategies previously specified, the occupational therapist should be sure to address all areas of occupation that may be difficult for the client, as well as those that may pose a safety risk. Occupations such as caring for a pet, navigating through a cafeteria for meals, traveling in vehicles other than cars, and attending religious or other community activities that require specific transfers (ie, to a church pew) are all examples of activities that may be part of a client's typical performance pattern and should be addressed by occupational therapy. The occupational therapist can assist the client in approaching meaningful occupations safely, observing any movement precautions that are required, and suggesting and demonstrating alternative methods and assistive devices.

Preoperative teaching programs are invaluable in aiding client adjustment. These classes familiarize clients with the hospital, nursing, physical therapy, occupational therapy, and discharge planning. Procedures and equipment, concerns regarding hospitalization, discharge, and therapy are addressed. Participation in this type of class has been shown to relieve anxiety and fear, empower the client during the hospitalization, and decrease the hospital length of stay.

Review Questions

1. Explain the difference in precautions for the anterolateral and posterolateral approaches for a hip replacement.
2. When a client is transferring from one surface to another, what is the general procedure to follow to ensure the safety and protection of the involved side?
3. List the most common types of adaptive equipment used during rehabilitation of hip fractures and LE joint replacements, and describe their purpose.
4. Describe how the case coordinator and occupational therapist can work together to ensure a safe discharge for the client.
5. List two specific suggestions for performing sexual activities for someone with a hip replacement.
6. What information should be obtained when completing the occupational profile?
7. Identify two factors that affect fracture healing.
8. Identify two ways an occupational therapist can address the psychosocial adjustment to LE joint replacement and hip fracture.
9. Why are weight-bearing precautions observed with an ORIF?
10. Compare the rehabilitation techniques of clients with a hip replacement to those of clients with a knee replacement.
11. What are the benefits of conducting client education preoperative classes for persons who are at risk for falls or who are planning a joint replacement?
12. How might a person's rehabilitation program be affected by bilateral joint replacements?
13. How do shoulder precautions limit daily activities?
14. During what activities would the occupational therapist suggest that a client wear a sling or swathe following a shoulder replacement?
15. During what activities would the occupational therapist suggest that a client opt not to utilize a sling following a shoulder replacement?
16. Identify one key exercise that a person should perform multiple times daily following a shoulder replacement. How will you ensure client safety during this exercise?

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41

Low Back Pain*

Ashley Uyeshiro Simon

CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Identify how low back pain can impact occupational engagement and daily life, physically and emotionally.
2. Identify the most common causes of low back pain.
3. Define neutral spine.
4. Identify the basic concepts of body mechanics and how this relates to anatomy.
5. Apply general body mechanics techniques during basic activities of daily living and instrumental activities of daily living.
6. Identify the occupational therapist's role in evaluation and intervention.
7. Recognize the psychosocial effect of low back pain.
8. Identify adaptive equipment that may improve function.
9. Identify other multidisciplinary pain team members.

KEY TERMS

Activity pacing
Body mechanics
Energy conservation
Ergonomics
Lifestyle modifications
Neutral spine

Self-regulation

Threaded Case Study

Maria, Part 1 (Evaluation)

Maria, a 47-year-old homemaker, lives with her husband and adult son in their one-story home. She worked in a retail store prior to her low back injury, which was caused by a motor vehicle accident (MVA) 3 years ago. Maria has bilateral myofascial (muscular) low back pain, and also has herniated disks at L4 and L5. She primarily complains of intense muscle soreness and often compares this to how muscles feel after rigorous exercise. Maria also reports sometimes feeling a sharp shooting pain down the buttock and back of the thigh when she bends over, which only lasts for short periods of time. She is currently also receiving physical therapy (PT).

Maria has been referred to occupational therapy because she is having difficulty completing activities of daily living (ADLs) (dressing, getting in and out of bed, and meal preparation), difficulty doing home management tasks (laundry, dishes), and was diagnosed with depression. Maria's goals are to decrease her pain, to improve her ability to complete home tasks independently, and to be able to go to a movie with friends.

During the evaluation, the Canadian Occupational Performance Measure (COPM) is used to assess functional limitations and occupational engagement difficulties.[2] Maria reports any activities involving bending or twisting are difficult and painful, including doing laundry, picking items up off the floor, making the bed, and completing her morning hygiene routine. She also reports she is not going out of the house (except for doctor's appointments), has significantly decreased her social activities, and has low energy levels. Maria's baseline level of pain is 5/10 on the numeric rating scale. During self-care and home management activities, her pain increases to 8/10, and after staying in one position for too long, her pain increases to 7/10, which makes it difficult for her to sleep well. Due to difficulty with meal prep and because her husband and son are at work during the day, Maria has also been eating only one morning snack and one large meal per day.

Maria experiences a lot of guilt about not being a good mother and wife, and she often pushes herself to do tasks despite significant pain increases. She demonstrates little awareness of how her mood affects her pain levels, and vice versa.

Maria's occupational therapy intervention plan will involve education about body mechanics, positioning techniques, and depression management strategies. Problem-solving with Maria and her family about how she can incorporate this education into her daily life to decrease pain and increase engagement in occupations will be a large part of treatment. She will also receive training in relaxation techniques and use of adaptive equipment if necessary.

Critical Thinking Questions

1. What other occupations (not listed in the case study) do you think would be impacted by Maria's low back pain?

2. How do you think Maria's depression contributes or relates to her low back pain?

3. What barriers and supports to occupational engagement exist for Maria?

4. What is anatomically happening to the spinal column as Maria bends or twists that is causing pain?

Introduction

Low back pain (LBP) can impact almost every area of functioning, from self-care activities, to childcare and relationships, to emotional functioning. Low back pain is the most common type of pain in the United States (27%) and the leading cause of disability in Americans younger than 45 years old.[3] It is also the number one cause of years lived with disability in the world and in the United States.[4]

Nearly 1 in every 12 people experience frequent back pain of varying degrees.[4] For some, this pain will resolve on its own; for others, it can be minimized or eliminated with exercise, core strengthening, and rehabilitation. As for the rest, back pain can become chronic, and these people will have to function with back pain for the rest of their lives.

Have you ever thrown out your back, had a low back injury, sat in an uncomfortable chair for too long, or just lifted something in the wrong way that caused LBP or muscle strain? Even if you have never personally experienced LBP, perhaps you know someone who has, or you can imagine what it is like. Think of the daily occupations this pain may impact. If prolonged sitting is painful, then driving, working at a desk job, studying, or even eating a meal can be difficult. If standing still or leaning forward is painful, then cooking a meal, washing your face, showering, or applying makeup can be impacted. For many people with low back pain, even lying down can be painful, which can limit restorative sleep routines.

Mentally walk through your day from beginning to end, and think about all of the activities *you* do that involve movement, strength, and flexibility from the low back. Think of how having LBP may influence these activities. What if you want to pick up your child? How will you exercise so you do not gain weight? Would you be able to concentrate to study? How will you do the laundry if you live alone? Would you be as social if you were in pain? Even something as simple as picking up a dropped pen can be difficult, depending on the severity of low back pain. Thinking about the breadth of the impact of LBP will help you to better understand how to help your patients.

Common Causes of Low Back Pain

Understanding the anatomy of the back is essential to help a client with LBP. The occupational therapist must understand both normal anatomy as well as the pathology underlying numerous back problems, and must be able to convey this information to patients of varying backgrounds and levels of understanding. To educate the patient regarding the rationale for proper **body mechanics**, the occupational therapist must also understand how the anatomy and pathology are related to movement and daily occupations. Patients who understand the causes of their pain are often capable of applying strategies in multiple contexts and more motivated to make changes to manage their pain.

Vertebral Column and Musculature Review

The vertebral column is composed of the vertebrae and intervertebral disks. Each vertebra contains the vertebral body, which is the weight-bearing component, and the vertebral arch, which arises from the back of the vertebral body (Fig. 41.1). The vertebral arch is composed of two pedicles (one on each side) that extend into the lamina. The laminae join to form the vertebral foramina, which make up the vertebral canal in which the spinal cord resides. From the pedicle and joining of laminae are three bony projections called processes. These lateral processes join to form joints with adjacent vertebrae superiorly and inferiorly (Fig. 41.2). Between the joint of these adjacent vertebrae is the intervertebral foramen, from which the spinal nerves enter and exit. At the back of the spinal arch is the spinous process, where muscles attach. The low back region is composed of five lumbar vertebrae.

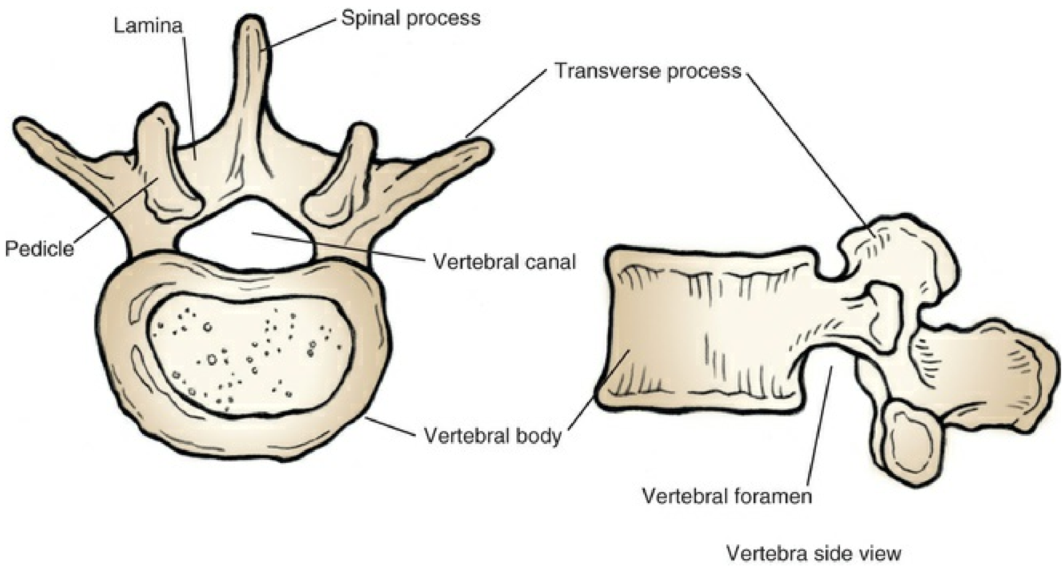

FIG 41.1 Vertebra from above and side view.

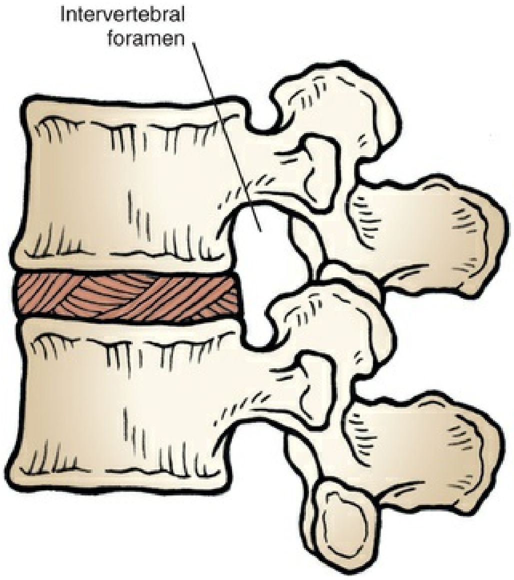

FIG 41.2 Two vertebrae in articulation. The spinal nerve exits via the intervertebral foramen.

Between the vertebrae are intervertebral disks, which are composed of fibrocartilage, a harder outer shell, and the nucleus pulposus, a softer gelatinous tissue (Fig. 41.3). The disks work as shock absorbers and are relieved of pressure only when the body is supine. As the nonrigid parts of the vertebral column, they provide spinal flexibility for movement. When a person is standing with a **neutral spine**—the most comfortable spinal posture and pelvic tilt, yielding equal pressure on all the vertebrae and disks—the pressure on all sides of the disk is equal. Movements such as bending, leaning, and reaching result in disk pressure and bulging on the side that the person is bending toward and stretching of the disk on the opposite side (Fig. 41.4).

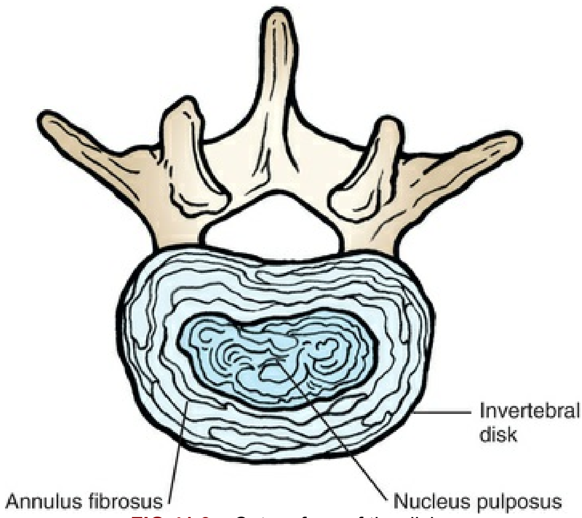

FIG 41.3 Cut surface of the disk.

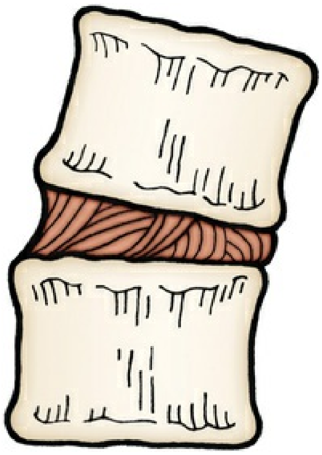

FIG 41.4 The same disk may be under compression and extension at the same time.

Anterior and posterior longitudinal ligaments extend the length of the vertebral column and are attached to the vertebral bodies and intervertebral disks. These ligaments prevent excessive movement of the column. The sacrum is the lower fused portion of the vertebral column and is attached to the pelvis. Movement of the pelvis changes the lordosis, or curve of the lumbar spine: anterior tilt of the pelvis results in more lordosis (arching of the low back), and posterior tilt of the pelvis flattens the low back.

Muscles of the lumbar spine include the intertransversarii and interspinales, which are small intersegmental muscles that connect the transverse process to the spinous process of adjacent vertebrae (Fig. 41.5). The lumbar multifidus, lumbar longissimus, and iliocostalis make up the lumbar muscles. These muscles are primarily extensors for the spine, but the lumbar longissimus and iliocostalis can also assist in lateral flexion. In addition, muscles of the abdominal wall, including the transversus abdominis and obliquus internus abdominis, help to stabilize the spine by providing a corseting effect. For further information on interaction of the back and abdominal muscles during specific movements, the reader is advised to do additional reading in this area.

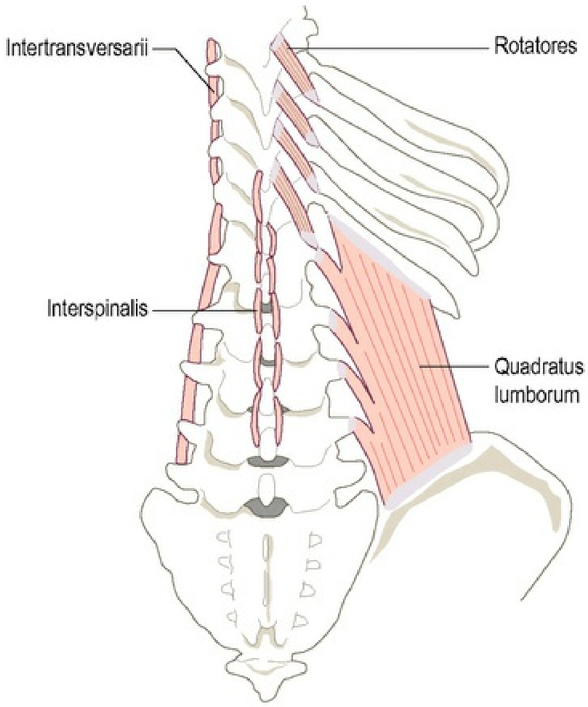

FIG 41.5 Intertransversarii and interspinales muscles. (From Palastanga N, Soames RW: *Anatomy and human movement: structure and function*, ed 6, Edinburgh, 2012, Churchill Livingstone.)

Common Low Back Pain Diagnoses

Typically, back pain is a result of poor physical fitness, obesity, reduced muscle strength and endurance, or poor body mechanics. For 90% of clients, LBP resolves within 6 weeks; for another 5%, it resolves in 12 weeks. "Less than 1% of back pain is due to 'serious' spinal disease (eg, tumor, infection). Less than 1% of back pain stems from inflammatory disease, and less than 5% is true nerve root pain."[1] Changes in the structure or mechanics of the lower part of the back may lead to problems, including the following:

- Sciatic (nerve root) pain: the nerve is entrapped by a herniated disk.
- Spinal stenosis: narrowing of the intervertebral foramen decreases the space where the spinal nerve exits or enters the spine.
- Facet joint pain: inflammation or changes in the spinal joints cause facet joint pain.
- Spondylosis: this is a stress fracture of the dorsal to the transverse process.
- Spondylolisthesis: one vertebra slips on another.
- Herniated nucleus pulposus: stress may tear fibers of the disk and result in an outward bulge of the enclosed nucleus pulposus. This bulge may press on spinal nerves and cause various symptoms, including nerve entrapment.
- Compression/stress fractures: these fractures are usually a result of osteoporosis and occur in the vertebrae.[5]

As noted later in the chapter, behavioral health has a significant impact on pain, and a mental health diagnosis such as anxiety or depression can often worsen, or in some cases cause, LBP as well.

Occupational Therapy Evaluation

The occupational therapist's primary goals during the evaluation are to determine which occupations are impacted by LBP and how the person's actions influence pain. This can be done by using self-report questionnaires, assessment tools, patient/caregiver interviews, or patient demonstration, depending on the treatment setting. Box 41.1 lists some common LBP assessment tools. Educating the patient about the role of occupational therapy and how occupational therapists can help improve function is vital in the evaluation so the patient can correctly identify areas of functional difficulty.

Box 41.1

Common Low Back Pain Assessment Tools

- Canadian Occupational Performance Measure (COPM)[2]
- Brief Pain Inventory[8]
- Pain Self-Efficacy Questionnaire[6]
- Beck Depression Inventory-II[10]
- Activity of daily living checklists
- Numeric rating scale
- Wong-Baker Faces[11]

The patient's current understanding and knowledge of LBP and pain-relieving strategies can be assessed by asking if patients know any activities that decrease or increase their pain or by listening for action-oriented statements that describe the patient's experimentation with various techniques to find strategies for pain management. The occupational therapist's evaluation should not be limited to physical problematic areas but should include an assessment of how the LBP impacts the person's emotional, spiritual, and social functioning.

When creating a plan of care, outcomes can include reduction of pain, use of back stabilization techniques, use of adaptive equipment, and incorporation of body mechanics and **ergonomics** into client-specific areas of occupation, as well as the ability to adapt this information to new occupations to prevent future problems. Depending on the payer, goals can also be written about stress and mood management, lifestyle and habit changes like losing weight or managing blood sugar levels, work/school abilities, and socialization.

Postoperative Occupational Therapy Evaluation

Surgical treatment of back problems has undergone many advances. Interventions include laminectomy, fusion, nerve decompression, disk dissection, vertebroplasty, and kyphoplasty. Surgical interventions are divided into two basic types: surgery that decompresses the nerve and surgery that stabilizes the spine to reduce pain. Surgeries that decompress the nerve open the transverse foramen and increase the space for exit of the spinal nerve and entrance to the spinal cord. Some surgeries may remove a structure, such as part of a disk or an osteophyte that is putting pressure on the nerve root. Stabilization can include the use of various pieces of hardware, such as screws, wires, rods, and bone grafts, to stabilize the bony structures of the spine. In addition, both vertebroplasty and kyphoplasty use a cement-like substance to stabilize compression/stress fractures. Kyphoplasty involves the use of a balloon that is placed in the fracture and, when inflated, helps restore height and reduce deformity before the cement is injected.[5]

Client precautions must be identified. Therapists should work with the physician to develop protocols or standards of care for specific surgeries. It is also important to identify the types of braces and other equipment that may be used for a specific surgery by a specific physician so that the occupational therapist can provide the expected instructions and precautions for use of the equipment in daily occupations. For example, one physician may allow a client to put a brace on while sitting at the bedside, whereas another physician may require the client to logroll into the brace and completely don it before coming to a seated position. Frequently, braces are ordered and fitted before surgery so that they are available to patients upon admission.

When seeing a client for the first time postoperatively, the occupational therapist should obtain the client's history and occupational profile, as well as a description of his or her home environment to ascertain the types of modifications required for safety. During the occupational profile, ADL and instrumental activity of daily living (IADL) issues should be identified. As part of the home assessment, education in work simplification techniques, in conjunction with directive questions, helps the client identify further needs. For example, when explaining how storing frequently used items within easy reach and infrequently used items in lower or higher places can save energy, the therapist can then ask the client how meal prep and eating items are stored in the home. This return demonstration helps clients to process the training and to independently identify other areas of the home where this concept may apply. Home modifications may include picking up rugs to prevent falls, increasing awareness of pets, and selecting a type of chair that is easy to get in and out of and that provides good support and fits the client well. The therapist should also determine whether the home contains a standard toilet and shower and whether modifications for safety and comfort are required.

Occupational Therapy Interventions

Based on the occupational therapy evaluation, the therapist may implement any of the following intervention areas, depending on the needs and personal goals of the client. Factors to consider when implementing interventions include the client's willingness to change old behaviors, educational level, financial abilities, social support, cognition, and self-awareness.

Client Education

Education is the key to success for a client with LBP. Knowledge of basic anatomy and physiology helps the client understand what is occurring while engaging in an occupation. Understanding how lifestyle factors and stress levels can affect pain helps motivate the client to make behavior changes. This knowledge is the foundation on which to build the rest of the intervention plan and ultimately select the appropriate interventions.

Information individualized to each client's needs is ideal. Many books, videos, card systems, and computerized educational systems are available. In addition, charts and models of anatomy can help the client to understand anatomy and physiology. Education can be provided in both group and individual settings.

Body Mechanics

To incorporate body mechanics, the person must first find his or her own "neutral" spinal position by standing with the knees slightly bent and the weight distributed evenly. Using the abdominal muscles to tilt the pelvis, the client should flex and extend the lumbar spine until he or she attains the balanced position of optimal function and stability (Fig. 41.6). The abdominal muscles should be contracted to maintain this position, much as a corset would. This position or stabilization should be maintained and integrated into performance of the client's occupations. Some individuals experience no pain while in a greater degree of extension or with a greater curve in the lower back region, whereas others prefer a neutral position of flexion and have more of a flattened abdomen.

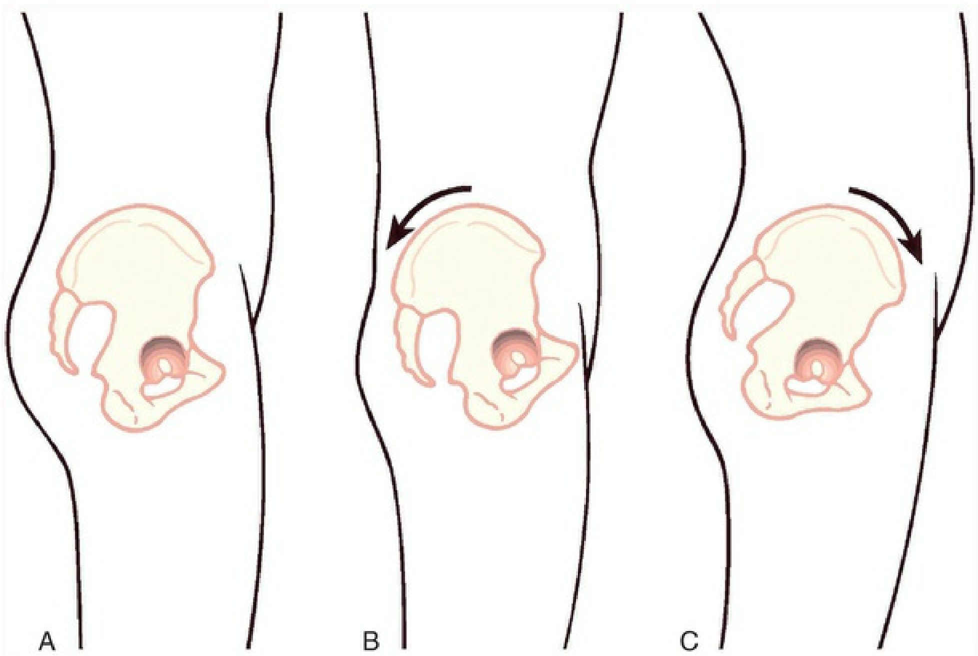

FIG 41.6 Sagittal plane movements of the pelvis. A demonstrates a pelvis in neutral position. B demonstrates a posteriorly tilted pelvis (pelvis tilted to a flattened back). C demonstrates an anteriorly tilted pelvis (pelvis tilted to an arched back). To obtain a neutral spinal position, a person must find a comfortable position between arched and flattened. (From Muscolino JE, Cipriana S: Pilates and the "powerhouse," *J Body Work Movement Ther* 8:15-24, 2004, Figure 6, page 20.)

In addition to developing a neutral spine, the client will need to learn and integrate different techniques into activities to help in lifting and movement. These positions include the squat, diagonal lift, and golfer's lift. Performing a squat requires the absence of any knee or hip pathology; the client keeps the back straight while maintaining a neutral spine (Fig. 41.7, A). A diagonal lift requires the lift to be performed with one foot in front of the other and the legs shoulder length apart (Fig. 41.7, B). A golfer's lift requires bending at the hips while raising one leg behind (Fig. 41.7, C).

FIG 41.7 **A,** Squat. Squat and lift with both arms held against the upper part of the trunk. Tighten the stomach muscles without holding your breath. Use smooth movements to avoid jerking. **B,** Diagonal lift. Squat down and bring the item close for lifting. **C,** Golfer's lift. When reaching into the cart, lift the opposite leg to keep the back straight.

It is important that clients thoroughly understand how to use body mechanics to stabilize their backs. This includes maintaining a straight back, bending from the hip, avoiding twisting, maintaining good posture, carrying objects close to the body, lifting with the legs to promote safe performance, and using a wide base of support. To reduce back stress for activities done in standing, the client can use a small stool or open a cabinet door and rest the foot inside the cabinet base. Instruction in avoiding any twisting of the back during activities is also essential, as will be noted in many habitual activities such as flushing the toilet. In these instances the client must be instructed to turn the body as a unit while maintaining a neutral spine.

Ergonomics at Work

Many LBP injuries are caused or exacerbated by working. Whether the person sits at a computer all day or works on an assembly line, the spine is involved with every movement. For labor-intensive jobs, principles of body mechanics are applied to encourage posture and limit strain on the back. For desk jobs, ergonomic principles are applied to ensure a neutrally positioned spine and to minimize muscle strain during periods of extended sitting.

Equipment that allows employees to work while both sitting and standing (Fig. 41.8) can benefit those with LBP, as frequently changing positions reduces muscle strain and promotes more neutral alignment of the spine. Ideally, the person should change positions at least every 30 minutes to alleviate prolonged pressure on disks, pressing of nerves, and muscle strain.

FIG 41.8 Sit/stand equipment example. (Courtesy Ergotron, Inc., St. Paul, MN.)

Ergonomic task chairs that permit seat height, seat depth, back angle, and back height or lumbar placement adjustments allow users to fit the chair to their bodies. A chair for desktop work must provide back support (ideally all the way up to the shoulders) and maintain the hips and knees at 90 degrees with the feet flat on the floor or a footrest. Tilt on a chair can also provide desk decompression periodically throughout the day. Often clients place their chairs too high, resulting in pelvic anterior tilt and putting strain on the low back.

The occupational therapist assesses the client's work tasks and helps the client to modify his or her workspace, equipment, and behaviors. The client is taught to take frequent breaks (again once every 30 minutes), change positions and tasks frequently, and move objects closer to prevent repetitive reaching or leaning. Apps, phone and calendar reminders, and computer software programs can be used to cue clients to take more frequent breaks at work.

Occupational therapists are prime candidates for ergonomic consulting given their anatomic training, occupational analysis, and creative problem-solving skills. Ergonomic equipment manufacturers can help a therapist identify specific products that fit a client's needs, and therapists should make contacts with these vendors.

Chapter 14 discusses ergonomic principles in more detail.

Energy Conservation

Clients may not realize the toll that normal daily activities can take when they have back pain. For instance, a man who usually runs all of his errands in one day may not be aware of how taxing this is on his back and how this pattern is contributing to a pain increase, as opposed to doing one or two errands each day. Teaching clients the principles of **energy conservation** can alleviate or minimize problems in this area. These principles include planning ahead, setting priorities, learning one's activity tolerance, eliminating or delegating unnecessary tasks, and expending less energy for tasks that are performed (Box 41.2).

Box 41.2

Energy Conservation Strategies for Hosting Dinner With Friends

- Planning ahead: shop for food 2 days prior; do all chopping and food prep one day prior.
- Prioritize: do not schedule other events that day to save energy for dinner that night.
- Eliminate tasks: go out to eat to eliminate the need for cooking, cleaning before, and cleaning after the dinner.
- Delegate: make the signature dish, and let others bring side dishes.
- Learning activity tolerance: limit the dinner to a certain amount of time.
- Decreasing required energy for a task: sit while preparing food instead of standing; use a fan in the kitchen to decrease heat exhaustion.

Energy conservation analogies are helpful when educating clients about how this concept can be applied to their lives. One analogy is that of a pitcher of water. Imagine the pitcher represents how much *potential* energy a person has, and the amount of water in it is the *actual* amount of energy the person wakes up with at the beginning of the day. Energy levels may differ based on sleep quality, pain levels, or general fatigue.

Now imagine each occupation is a cup, and depending on the activity, the cups may be of varying sizes. The person must prioritize and plan ahead for which cups he or she is going to pour water into, as sometimes the most important tasks come toward the end of the day when energy has already been expended (meal prep, time with family, sex, etc.). The person must also choose how much water is going to be poured into each glass, as some glasses do not have to be filled completely (instead of cleaning the whole house, a person can choose to dust, decreasing the amount of required energy).

This analogy often helps clients visualize the concepts of energy conservation as well as convey the idea that energy is finite and must be spent wisely. A person can dig into his or her “reserves” for more energy if needed, but this will result in less energy to start with the next day and often can cause a pain flare-up, decreasing that person's level of functioning. The key to success in incorporating energy conservation into one's daily occupational life is for the client to be aware of his or her individual activity tolerance, including specific knowledge regarding triggers of fatigue and the amount of rest necessary for recovery.

For Maria, implementing energy conservation techniques during laundry tasks may be as simple as sitting while she folds laundry or using an ironing board as a raised table if folding laundry when standing. This technique would decrease the size of the “cup,” or required energy, and thus would require less “water” or energy to complete the task, leaving more water for other activities.

Activity Pacing

Activity pacing is a simple concept in theory, but it can be one of the most difficult concepts to help a person implement into daily life. Activity pacing is applied both on a large scale (daily or weekly) and on a small scale (moment to moment). In its simplest form, activity pacing calls for always alternating between periods of activity and periods of rest in order to prevent overexertion.

On a large scale, people can use time management skills and good planning to make sure they pace themselves with activity. For example, if Maria wants to have her friends over to her home, she may choose to cook foods that can be prepped the day before, go food shopping several days beforehand, and schedule a period of rest just before the event. This would help her to avoid overexertion, which would minimize fatigue and limit pain exacerbation.

On a smaller scale, activity pacing can also happen from moment to moment, as people listen and respond to their changing pain and fatigue levels (Fig. 41.9). Often people with pain will push themselves to finish tasks despite significantly increased pain, as they fear the unpredictability of pain may prevent them from being functional later. However, when people push themselves to their body's limit, they are further sensitizing and damaging the painful area, as well as putting themselves at risk for a subsequent period of decreased function (usually people report this as being "out of commission" for a few hours to a few days) while their bodies recover. This becomes a vicious cycle, as people push themselves, have a pain flare, then have an abnormally long period of decreased function, causing them to believe they only have small windows of opportunity in which to accomplish tasks. This then leads back to overexertion.

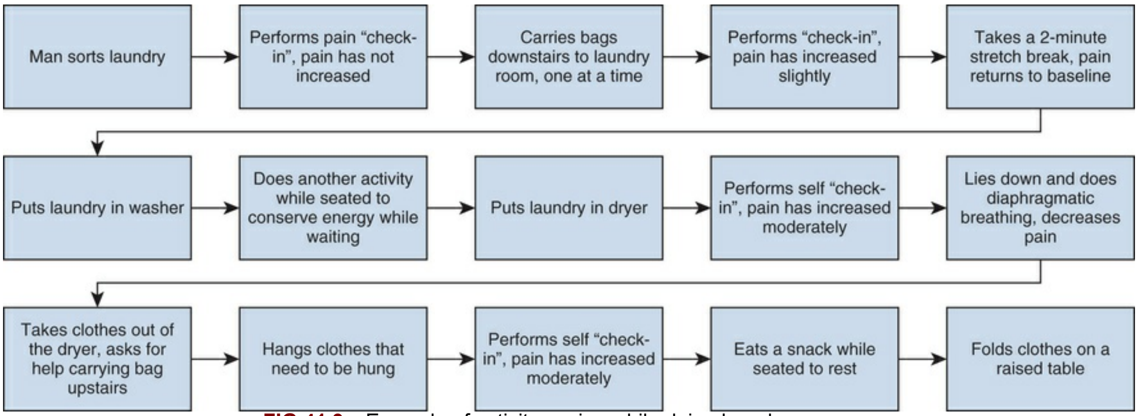

FIG 41.9 Example of activity pacing while doing laundry.

Poor activity pacing can include scheduling too many activities in one day (or one week) without enough rest breaks, having unrealistic expectations of what can be accomplished in a given amount of time, or periods of overexertion followed by a pain flare that lasts for an abnormal period of time.[7]

Occupational Strength and Endurance Building

Once the principles of energy conservation have been taught and incorporated into several of the client's occupations, it is important to build on that knowledge and enable the client to increase strength and endurance for more occupational engagement. Gentle and slow-paced activity grading is the primary strategy for building tolerance when treating someone with pain, as the body's response to increased activity can vary. For example, given the opportunity to prepare a meal nightly, the client can soon develop the endurance to prepare a meal for guests. Likewise, sitting at a computer to write a letter while maintaining a neutral spine strengthens the abdominal muscles and sitting tolerance, which can increase the ability to sit in the car for a moderate to long car ride.

Self-Regulation Training and Coping Skills

LBP can also be influenced by a person's behavioral health status. Stress, anxiety, depression, and sometimes other behavioral health issues can have a significant impact on pain level and the person's perceived control over pain. Likewise, being in pain (especially chronic pain) can influence emotions and mood (Fig. 41.10). According to the Centers for Disease Control and Prevention, adults who report LBP are more than four times as likely to experience serious psychological distress as people without LBP.[3]

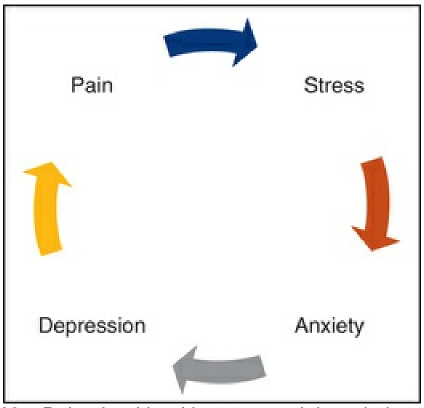

FIG 41.10 Behavioral health status and the relation to pain.

Stress and Anxiety

Pain causes stress on the body, simply because pain is a signal to the body that something is wrong, and this triggers automatic responses to encourage the body to remove or address the painful stimulus (eg, moving your foot away from a fire). In addition, feeling stress or anxiety stimulates the sympathetic nervous system, which adds to an already overly excited nervous system, causing a cycle of stress, anxiety, and pain that is difficult to control, as one usually feeds the other.

Depression

Depression and LBP are often comorbid and are the two leading causes of years lived with disability in the United States and globally.[4] Depression can cause physical symptoms that include painful responses, and it is also believed that depression influences pain through neurotransmitter dysregulation.[9] For Maria, not only do her pain and depression influence one another, but she also reports feelings of guilt due to not being able to accomplish the tasks that she feels contribute to her family's needs. She also is dealing with the loss and change of former occupations, which she is both grieving and learning to accept.

Behavioral Health Interventions

Box 41.3 provides basic strategies to encourage patients to self-manage their stress and mood. Several interventions listed encourage parasympathetic nervous system activation, thereby decreasing the sympathetic nervous system response, and are deemed **self-regulation** techniques as they seek to regulate and calm an overstimulated nervous system. These strategies not only target the behavioral health of the patient, but often they can directly affect pain levels as well by dampening the sympathetic response. Also see the section in Chapter 7, Section 2, on mindfulness strategies.

Box 41.3

Behavioral Health Strategies for Pain

- Getting 20 minutes of direct or indirect sunlight exposure each day
- Getting dressed each day
- Performing good self-hygiene
- Exercising, as tolerated
- Getting out of the house each day
- Taking medications on time
- Using diaphragmatic breathing

- Employing progressive muscle relaxation (passive or active)
- Incorporating guided visualization/imagery
- Socializing regularly

Lifestyle Modifications

Eating

Making **lifestyle modifications** and behavioral changes to keep blood sugar stable, so as to prevent episodes of very low blood sugar, can help people avoid episodes of increased achiness and low energy. Identifying an eating schedule, educating a person about general blood sugar management strategies, and problem-solving when the person is going to go food shopping and how he or she is going to prep meals without increasing pain are all areas occupational therapists can address.

Sleep

Lack of quality and amount of sleep can cause dysregulation in the body and thereby increase pain levels. However, pain can often limit a person's ability to get enough quality sleep due to difficulty falling asleep, frequent waking, anxiety, or discomfort. This creates a problematic cycle for some people with LBP, as pain interferes with restorative sleep, leading to more pain the following day. See Chapter 13 for more information.

Occupational therapists can educate clients about sleep hygiene strategies to help people fall asleep and stay asleep, or fall back asleep if frequent waking at night is an issue. Activities performed prior to bedtime can greatly impact one's ability to fall asleep and the quality of that sleep. Avoiding stimulating activities that will alert the mind or body for at least 30 minutes (ideally 60 minutes) before bed is important. This includes using electronic devices with bright screens, exercise, housework, answering emails, and sometimes looking at social media. Alcohol and nicotine should also be avoided, as these can interfere with sleep cycles.

Instead, people should be encouraged to engage in calming and relaxing activities before they plan to fall asleep. Reading, listening to music, light stretching, aromatherapy, and hot showers are often used to relax the body and mind before bed. Refocusing thoughts on breathing exercises, guided muscle relaxation, meditation, or even just using white noise can often help people fall asleep more easily by taking their minds off stressful thoughts. Sleep hygiene plans should be individualized to fit the client's preferences and opinions to optimize relaxation before bed (Fig. 41.11).

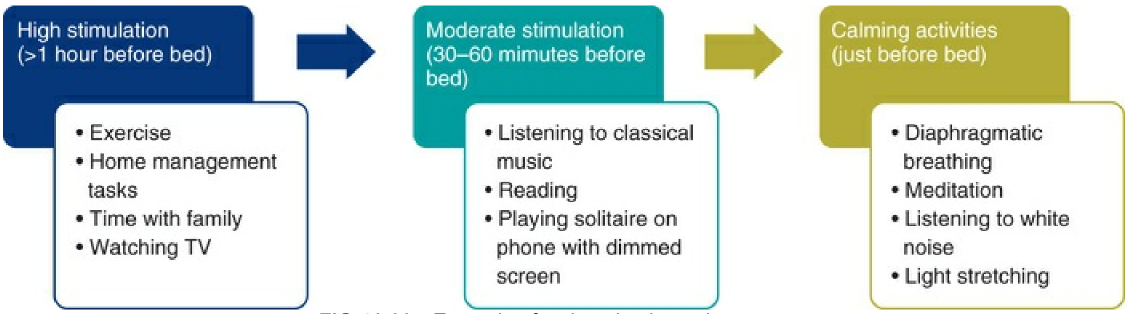

FIG 41.11 Example of a sleep hygiene plan.

Exercise

Maintaining muscle tone is important for those with LBP. Improving muscle strength in the areas surrounding the damaged site can reduce painful symptoms for conditions such as herniated disks or arthritis. Yoga, Pilates, and other strength-building activities can be helpful in these situations and can be slow, controlled, and easily graded if the person fears exercise. In addition, people with LBP often find the right forms of exercise can alleviate pain. Movement of joints releases synovial fluid and can reduce pain and improve mobility for those with arthritis or degenerative diseases.

Pool exercises can be extremely useful for those with LBP, as water decreases gravity's pull, which will decrease strain on muscles and lessen the compression of vertebral disks. Water also provides resistance, which is helpful when trying to build strength over time.

Medication Management and Cognition

Some patients may have difficulty managing their medications, possibly due to cognitive deficits, medication side effects, or being overwhelmed. These difficulties can include the following:

- Frequently forgetting to take medications
- Not taking medications on time
- Not using medication appropriately (addressed with the guidance of a physician)
- Difficulty remembering body mechanic techniques
- Forgetting where adaptive equipment is placed
- Poor attendance at healthcare appointments

Occupational therapists can help people improve medication management skills by providing organization, tracking, and cueing strategies to increase the accuracy of dosages and promote patient safety.

Adaptive Equipment

Adaptive equipment is often useful for patients with LBP. The most frequently recommended pieces of equipment for persons with LBP are used primarily to prevent the client from excessive spinal movement and include long-handled sponges or brushes, reachers, long-handled shoehorns, sock aids, elevated commodes or toilet seats, wiping wands for toileting, handheld shower sprayers, and footstools.

Postoperative Interventions

After surgery, it is the therapist's responsibility to educate the client in the required performance precautions for daily occupations. This should take place before even attempting to have the client get out of bed. Contrary to customary practice in occupational therapy wherein the therapist observes occupations and makes corrections afterward, in this situation the therapist does not want to observe performance before the intervention. Instead, the primary focus is to educate then cue the client through the process to avoid any improper positions or posture that creates stress on the surgical area. The goal of occupational therapy intervention is to train the patient to perform necessary ADLs while maintaining a straight back, avoiding twisting, incorporating back safety techniques, and using adaptive equipment.

The most basic ADLs must be addressed initially while the client is in the hospital. It is important to educate clients on proper positions for sleeping and have them return-demonstrate the positions correctly. The client will need to use the logroll technique for functional mobility in the bed. Proper methods are also taught for getting in and out of bed, in and out of a chair, and on and off a toilet; brushing teeth; washing the face; shaving; and dressing using the back protection techniques discussed earlier. Clients are instructed to use adaptive equipment to prevent back stress during daily activities, including getting in and out of an automobile.

Because hospital stays are often short and because most people will be discharged home, it is good to provide them with resources should specific occupations be overlooked during the hospital stay. Some facilities develop educational materials that include basic body mechanics information, hints on ADLs, and anatomic and surgical information. Various publications include postsurgical back dos and don'ts. Many hospitals have computerized education programs that allow the provider to issue information on the surgical procedure and the resulting back precautions. Although most insurance plans do not cover adaptive equipment such as reachers, raised commodes, shower chairs, and long-handled sponges, this equipment is necessary to ensure a successful postoperative outcome, and many clients purchase these items and have them delivered to their homes before discharge. To prepare the client for home and occupation modifications, many hospitals provide preoperative classes.

Client-Centered Occupational Therapy Analysis

Consider the following questions when providing occupational therapy services for a client with LBP:

Evaluation

- What are the client's goals?
- What is the occupational goal?
- What is the context in which the occupation is performed?
- What supports and barriers to engagement exist?
- How does the patient perform the necessary occupations currently?

Intervention

- What movements during activity increase pain?
- What anatomic structures are involved during occupational performance?
- What can the patient do or use to decrease pain?
- How can the environment or task be modified to fit the patient's needs?

Reassessment

- Did the intervention improve the patient's function?
- Is the patient able to manage pain during and after activity?
- Does the patient have the education needed to problem-solve through occupational engagement barriers independently after discharge?

In addition, it is important to always consider how the person, occupation, and environment interact when deciding on treatment interventions (Fig. 41.12). Thinking of the complex way in which these three areas support and contradict each other (especially with the help of the patients themselves) is what leads to effective, individualized care plans.

Threaded Case Study

Maria, Part 2 (Occupational Analysis)

Maria states her primary goal is to do the family's laundry independently, as this would give her a sense of productivity and fulfillment. The occupational therapist observes Maria attempt to load and unload the top-load washer and observes that Maria often folds at the hips and uses her back to lift the basket of clothing, reporting increased pain. When unloading the washer and placing clothes in the front-load dryer, the therapist also notes Maria bends forward again to retrieve the clothes, then twists and leans back and to the right to toss the clothing into the dryer.

Person

Maria states laundry is very important for her to do independently, as this will give her a sense of fulfillment. This means delegating part or all of the activity may not be the first option for her. Maria is willing to make changes to the way she goes about doing the laundry, but sometimes her depression makes it difficult to initiate tasks. Maria also states she tends to push herself despite pain increases during activity, as she believes her pain flare-ups are unpredictable and wants to finish things “while she still can.”

To increase motivation, the occupational therapist uses a motivational interviewing approach to help Maria identify why it is important to her that she be able to do the family's laundry. The therapist also has Maria place cue cards around the home to remind her that even small accomplishments are victories (for example, placing clothes in the hamper instead of in a pile).

The anatomic causes of Maria's LBP (herniated disks, myofascial pain) are mostly fixed, so treatment will focus on managing and minimizing her pain, not necessarily eliminating pain.

Occupation

As Maria bends forward, she is straining the posterior portion of the lumbar disks and causing the anterior portion of the disk to bulge outward. She is also placing strain on the spinal musculature in the lumbar area, especially when she picks up the basket of laundry and when bending to retrieve items from the washer.

These tasks may be modified using good body mechanics to lift a heavy laundry basket, such as using a golf lift for item retrieval and to ensure the hips and shoulders are always facing the same way to prevent twisting. The speed and intensity of the task can also be modified because Maria tends to push herself; if unloading the washer is the most painful part of this activity, Maria can do it in two parts with a break in between to prevent her pain from increasing significantly.

Environment

Barriers to Maria doing laundry independently are lack of assistance during the day, not owning any adaptive equipment, and having laundry equipment that encourages bending forward (top-load washer).

Maria can change to a front-load machine, then put the washer and dryer (also front-loading) on risers to limit the amount of bending she has to do. This will allow her to squat or kneel with a neutral spine next to the open machine door and reach in without twisting or leaning. If this is not possible, Maria can use a long-handled reacher or dressing stick to retrieve the clothes from the washer. If Maria spends a lot of time doing laundry, she can acquire an antifatigue mat to limit disk compression when standing. Maria can also place a small table near her laundry machines, so she can prevent bending and never has to place the laundry basket on the floor. She may also be able to use this table to fold clothing afterward.

If Maria is willing, she can ask her son and husband to carry the laundry baskets to the laundry room before they leave for work, then carry them back when the clothes are washed. This will help her to conserve energy. If Maria is unsure about asking for help, the occupational therapist can suggest this task modification be a temporary solution until Maria is able to tolerate more activity.

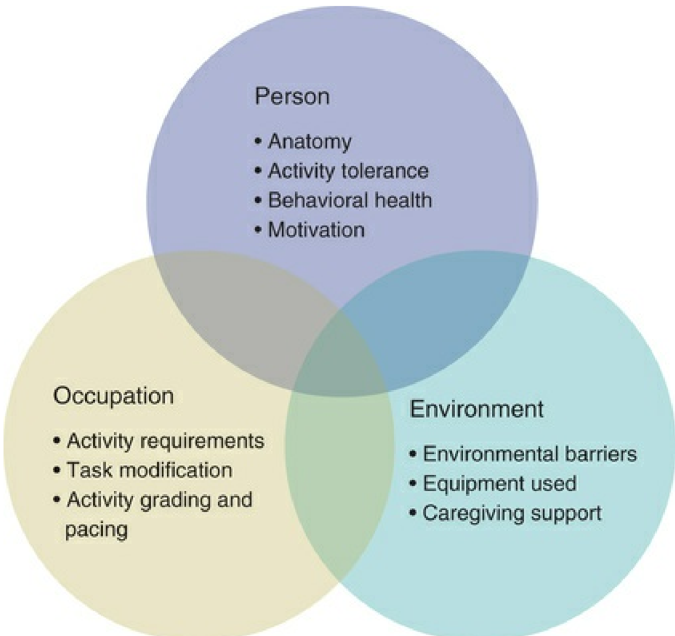

FIG 41.12 Person, environment, and occupation influences.

Intervention Strategies for Frequently Impacted Occupations

Showering

To promote energy conservation and limit bending, clients can keep all items on a shower rack or ledge that stands between chest and eye height. Use of a shower chair or bench can help if balance and bending when washing lower extremities is difficult while standing. Use of long-handled scrub brushes or sponges allows clients to wash their back, legs, and feet without bending and twisting. A handheld shower attachment controls water flow and decreases unnecessary movements. For safety, the client should always use a bath mat to reduce the chance of slipping and drain the water before attempting to get out.

Dressing

Keeping the back in a neutral position is the main goal when dressing. The client can sit in a chair or lie flat on the bed while using mostly hip flexion to get clothing onto the lower extremities, as opposed to spinal flexion (Fig. 41.13). To don and doff socks and shoes, the client should sit and bring the foot to rest on the knee using external rotation at the hip, or place the foot on a stool using mostly hip flexion. Maria preferred to use slip-on shoes as a compensatory strategy to minimize and avoid bending. A long-handled shoehorn and elastic shoelaces are useful for donning shoes that require tying. Back protection techniques should be used for both dressing and undressing.

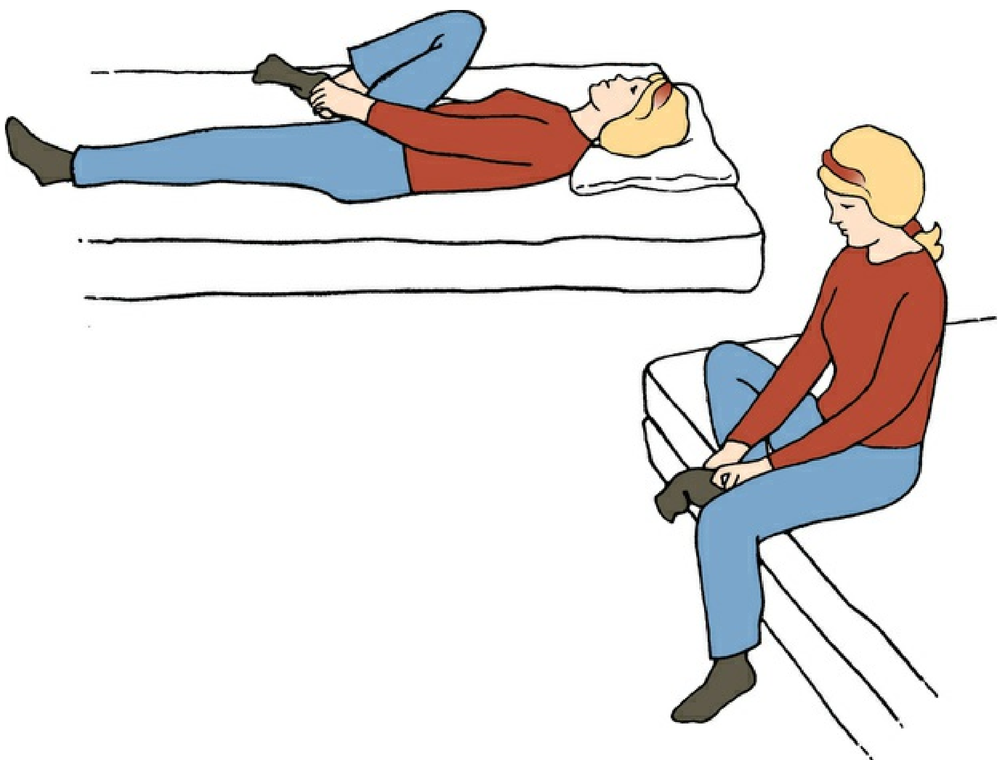

FIG 41.13 Dressing. Lie on your back to place socks or slacks over your feet, or bend your leg up while keeping your back straight.

Functional Mobility

Use of the *logroll* technique to maneuver in bed requires moving the body as a whole unit (Fig. 41.14, A). To sit up, the client lies on one side, bends the knees over the side of the bed, and pushes up with the arms while coming to a sitting position, using the weight of the legs as leverage (Fig. 41.14, B). To lie down, the client brings the legs up and uses the arms to lower the body to the bedside. During both movements, the client must keep the back straight and tighten the abdominal muscles to support the back.

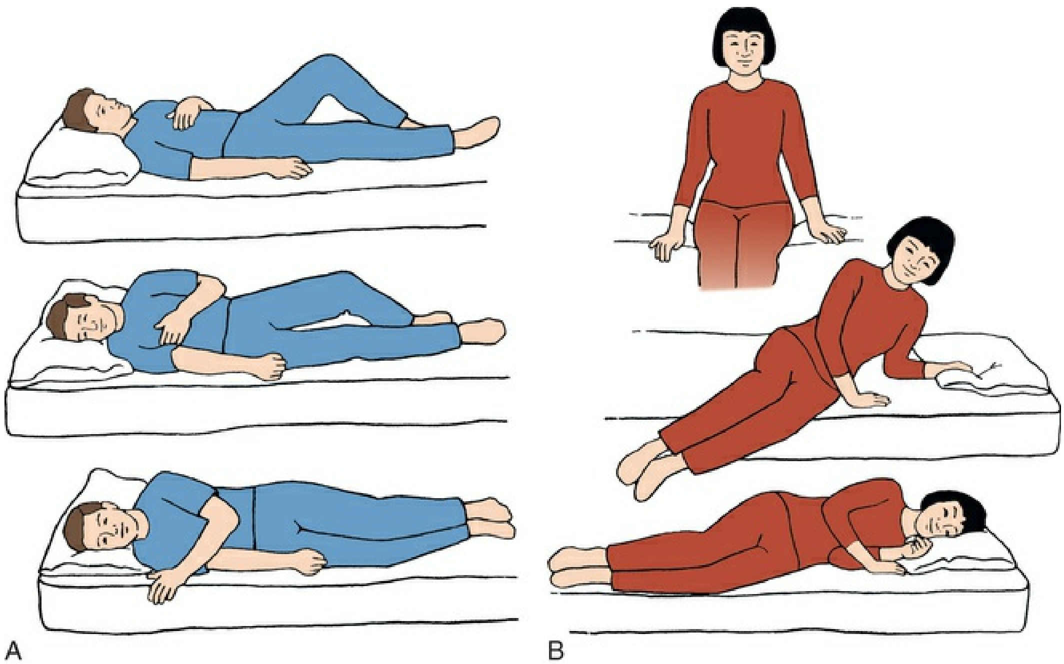

FIG 41.14 **A,** Logroll. Lying on your back, bend your left knee and place your left arm across your chest. Roll all in one movement to the right. Reverse for rolling to the left. Always move as one unit. **B,** Movement in and out of bed. Lower your body to lie down on one side by raising your legs and lowering your head at the same time. Use your arms to assist in moving without twisting. Bend both knees to roll onto your back if desired. To sit up, start by lying on your side, and use the same movements in reverse. Keep your trunk aligned with your legs.

When getting on and off the toilet, the client must maintain a straight back and neutral spine, and she or he should move slowly if pain levels are high. Supporting the hands on the thighs is helpful, or, if needed, a toilet frame or grab bars at the side of the toilet can be used. Occupational therapists must teach clients to differentiate between a weight-bearing grab bar that is bolted into the wall and towel bars or shelves that are not meant to bear weight. Clients also need to receive education regarding the safe use of other surfaces for stability, as people often use countertops, tubs, and walls for bracing during transfer, which can jeopardize safety and cause twisting. For some clients, a raised toilet seat can be helpful.

It is recommended that clients use an armed chair with firm cushions that is supportive and not too low, as compared to an oversized plush couch. The client can use the chair arms to push up to a standing position (Fig. 41.15), and the firm pillows will better support the back while seated. To reduce stiffness, the client should stand and walk or stretch frequently (about every 15-20 minutes).

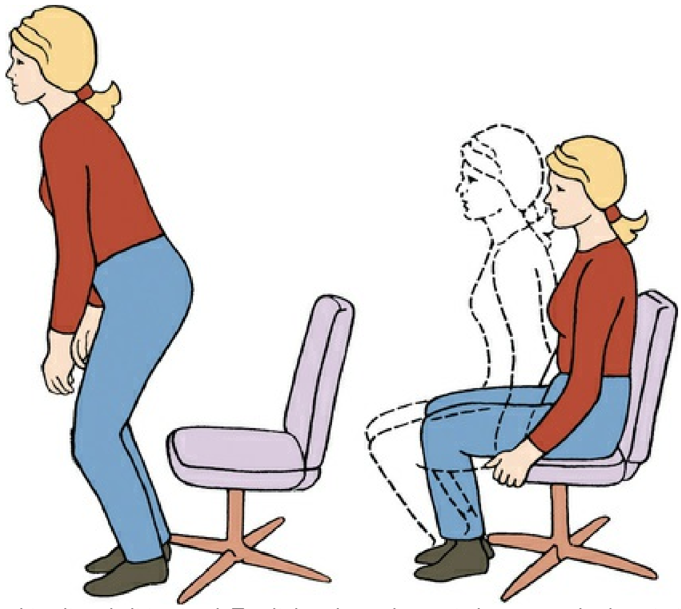

FIG 41.15 Stand to sit and sit to stand. To sit, bend your knees to lower your body onto the front edge of the chair and then scoot back on the seat. To stand, reverse the sequence by placing one foot forward and scoot to the front of the seat. Use a rocking motion to stand up.

Personal Hygiene

Activities at the bathroom sink can be difficult, as most sinks are hip or waist height, requiring most adults to bend forward, increasing stress and strain on the low back. While brushing the teeth, shaving, or washing the face, the client should place one foot inside the base cabinet to reduce strain on the lower part of the back and bend from the hips while keeping the back as straight as possible (Fig. 41.16). Alternatively, the client may bend forward and bear weight through one knee while extending a straight leg back for balance and support and maintaining a neutral spine position. Maria prefers to lean against the countertop with one hand to relieve some of the compression on her low back when rinsing after brushing her teeth, or she uses a cup to rinse her mouth instead of leaning over the sink. To apply her cosmetics, Maria uses a handheld mirror or a mirror attached to the wall at face height to limit bending.

FIG 41.16 Shaving. Stay upright with one foot on the ledge of the cabinet under the sink. (Courtesy Visual Health Information, Tacoma, WA.)

Sexual Activity

Sexual activities require positions and movements that keep the low back in the neutral position and prevent excessive twisting or repetitive flexion and extension of the spine. Clients whose pain increases with spinal extension may be most comfortable lying on their back with pillows under the buttocks or upper part of the back to minimize extension. For those whose pain increases with spinal flexion, a rolled towel under the low back may also help maintain a neutral back position (Fig. 41.17). If the client prefers positions that require being on hands and knees, large wedge pillows can assist the client in keeping a neutral spine. For men, standing during sexual activity and placing one foot in front of the other can promote good alignment.

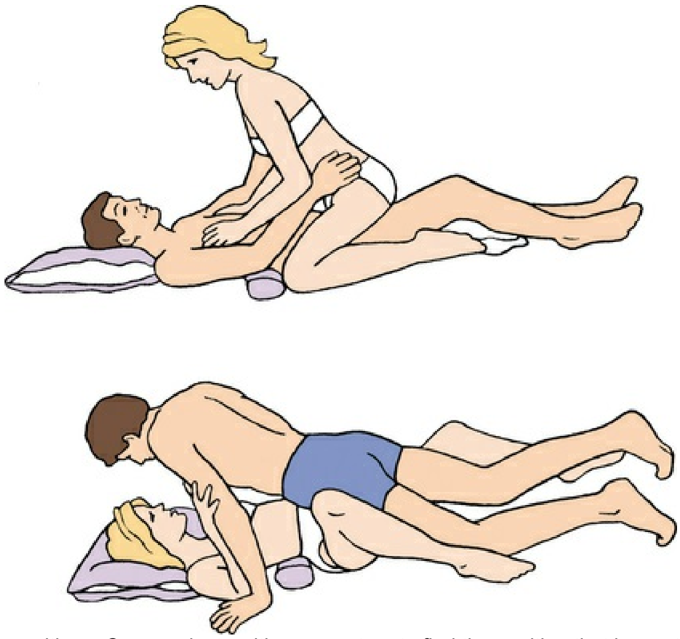

FIG 41.17 Sex positions. Communicate with your partner to find the position that is most comfortable for you. Plan ahead, and use pillows and rolls for support as needed.

Activity grading and pacing are especially important with sexual activity, and the client is advised to start slowly and gradually work up to more vigorous movements depending on tolerance. Before sexual activity, stretching and warming up muscles or taking a warm shower may enable greater activity through muscle relaxation.

Communication with a partner is also a key component of engaging in sexual activity. Often clients are too embarrassed, shy, or excited to talk about tolerance levels and speak up during activity when a movement becomes painful. Teaching clients about assertive communication strategies and helping them create an individualized plan for sexual activity can prevent injury and increase a patient's confidence.

Sleep

We spend almost a third of our lives in bed, so it is important to consider the effects that sleep positioning has on our backs. A firm, supportive mattress is important, as mattresses that are too soft or plush will not maintain neutral alignment. The pillow should support the neck and head without causing the neck to flex forward or laterally. Many types of contoured cervical pillows are helpful for this purpose.

While sleeping on the back, the client should place a pillow under the knees to reduce strain on the lower part of the back and help maintain a balanced lower back position (Fig. 41.18, A).

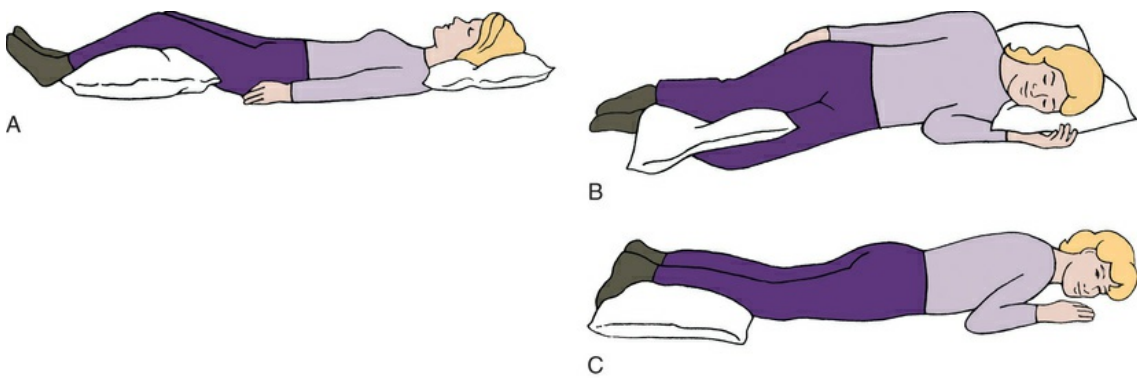

FIG 41.18 **A,** Sleeping on the back. Place a pillow under your knees. A pillow with cervical support and a roll around the waist are also helpful. **B,** Sleeping on the side. Place a pillow between your knees. Use cervical support under your neck and a roll around your waist as needed. **C,** Sleeping on the stomach. If

this is your only desirable sleep position, place a pillow under the lower part of your legs and under your stomach or chest as needed.

While lying on the side, the client should place a pillow between the knees to prevent the hips from collapsing in toward the bed and twisting the lower part of the back (Fig. 41.18, B). It is also sometimes helpful for people to hold a pillow at chest height when side-lying, as sometimes the shoulders collapse in toward the bed as well. A long body pillow can be used instead of two smaller pillows if desired.

It is not recommended that individuals sleep on their stomachs, but individuals who prefer this position should place a small pillow under the ankles to bend the knees and take stress off the lower back region (Fig. 41.18, C). If back extension is painful, a flat pillow can be placed under the hips. For additional information on sleep and rest, please refer to Chapter 13.

Toileting

When cleaning after toileting, the client should reach between the legs to avoid twisting the back, using a long-handled tissue holder if needed. When turning to flush the toilet, the client should stand first, then turn all the way around and face the toilet rather than twisting and reaching. During an acute episode of back pain, the client can straddle the toilet seat and face the back of the toilet. This affords a wider base of support and allows one to use the toilet tank when coming to a standing position.

Child Care

Handling children requires special precautions for individuals with back pain. Sudden movements can increase the client's pain and interfere with the ability to handle the child safely. Clients should use a changing table or elevated surface when dressing the child. Bathing can be performed in a kitchen sink or in a portable tub on an elevated surface. Many contemporary cribs have drop-down rails so that the client does not need to extend his or her arms to lift the child over the crib.

Always remind the client to bend at the hips and knees while keeping the back straight during these tasks. To lift a child from the ground, the client should squat down and bring the child close before using the legs and buttock muscles to stand up, all while engaging the abdominals. To place a child in a car seat, the client should stand close to the car seat and keep the back straight, minimizing any twisting movements (Fig. 41.19). Therapists should also encourage their clients to think of bonding activities that require less strain on the back, such as reading, doing tabletop puzzles, or snuggling in bed.

FIG 41.19 Child care, in and out of a car. Stand close and keep your back straight. Bend your knees to put the baby in or take the baby out of the car seat.

Pet Care

Depending on the size and type of the pet, a client may need different strategies to protect the low back. Use of proper body mechanics strategies such as squatting or kneeling with a neutral spine to serve food, water, or to pick up the pet itself is advised. Long-handled pet waste scoopers and self-cleaning litter boxes can minimize bending as well. Self-dispensing food and water containers can eliminate the need to bend multiple times per day. Clients with larger dogs need to be cautious when walking or playing with the pet to avoid any sudden twists or jerks.

Computer Use

It is important to remind people to fit the environment and equipment to the body, instead of using the body to compensate for environmental shortcomings. Clients should first position themselves in a seated neutral position by adjusting the chair and their own posture, then place items in close proximity to prevent reaching, bending, or twisting. The keyboard and mouse should be easily reached without the elbows leaving the sides of the body, which allows the chair to support the back from sacrum to scapulae. Frequently used items should be within arm's length, accessible without the scapulae coming off the back of the chair to prevent repetitive reaching.

The monitor should be placed at a height that encourages sitting up in the chair, rather than slouching. Clients should be taught to use their eyes to look down at the screen, as opposed to using neck and spinal flexion. Document holders can assist in proper placement of papers and books to prevent the need for repetitive or sustained twisting or bending. Tall users may need a different desk height compared to shorter users, and the keyboard (usually placed below the elbows) may need to be a different height than a writing surface (usually above the elbows).

Maria used a laptop computer while seated on the couch, which created much discomfort. To limit spinal flexion, Maria now uses an external keyboard, external mouse, and a laptop stand (or a stack of books) to prevent reaching or slouching. She also now uses the laptop at a desk instead of on the couch to provide herself with more back support. Most important, clients like Maria are encouraged to stretch, take breaks, and change positions at least every 20 to 30 minutes. (See Chapter 14 for additional information on ergonomics and seating.)

Driving

When transferring in and out of a car, the client should sit on the seat while facing the door and turn the body as a unit to keep from twisting. In some cars, and depending on the person's height, this may require adjusting the seat forward and backward to get in and out. The client should also increase the height of the seat to decrease the effort needed to sit and stand, as well as sit with the knees no higher than the hips to reduce strain on the low back. Most cars now allow adjustments in seat height, seat angle, seat position, and steering wheel angle, and some even come with adjustable lumbar support. A small, rolled-up towel positioned in the lumbar area will suffice as well. When riding for extended periods, the client should schedule rest breaks to change positions and use the recline feature of the seat to alleviate any spinal compression from sitting upright for prolonged periods of time. For drivers with back pain, use of cruise control allows more frequent changes in position, and taking frequent rest stops to stand, walk, and stretch is vital.

Home Management

Organization

The client should organize all work spaces so the equipment and materials needed for specific tasks are within easy reach and the work area is at an optimal height (usually around elbow height). For example, if the client is planning to bake cookies, flour, sugar, baking spices, bowls, measuring cups, and maybe a mixer should all be within reach. Routinely used items should be stored on the countertop, in the lowest cabinets, or in the highest drawers to limit back extension, reaching, and bending. Items in lower cabinets can be accessed with a partial or full squat. This same technique is used to reach items on the lower shelf of the refrigerator (Fig. 41.20), and items above the head can be accessed using a footstool. Cabinets can be modified with slide-out shelves/drawers that eliminate the need to reach far back into the cabinet. Items that are used less frequently can be stored in less accessible cabinets.

A B

FIG 41.20 **A,** Incorrect way to reach into a refrigerator. **B,** Squat with the knees apart to reach the lower shelves and drawers.

Laundry

To remove clothing from a top-load washer, the client should use a golfer's lift to reach inside the machine (Fig. 41.21). To place clothes in a front-load washer or dryer, the client is instructed to use a squat or to use an underhand toss without any spinal twisting or bending. To retrieve clothes from a front-load machine, the client repeats the squat, removes the clothes, and places them in a basket that is positioned nearby. When carrying the basket, the client should hold it close to the body and use the body mechanics for lifting that were discussed earlier in this chapter. It is highly recommended that the client fold clothes on an appropriate elbow-height table while standing or seated, to minimize the need for prolonged bending.

FIG 41.21 Laundry: unloading the wash. To unload small items at the bottom of the washer, lift your leg opposite the arm used for reaching.

For ironing, it is recommended that the client raise the ironing board to elbow height, and to use mostly shoulder flexion and elbow extension to maneuver the iron instead of twisting the lower back. While ironing, the client is instructed to rest one foot on a low stool to help reduce low back strain. Ironing can also be completed while sitting if the ironing board is lowered beforehand. Because of the adjustability of an ironing board, this surface can be used for many other activities, such as folding clothes and wrapping packages.

Dishes

Similar to standing at the sink for bathroom activities, washing dishes sometimes causes people to stand for prolonged periods of time in spinal flexion. Clients should open the cabinets below the sink and use the lowest shelf as a footrest, alternating one foot at a time. In addition, over-the-sink dish racks or countertop tubs can be used to elevate dishes while washing and avoid the need to bend forward to retrieve items repetitively.

Cleaning

A long-handled brush, sponge, or Swiffer mop is recommended to clean low surfaces such as the floor or bottom of a tub. Using a handheld spray cleaner is easier than scrubbing and rinsing the surfaces. While vacuuming, clients should move their feet and legs rather than reach or bend forward. They are also cautioned to avoid twisting; when vacuuming under a table or chair, they should bend at the hips and knees to keep the back in a balanced position.

Yard Work

When mowing the lawn, the client should face forward and align the hips with the mower. The client should keep the back straight, the spine in a neutral position, and the abdominal muscles tight; take frequent breaks; and refrain from twisting or using the back to move the mower. When using a shovel, the client should bend at the hips and knees rather than at the waist and keep the shovel and its load close to the body. The preferred method for emptying the shovel is to turn the entire body and keep the hips and shoulders in alignment while maintaining the load close to the body and facing the location to unload the shovel. None of these yard activities should be attempted when the client is in an unstable condition with acute pain.

Gardening can be challenging for clients with back problems. Raised garden beds, potted plants on windowsills, and light-weight hoses are good options to reduce back strain. Many carts or moving seats can be purchased that allow safer back positioning when working at ground level. Knee pads make gardening in a kneeling position more comfortable. The gardener is cautioned to work only within his or her immediate reach to avoid bending forward or twisting.

Shopping

When retrieving items from a lower shelf, the client should squat or kneel while keeping the back straight. The thigh can be used as support when returning to a standing position; clients are not advised to use the shelf for support, as these are not meant to be weight bearing and may tip. To use a shopping cart, the client should find his or her neutral spine position, keep the abdominals activated, stand up straight, and push the cart with the elbows at the side, using the legs and gluteals for pushing force instead of the back. Use of a cart is preferable to carrying a basket even for small loads, as baskets cause uneven strain on the back. Clients can also place items in the upper portion of the cart, decreasing the need for bending. When unloading the cart, the client should use the golfer's lift to retrieve items. Heavier items should be placed in the tray below the cart if possible, as a squat or kneel can be used to get the item closer to the body.

Work

Job demands vary considerably. Many employers now have health and safety staff to assess workstations, educate employees about body mechanics, and determine whether modifications can be made (see Chapter 14). In many cases, however, it is up to the individual to modify his or her work situation. Many improvements can be made by simply using correct lifting techniques, using the proper equipment for the job, pacing the activity, and asking for help.

Leisure

When reading, clients should sit in a supported chair, not curl up on a sofa. Tabletop hobbies such as sewing and building models require attention to table height, chair comfort, and positioning of the work items. These positioning recommendations resemble those for computer use and will reduce uneven pulling and twisting of the body.

When traveling, the client should use a wheeled suitcase that can be pushed or pulled, which is easier on the back. When wheeling the suitcase, clients should be mindful of pulling the suitcase without twisting at the shoulders or waist. Backpacks and fanny packs with light loads can also be used. Travelers are encouraged to pack lightly and take only what is needed for the trip. Checking luggage and asking for help with placing luggage in overhead bins is also recommended. If needed, the client can also bring a seat or back cushion to promote proper positioning during longer flights. Similar to working at a computer, the person is encouraged to take frequent breaks from sitting (see Chapter 16).

Many clients, male or female, carry briefcases, purses, or bags throughout their daily routines. Decreasing the weight of the bag and frequently switching shoulders can decrease the uneven strain on the back, but using a rolling laptop case or purse is optimal for alleviating back strain.

When using a cell phone, tablet, or other small electronic device, it is important to remember the positioning principles discussed throughout this chapter. Instead of holding a cell phone at a low level and using extreme neck and back flexion to look down, clients should be instructed to hold the device just below eye height, similar to that of a computer monitor. If using the device for prolonged periods of time, the client can use pillows (if seated) to prop the elbows up without tensing the shoulders. Again, frequent breaks are recommended to avoid prolonged spinal column discomfort.

For Maria, socializing is very important to her well-being. She requires help with problem-solving different social situations, including how to best communicate her health needs to her friends and family. Analyzing different types of social gatherings to identify factors that may influence successful pain management (eg, ability to sit, stand, or stretch when needed; the ability to bring a lumbar cushion for use when seated) is key in Maria's successful social engagement.

Only a few of the many possible interventions have been described here. Each occupation must be analyzed, and an individualized intervention should be developed for each client. ADL body mechanics cards from Visual Health Information can be used to customize recommendations. This is a card file system from which cards can be selected and copied to develop interventions for each client according to his or her individual needs. Also available are many preprinted booklets and computer programs that may assist in client instruction. It is important to remember that most insurance companies do not cover adaptive equipment, and hospitals typically have large markups on vended equipment. Consequently, many clinics offer sample equipment for clients to try and provide community resources for equipment or consumer catalogs from vendors such as Sammons/Preston and North Coast Medical. Consumers should be made aware that many products once considered adaptive therapy equipment or ergonomic items are frequently available at a lower cost in discount stores.

Other Multidisciplinary Pain Team Members

The best intervention strategy for managing LBP is a team approach with the patient as the central and most important team member. Occupational therapists should validate their patients' opinions and goals and remind patients to advocate for themselves. It is important for all team members to remember that the client is the expert on his or her own life, and despite what healthcare providers objectively think and observe, in the end the person's subjective experience is what is real to himself or herself.

Box 41.4 lists common multidisciplinary team members who can play a role in LBP management for patients. Complementary and alternative therapists, although not always part of the immediate medical team, can contribute to the pain management plan for certain patients and should be considered referral resources for the appropriate clients.

Threaded Case Study

Maria, Part 3 (Multidisciplinary Care)

The occupational therapist communicates with the other members of the pain team to create the best possible collective healthcare plan for Maria. The physical therapist plans to work on massaging the low back, as well as core exercises to strengthen the spinal column muscles, in the hope that this will lessen the herniated disk pain.

Due to the lack of motivation to initiate daily activities as a result of depression, the occupational therapist refers Maria to a pain psychologist to help Maria manage her depression. The pain psychologist uses cognitive behavioral therapy to help Maria change her thought patterns and learn how to use positive self-talk and objective reasoning to feel less guilty about not being able to do certain tasks that she previously performed for her family.

As Maria progresses through her therapies, she shows improvement in strength and motivation, and the occupational therapist uses these improvements to gradually grade and increase Maria's occupational goals.

Box 41.4

Multidisciplinary and Complementary Pain Team Members

Multidisciplinary

- Physician
- Occupational therapist
- Physical therapist
- Pain psychologist
- Psychiatrist
- Case worker
- Nurse

Other Pain Team Members

- Surgeon (if needed)
- Pharmacist

- Nutritionist
- Vocational counselor
- Discharge planner
- Social worker

Complementary and Alternative Therapies

- Acupuncture
- Chiropractic
- Reiki
- Animal-assisted therapy
- Gentle yoga
- Massage

Physician

The physician is responsible for the client's initial evaluation, usually including a thorough medical history, current symptoms and complaints, functional limitations, posture, gait, strength, reflexes and sensation, and past interventions for this problem. A diagnosis is usually made at this time, or the physician may order additional tests, such as nerve conduction tests, computed tomography scans, magnetic resonance imaging, and blood work. After arriving at a diagnosis, the physician often prescribes medication, determines restrictions in activity and exercise guidelines, and may refer the patient to physical therapy, occupational therapy, or counseling. To reevaluate progress or lack thereof, the physician will see the patient for follow-up visits at whatever frequency he or she deems necessary.

Physical Therapist

The client is usually referred to PT to address pain, spasms, limited flexibility, limited strength, and posture. The PT evaluation generally includes a review of the mechanism of injury, date of injury, progression of symptoms, medical history, recent tests and procedures, medications, past treatment history, previous level of functioning, and the client's goal for therapy. A subjective history of ADLs is reviewed. An objective examination will include analysis of posture, gait, active ROM of the spine, active ROM of the extremities, pelvic symmetry, signs of nerve tension, strength, reflexes and sensation, leg length, and palpation of soft tissue. On the basis of the data collected, the physical therapist develops a treatment plan that includes pain and spasm control, increased core stability and strength, exercises, improved joint mobility, and patient education. The goals of PT are to reduce symptoms and increase strength and flexibility to achieve a functional pain-free outcome for the client.

Physical therapists use dynamic lumbar stabilization (DLS) as a treatment technique that involves integration of the muscle groups that control movement of the spine and the abdominal muscles that support the back. The abdominal muscles act as a corset to support the lumbar area, and the client must learn to balance muscular function and flexibility to control the stresses that are placed on the spinal column during movement.

Pain Psychologist

We have addressed how pain and emotional health are integrally connected. Some clients, especially those with chronic pain, may require the support of a pain psychologist who can assess the person's coping skills and mental health status. Psychologists use cognitive behavioral therapy to help the patient cope with unhelpful thought processes, teach the client self-regulation techniques similar to those discussed earlier, and help the person process any anger, disbelief, or sadness surrounding pain. Psychologists can also help people better manage anxiety, depression, and other behavioral health diagnoses that may be impacting the client's pain levels and self-management capabilities.

Summary

Providing effective occupational therapy for a client with low back pain requires a good understanding of how anatomy, physiology, behavioral health, and lifestyle can impact pain. The ability to analyze daily occupations and keep the client at the center of treatment is crucial to attain successful outcomes. Good communication between the patient and the team and among all team members is important for reducing symptoms, integrating knowledge, and supporting the performance of meaningful occupations for a person living with low back pain.

Review Questions

1. Identify five ways low back pain can impact occupational engagement and daily life, physically and emotionally.
2. Identify three common causes of low back pain.
3. Define *neutral spine.*
4. Identify three body mechanic techniques and how they relate to anatomy.
5. Identify the occupational therapist's role in evaluation and intervention.
6. Identify five occupational therapy interventions used for patients with LBP.
7. Identify other multidisciplinary pain team members.
8. Identify the interventions used for postsurgical patients.

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Burns and Burn Rehabilitation*,**

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CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Define and identify the characteristics of the different burn depths.
2. Identify the anatomy of skin and its importance to individuals' health and well being.
3. Understand and describe the different phases of recovery and the role of occupational therapy in each phase.
4. Understand implications of scar formation on the individual and his or her occupational roles.
5. Understand the importance of early mobilization with therapy and its implications on recovery of the client's ability to perform activities of daily living.
6. Understand the complications of a severe burn injury and its implications on function in occupational roles.
7. Understand and appreciate the impact large or severe burn injuries have on an individual's performance patterns, occupational roles, and self-image.

KEY TERMS

Allograft
Autograft
Compartment syndrome
Deep partial-thickness burn
Dermis
Epidermis
Eschar
Escharotomy
Full-thickness burn
Heterotopic ossification
Hypertrophic scar
Ischemia
Keloid scar
Scar maturation
Subdermal burn
Superficial burn
Superficial partial-thickness burn
Total body surface area
Xenograft

Threaded Case Study

Tonio, Nora, and Lee, Part 1

Three case studies were developed to represent the array or gamut of circumstances the occupational therapy practitioner might encounter when treating clients with burns. Tonio's case is an example of a large total body surface area burn that required extensive rehabilitation. The injury impacted all aspects of his occupational role of a young man. Nora is an example of the impact burn injury has on a child. Although she suffered a small burn, it put her at risk for fine motor delays and body image problems. It also showcased the importance of family participation in her recovery. Finally, Lee's case represents the ideal functional outcomes when the patient is motivated and supported by the medical/rehabilitation team and family.

Case Study: Tonio

Tonio is a 27-year-old right hand–dominant (RHD) man who was involved in a house fire. He sustained 70% total body surface area (TBSA; to be described in more detail later in the chapter) deep partial- and full-thickness flame burns to his face, chest, back, abdomen, (B) upper extremity (UE), and (B) lower extremity (LE). He was noted to be obese, but his medical history was otherwise unremarkable. Tonio had a history of ethyl alcohol and hash oil use. He had a support system consisting of his girlfriend of 2 years, his brother, both of his parents, and friends. Tonio had been employed as an exterminator for several years. At the time of his injuries, he was initially evaluated and treated at an acute hospital without a burn center where he was intubated, sedated, and placed on a ventilator for suspected inhalation injury due to singed nasal hairs and suspected airway edema. He also underwent fluid resuscitation. He was later transferred to a large metropolitan burn center for higher level of care. Upon arrival, Tonio was assessed thoroughly by the burn medical team. He underwent a bronchoscopy, which confirmed the presence of an inhalation injury. Also on the day of admission, he required (B) UE and (B) LE escharotomies (surgical removal of scar tissue) due to increased concern for compartment syndrome. Despite the (B) LE escharotomies, Tonio required (B) LE fasciotomies (surgical release of the fascia to relieve tension and prevent the loss of circulation to an area of tissue or muscle) a few hours later as the LEs became pulseless and mottled. After the fasciotomies, he regained pulses detected by ultrasound Doppler studies. Over the next 8 weeks, Tonio underwent multiple surgeries to débride and cover his burn injuries with grafting. Because of the large surface area of burn, the patient had Integra (biosynthetic wound dressing) placed on his chest, abdomen, and right hand. During this time, he went into oliguric renal failure due to volume depletion with electrolyte imbalance. Tonio's kidneys recovered with resuscitation of fluids and electrolytes. He remained in the intensive care unit (ICU) during this time but was able to be weaned from the ventilator to oxygen via a tracheal mask and eventually to room air. Once he was weaned from the ventilator, after a month-long stay, he was transferred out of the ICU to the burn ward. Tonio required no further surgical interventions but remained in the burn center for complex wound care, pain management, and rehabilitation. His injuries continued to be treated for 3 months until his wounds were healed enough for him to be referred to inpatient rehabilitation where he could demonstrate the ability to tolerate 3 hours of therapy per day. Tonio continued inpatient rehabilitation for 1 month and was discharged home to his family.

Tonio continued to improve with the help of his home exercise program and outpatient physical and occupational therapy. He regained full independence with his basic activities of daily living (ADLs) and is working toward independence with instrumental activities of daily living (IADLs). Surgery is pending to remove the abnormal bone growth in his elbow. Tonio is also preparing to return to his work as an exterminator on a part-time basis with plans to return to full-time work after his elbow is repaired. He is also having discussions with doctors at the regional burn service concerning further reconstruction and scar revisions to the large areas of deformity caused by his burn scars.

Case Study: Nora

Nora is a 3-year-old girl who sustained a 1% TBSA partial-thickness contact burn to her left palm after touching a hot curling iron when she was 10 months old. Nora is a normal, healthy child. She lives with both her parents and two older siblings. Her injury is significant for severe hypertrophic scarring of the left palm resulting in flexion contractures of digits 2 through 5 and adduction contracture of the left thumb. Her burn recovery has been impacted severely by her mother's poor follow-through concerning recommendations and instructions provided by the burn medical staff as well as therapy recommendations. This noncompliance impacted Nora's ability to grasp and manipulate objects, effectively placing her at risk for fine motor developmental delay. Nora was initially treated in the outpatient pediatric occupational therapy department at a large metropolitan hospital but missed several appointments due to transportation issues. The burn occupational therapist (OT) as well as the pediatric OT referred Nora to a state/county-run medical therapy agency to assist in providing therapy services closer to home. The medical therapy agency was able to schedule Nora to be seen in a clinic closer to her home, and she was able to be more consistent in attending therapy appointments. At 13 months it was determined that the deformity to her left hand required surgical intervention. She underwent surgical release of the palmar scar contracture and full-thickness skin grafting. On post-op day (POD) 5, the physicians took down Nora's dressings and observed areas of dehiscence (wound separation or splitting). Nora was placed back in a Xeroform/Bactroban dressing and then in a resting hand splint to protect the skin graft. She was then sent home with referrals for both burn clinic follow-up and outpatient occupational therapy follow-up. Nora continued to receive aggressive outpatient occupational therapy services that consisted of serial splinting, range-of-motion (ROM) treatment, and scar massage, and her mother and father received parent education. Follow-up burn clinic visits consisted of ordering custom pressure garments, assessing hypertrophic scarring, and addressing therapy concerns raised by outpatient occupational therapy.

Despite aggressive management on the part of the burn clinic and the patient's outpatient therapist, Nora's joints once again became contracted at age 3 years. Growth contractures formed, and her mother did not follow up with her outpatient occupational therapy as scheduled. When Nora returned for a scheduled clinic visit, the burn clinic team again discussed with her mother the importance of attending follow-up appointments with her primary occupational therapist to prevent further deformity. Due to the significance of the scar contracture deformity, Nora underwent a second scar revision with local tissue rearrangement surgery to correct her deformity. Nora returned to outpatient occupational therapy, and her mother has been compliant with all therapy appointments, clinic schedules, and schedules with the custom pressure garment maker since her last surgery. Throughout Nora's burn care and recovery, it was found that her mother had significant stressors such as chronic medical issues of family members, denial of the significance of the injury, and educational and language barriers. It took many years for Nora's mother to comprehend the importance of good carryover of Nora's medical and therapeutic care.

Case Study: Lee

Lee is a 25-year-old Korean man who suffered 15% deep partial-thickness hot oil burns to his left hand and (B) LEs while frying fish at home. Lee was a healthy man with no previous injuries or medical conditions prior to his injuries. He is married and attends seminary school. He plans to become a pastor. Lee lives in an apartment with his wife. Both are devoutly religious. His interests were playing soccer and spending time with friends. Lee was admitted to a large burn center for complex wound care, pain management, and therapeutic intervention. The largest portion of his burn injury was to (B) LEs. This impacted Lee's ability to walk, and he required a front wheel walker (FWW) to walk 200 feet on level surfaces. Lee underwent surgical débridement and split-thickness skin grafting to his (B) LEs and left hand. A mesh graft was placed on the (B) LE burns, and a sheet graft was placed on the left hand burn. On POD 2, the surgeon removed the dressings to Lee's left hand to assess for seromas (collections of fluid that build up under the surface of the skin). None were found, and Lee was placed back in dressings and his left hand splint was replaced. After the POD 2 takedown (post-operative day removal of surgical dressings), Lee expressed being upset by the way the skin graft looked. His feelings were relieved after his therapist explained the changes to the skin graft that appear over time and that improvements will be observed over weeks and months. Lee expressed being comforted by having his feelings validated and his concerns addressed.

On POD 5, all of the surgical dressings were removed and, because he was motivated to return home, Lee was willing to work with his physical and occupational therapists to get out of bed, begin to move his extremities, and participate in ADLs. On POD 8, Lee was discharged home using an FWW for ambulation and being modified independent for his ADLs. Lee returned to the outpatient burn clinic for follow-up as instructed. He was observed to be walking independently and no longer required a walker. He continued to progress and became completely independent in his ADLs. When asked, Lee attributed his healing and improved ability to function to prayer and God. He expressed feeling happy about returning home and he was looking forward to returning to seminary school to complete his studies. He also stated that he would like to return to playing soccer as soon as possible.

Critical Thinking Questions

1. When should occupational therapy be initiated for optimal patient results?
2. What were the main factors affecting the pediatric patient's treatment in the preceding case study?
3. How were the occupational roles of the two adult patients affected by their burn injuries? How will their scars continue to affect their occupational roles in the future?
4. As you read and learn more about burn injuries and the role of occupational therapy, consider the effect of occupational therapy intervention on each of these patient's/client's lives. How were their performance skills and patterns affected? What were the long-term effects on occupational performance for each patient/client?

Increasing numbers of individuals are surviving burn injuries that in the past would have proved fatal. Since the 1970s, advances in burn management, such as in resuscitation, early excision and grafting, and surgical critical care, have dramatically improved the percentage of survivors of severe burn injuries.[14] With this improvement in survival comes an increased need for comprehensive burn rehabilitation so that when a life is saved, the quality of life and participation in meaningful occupation are also preserved.

Incidence of Burn Injuries and Burn-Related Deaths

It has been estimated that more than 0.5 million burn injuries requiring medical treatment occur each year in the United States.[3] This represents a significant decline in the incidence of burn injuries since the early 1960s, when an estimated 2 million injuries occurred annually.[4] Total fire- and burn-related deaths are currently estimated at 4000 per year. This total includes an estimated 3500 deaths from residential fires and 500 from motor vehicle and aircraft crashes; contact with electricity, chemicals, and hot liquids or objects; and other sources of burn injury.[3] Fire- and burn-related deaths in the United States continue to decline. Conversely, hospitalizations for burn injury have increased steadily because of improved emergency care helping victims survive. Burn prevention and fire safety measures have reduced the incidence of severe burn injury to the extent that burn centers are now admitting greater numbers of patients with less severe burns and fewer large, deep burns.[5]

Since the early 1970s, advances in the medical, surgical, and rehabilitative management of individuals who sustain burns have expanded the focus of burn care professionals from simply ensuring patient survival to include regaining quality of life and the previous life context after a burn injury. Although functional recovery may be a long and arduous process, most burn survivors can expect to resume their roles, function at a level that is comparatively close to their preinjury level of independence, and continue to engage in occupation for satisfactory participation in life. However, from the date of injury through the outpatient phase of care, a multidisciplinary team approach is necessary to effectively manage the medical, functional, and psychosocial problems encountered during recovery.

Skin Anatomy

The skin is the largest organ of the body. It varies greatly in thickness, flexibility, presence and amount of hair, degree of pigmentation, vascularity, nerve supply and sensitivity, amount of keratin, and types of glands present in different locations. Keratin is the tough protein substance present in skin and also forms the primary elements of hair, nails, and callused areas of the skin on the hands and feet. Most of the body is covered with thin, hairy skin. However, thicker, tougher, hairless skin, known as glabrous skin, covers the soles of the feet and the palmar surfaces of the hand and fingers.

Anatomically, the skin consists primarily of two layers: the dermis and the epidermis (Figure 42.1). The **dermis**, or corium, is composed of fibrous connective tissue made of collagen and elastin and contains numerous capillaries, lymphatics, and nerve endings. In it are the hair follicles and their smooth muscle fibers, sebaceous glands, and sweat glands and their ducts.[94]

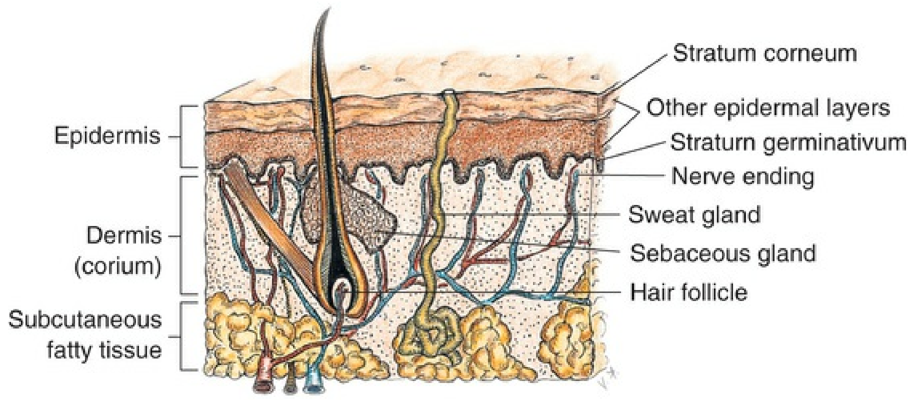

FIG 42.1 Cross section of the skin. (From Potter PA, et al, editors: *Fundamentals of nursing,* ed 9, St. Louis, 2017, Elsevier.)

The **epidermis** is the outermost layer of epithelium, and it also lines the nail beds and the skin appendages, which are pockets of epithelium that extend down into the dermis and contain the hair follicles, sweat glands, and sebaceous glands. The epidermis consists of four or five layers, depending on the location and type of skin. The innermost layer of the epidermis is the stratum germinativum, where the keratinocytes that synthesize keratin are formed. Above this layer lies the stratum spinosum, in which the progressive stages of keratinization occur. The keratinocytes in this layer have a well-developed capacity for phagocytosis, which helps control infection by ingesting and breaking down bacteria and particulate debris. Melanin granules, which give the skin and hair their color, are present in the cytoplasm of certain cells in the stratum spinosum. In the next layer, the stratum granulosum, the cells making their way toward the surface become flattened and accumulate many large keratin granules, termed keratohyalin. In this layer, cells lose their nucleus, change from viable to nonviable, and become a cornified layer composed chiefly of keratin filaments. Above this layer is the stratum lucidum, seen best in glabrous skin, which is thicker. The outermost layer, the stratum corneum, is composed of tightly packed dead keratinocytes known as squames that become the cornified, flattened skin cells that eventually separate from one another and detach from the surface of the epidermis. The time taken by a newly formed keratinocyte to pass from the deepest layer to the surface to be shed is estimated to be 45 to 75 days. This is the natural manner in which the epidermis continually renews itself.[95]

Skin Function

The skin serves as an environmental barrier that protects against ultraviolet rays, chemical contamination, and bacterial invasion. It also serves as a moisture barrier to prevent excessive absorption of moisture or evaporative loss. Temperature regulation is also a function of the skin, with hair to insulate and perspiration to cool the body. The skin perceives injury or infection through tactile sensory receptors located in the dermis layer of the skin. These receptors heighten environmental awareness through perceived touch, pressure, pain, and temperature. When the skin is damaged, various systemic, physiologic, and functional problems can occur. A burn injury causes destruction of the protective environmental barrier, which results in exposed nerve endings, loss of body heat, seepage of body fluids, and exposure to bacterial invasion.

The skin also influences the development of an individual's body image and personal identity and enhances nonverbal social interaction. Along with age, gender, body type, and voice, the skin's scent, texture, and coloration and the appearance of facial features contribute strongly to a person's external context (physical) and self-concept–related internal contexts (e.g., body image, self-regard, and sense of social and cultural acceptance). Because of all these factors, a large burn injury is considered to be one of the most physically and psychologically painful forms of trauma.

After a burn injury, many factors are taken into consideration in determining the severity of injury, potential for functional recovery, and treatment needs. Primary considerations in evaluating burn wounds are the mechanism of injury, the depth and extent of the burn, specific body areas burned, and associated or concurrent injuries such as inhalation injury and fractures. The individual's age, medical history, preinjury health, and previous life context are of equal importance in determining the impact of a serious burn injury on future occupational performance.

Mechanism of Injury and Burn Depth

Burns can be thermal, chemical, or electrical in nature and can be caused by flame, steam, hot liquids, hot surfaces, and radiation. The severity of the injury depends on the area of the body exposed and the duration and intensity of thermal exposure. Thermal burns can be caused by heat in the form of flame, steam, hot liquids, or hot objects. The type of fluid or type of object is important to assess; for example, hot oil boils at a higher temperature than water and retains heat for a longer period of time, resulting in a deeper burn injury, and objects heated for construction or industrial purposes are often hotter than household items. Thermal burns can also be caused by excessive cold such as in dry ice. Electrical burns often have the appearance of being a small burn with an entrance and exit wound, but this burn injury can be deceptive as the electrical current can cause damage beneath the skin through soft tissue, burning the patient from within. Electrical burns can also affect the heart, so these patients often require monitoring with an electrocardiogram to ensure that the current did not damage their hearts. Chemical burns can often be deep, requiring that the patient be washed with a neutralizing agent. Patients suffering from chemical burns are often asked for the name or type of substance they were using. This information assists the burn team, especially the pharmacist, in identifying the correct neutralizing agent.

Burn wounds are classified by depth, which is determined by clinical assessment of the appearance, sensitivity, and pliability of the wound.[99] Burn injuries were traditionally classified as first, second, third, and fourth degree. They are now classified as superficial, superficial partial thickness, deep partial thickness, full thickness, and subdermal.[44] The depth of injury is established by clinical determination of which anatomic layers of the skin are involved.[91]

A **superficial burn**, previously referred to as a first-degree burn, involves only the upper layers of the epidermis. Damage through the epidermis and upper third of the dermis is referred to as a **superficial partial-thickness burn**. The term **deep partial-thickness burn** describes damage to the epidermis and upper two thirds of the dermis, and a **full-thickness burn** describes an injury that extends down through the entire dermis. A **subdermal burn** involves the fatty layer, fascia, muscle, tendon, bone, or other subdermal tissues (e.g., those seen in electrical injuries; Table 42.1).

TABLE 42.1
Burn Wound Characteristics

Burn Depth	Common Causes	Tissue Depth	Clinical Findings	Healing Time	Scar Potential
Superficial	Sunburn, brief flash burns, brief exposure to hot liquids or chemicals	Superficial epidermis	Erythema, dry, no blisters, short-term moderate pain	3–7 days	No potential for hypertrophic scar or contractures
Superficial partial thickness and donor sites	Severe sunburn or radiation burn, prolonged exposure to hot liquids, brief contact with hot metal objects	Epidermis, upper dermis	Erythema, wet, blisters; significant pain	Less than 2 weeks	Minimal potential for hypertrophy or contractures if healing is not delayed by secondary infection or further trauma
Deep partial thickness	Flames; firm or prolonged contact with hot metal objects; prolonged contact with hot, viscous liquids	Epidermis and much of the dermis nonviable, but survival of skin appendages from which skin may regenerate	Erythema; larger, usually broken blisters on skin with hair; on glabrous skin of the palms and soles of the feet; large, possibly intact blisters over beefy red dermis; severe pain to even light touch	Longer than 2 weeks, may convert to full thickness with onset of infection	High potential for hypertrophic scarring and contractures across joints, web spaces, and facial contours; high risk for boutonnière deformities if the dorsal surface of fingers involved
Full thickness	Extreme heat or prolonged exposure to heat, hot objects, or chemicals for extended periods	Epidermis and dermis: nonviable skin appendages and nerve endings	Pale, nonblanching, dry, coagulated capillaries possible; no sensation to light touch except at deep partial-thickness borders	Surgical intervention required for wound closure in larger areas; possible for smaller areas to heal inward from borders over extended period	Extremely high potential for hypertrophic scarring or contractures, depending on the method used for wound closure
Full thickness with complications	Electrical burns and severe long-duration burns (e.g., house fires, entrapment in or under a burning motor vehicle or hot exhaust system, smoking in bed or alcohol-related burns)	Full-thickness burn with damage to underlying tissue	Possible charring of nonviable surface or, with exposed fat, possible presence of small external wounds on tendons, muscles; with electrical injuries, possibility for small external wounds with significant secondary loss of subdermal tissue and peripheral nerve damage	Requires surgical intervention for wound closure; may require amputation or significant reconstruction	Similar to full-thickness burns except when amputation removes the burn site

Superficial burns are usually caused by sun exposure or brief contact with rapidly cooling, nonviscous hot fluids or surfaces (e.g., spilled coffee or a hot pan). Superficial partial-thickness burns are typically caused by prolonged sun exposure, contact with flames, or brief contact with hot viscous liquids (Figure 42.2, A). Deep partial-thickness burns (Figure 42.2, B) are caused by longer exposure to intense heat, such as immersion in hot water or contact of the skin with flaming material. Full-thickness burns usually result from prolonged immersion scalding, contact with flaming or high-temperature viscous material such as hot grease or melted tar, extended exposure to chemical agents, and contact with electrical current (Figure 42.2, C).

FIG 42.2 **A,** Superficial partial-thickness burns are wet and painful with characteristic fluid-filled blisters. **B,** Deep partial-thickness injury. Note the moist open wound. **C,** Full-thickness injury with thick adherent eschar. (*C,* From Song DH, Neligan PC, editors: *Plastic surgery,* ed 3, London, 2013, Saunders.)

Superficial partial-thickness and deep partial-thickness burns generally heal without surgical intervention. However, once healed, they tend to be excessively dry, itchy, and subsequently susceptible to excoriation (i.e., abrasion or tearing of the skin surface) secondary to shear forces caused by rubbing, scratching, and other trauma. These shear forces can give rise to blisters and compromise long-term skin integrity as a result of repetitious reopening of the wound. Partial-thickness and full-thickness burns usually lead to uneven pigmentation of the healed scar. Deep partial- and full-thickness burns have a greater potential for thick, hypertrophic scar and contracture formation because of the prolonged healing period. This is especially true if a burn converts from partial thickness to full thickness because of infection or repeated trauma. Most full-thickness wounds require surgical intervention or skin grafting for wound closure. Skin graft donor sites generally heal in the same manner that superficial partial-thickness burns do, with less scarring but uneven pigmentation. In all three of the case studies, the majority of the patients' burns were deep partial-thickness injuries but with serious scar development after healing.

Percentage of Total Body Surface Area Involved

The extent of a burn is classified as a percentage of the **total body surface area** (%TBSA) burned. The two most common methods for estimating %TBSA are the "rule of nines" and the Lund and Browder chart.[34,57,89] The rule of nines divides the body surface into areas consisting of 9%, or multiples of 9%, with the perineum making up the final 1%. The head and neck area is 9%, each upper extremity is 9%, each lower extremity is 18%, and the front and back of the trunk are each 18%. Body proportions vary in children, depending on their age, especially in the head and legs (Figure 42.3). The Lund and Browder chart[53] provides a more accurate estimate of TBSA[67] and is used in most burn centers. This chart assigns a percentage of surface area to body segments (Figure 42.4), with the calculations adjusted for different age groups. For smaller %TBSA injuries, the therapist can obtain a quick, rough estimate by using the size of the patient's palm (the hand excluding the fingers) to equal approximately 1% of the individual's TBSA.

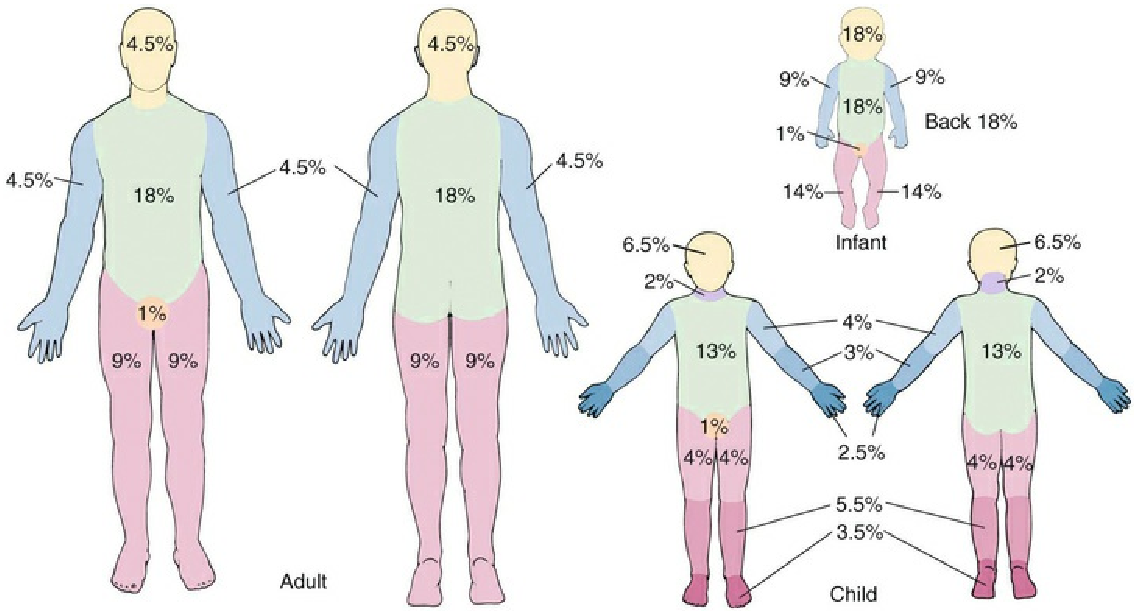

FIG 42.3 Rule of nines. Proportions for adults/adolescents, children, and infants are shown. Note the relatively greater surface area of the head and slightly lesser surface area of the lower extremities in young children than in adults. (From Lovaasen KR: *ICD-10-CM/PCS coding: theory and practice,* St. Louis, 2016, Elsevier.)

Modified Lund and Browder Chart								
Area	Age (Years)					% Partial-thickness	% Full-thickness	% Total
	0-1	1-4	5-9	10-15	Adult			
Head	19	17	13	10	7			
Neck	2	2	2	2	2			
Ant. trunk	13	13	13	13	13			
Post. trunk	13	13	13	13	13			
R. buttock	2.5	2.5	2.5	2.5	2.5			
L. buttock	2.5	2.5	2.5	2.5	2.5			
Genitalia	1	1	1	1	1			
R. U. arm	4	4	4	4	4			
L. U. arm	4	4	4	4	4			
R. L. arm	3	3	3	3	3			
L. L. arm	3	3	3	3	3			
R. hand	2.5	2.5	2.5	2.5	2.5			
L. hand	2.5	2.5	2.5	2.5	2.5			
R. thigh	5.5	6.5	8.5	8.5	9.5			
L. thigh	5.5	6.5	8.5	8.5	9.5			
R. leg	5	5	5.5	6	7			
L. leg	5	5	5.5	6	7			
R. foot	3.5	3.5	3.5	3.5	3.5			
L. foot	3.5	3.5	3.5	3.5	3.5			
					Total			

FIG 42.4 Modified Lund and Browder chart. Burn size can be determined most accurately in children by using the Lund and Browder chart, which accounts for changes in the size of body parts that occur with growth. (Modified from Lund CC, Browder NC: The estimation of areas of burns, *Surg Gynecol Obstet* 79:352, 1944.)

In the case studies, the %TBSA of the burn injury varied considerably from one individual to another. Tonio's %TBSA burn was 70%. Nora's burn injury was <1% TBSA burn, and Lee's %TBSA was 15%.

It is also important as a clinician to understand that the %TBSA of the burn injury will change as the burn injury evolves and fully declares itself in the first 3 to 5 days. Also to be considered in the case of burn patients that require surgical interventions is that the donor site for surgery then adds to the percentage of open wound even though it is not a part of the actual burn injury. This is important for nutritional optimization, wound dressings, and discharge planning.

Severity of Injury

The severity of a burn injury is determined by many factors. The size, depth, and location of the injury are of primary concern in a burn-injured patient, but other factors such as a patient's age, previous medical history, social support and resources, functional ability, and pain are also important for determination of admission to a burn center and also the individual's ability to recover. Usually a burn of 15% or greater with a superficial partial- to full-thickness injury is cause for admission as it will require fluid resuscitation. However, burn centers will at times admit patients with smaller burns if the patient is nutritionally deficient, the pain of the burn injury is unable to be managed effectively on a home regimen, or the patient's functional ability is severely impaired (i.e., the patient is unable to ambulate due to the LE burn injury).

Burns that are partial-thickness, deep partial-thickness, or full-thickness injuries that are larger than 20% usually require a period of hospitalization that includes complex wound care, pain management, nutritional optimization, and rehabilitation. The burn injury becomes more severe if the person sustains an inhalational injury in addition to the cutaneous burn injury.

Burns of <15% TBSA that are partial-thickness injuries not requiring surgery can be treated on an outpatient basis as long as the patient has adequate resources, social supports to provide optimal wound care, pain management, and functional mobility at home.

A patient's past medical history will also affect his or her ability to recover from a burn injury, even one that is relatively small. A patient's comorbidities will increase mortality in burn-injured patients. Chronic conditions that are cardiovascular, neurologic, renal, or pulmonary in nature will increase the likelihood of death, especially in the presence of a cutaneous injury or inhalation injury.[95]

Phases of Wound Healing

Wound healing takes place in three overlapping phases: the inflammatory phase, the proliferation phase, and the maturation phase.

Inflammatory Phase

The inflammatory phase usually lasts 3 to 10 days after onset. This phase is characterized by a vascular and cellular response, with neutrophils and monocytes migrating to the wound to attack bacteria, débride the wound, and initiate the healing process. The wound is typically painful, warm, and erythematous (red), and edema develops.

Proliferation Phase

The proliferation phase begins by the third day after the injury and lasts until the wound heals. It is during this phase that revascularization, reepithelialization, and contraction of the burn wound take place. Endothelial cells bud at the end of capillaries, and they grow and create a vascular bed for new skin growth. Epithelial cells migrate over the vascular bed to form a new skin layer. Fibroblasts deposit collagen fibers, which contract to reduce wound size. During this phase the wound remains erythemic, and raised, rigid scars may develop. The tensile strength of the newly healed scars is poor and they are easily excoriated or injured.

Maturation Phase

The maturation phase generally begins by the third week after initial healing and may last 2 or more years after the initial burn injury or the date of the last reconstructive surgical procedure. During this phase, the fibroblasts leave and collagen remodeling takes place. The erythema fades, and the scar softens and flattens. The tensile strength of the scars increases but never recovers to more than 80% of the original tensile strength of the unburned skin.[66]

Scar Formation

After initial healing, most burn wounds have an erythematous, flat appearance. As the healing process continues, the wound's appearance may change as a result of scar hypertrophy and contraction. The long-term quality of a mature burn scar can be affected by numerous factors, some of which occur during the early phases of burn care.[40] The amount of time needed to achieve wound closure is a strong determinant. Age, race, and burn depth are other variables.[34] Bacterial infections in the wound increase the inflammatory response, which can delay wound healing and contribute to scar formation. However, any factor that delays healing will increase the potential for scarring.

Hypertrophic scars are thick, rigid, erythematous scars that become apparent 6 to 8 weeks after wound closure.[1] Histologically, these immature scars have increased vascularity, fibroblasts, myofibroblasts, mast cells, and collagen fibers arranged in whorls or nodules that make the scar appear raised and rigid.[10,66] Biochemical investigations have discovered increased synthesis of collagen fibers and connective tissue in hypertrophic scars. As a hypertrophic scar matures, capillaries, fibroblasts, and myofibroblasts decrease significantly, collagen fibers relax into parallel bands, and the scar becomes flatter and more pliable. The time needed for scars to mature differs markedly among individuals and depends on genetics, the age of the patient, the location and depth of the original burn wound, the presence of chronic inflammation, wound contamination, and other factors that have been reported to influence hypertrophic scarring.[26,90] Superficial burns that heal in less than 2 weeks will not generally form a hypertrophic scar. Deeper burns that take longer than 2 weeks to heal have a greater potential to form hypertrophic scars. Although most hypertrophic scars mature in 12 to 24 months,[24] excessive scar formation, including keloid scars, may take up to 3 years to mature (Figure 42.5). All three subjects in the case studies were of different age groups and ethnic/genetic backgrounds and had different occupational therapy interventions. Nevertheless, they all experienced serious scarring as a result of their burns.

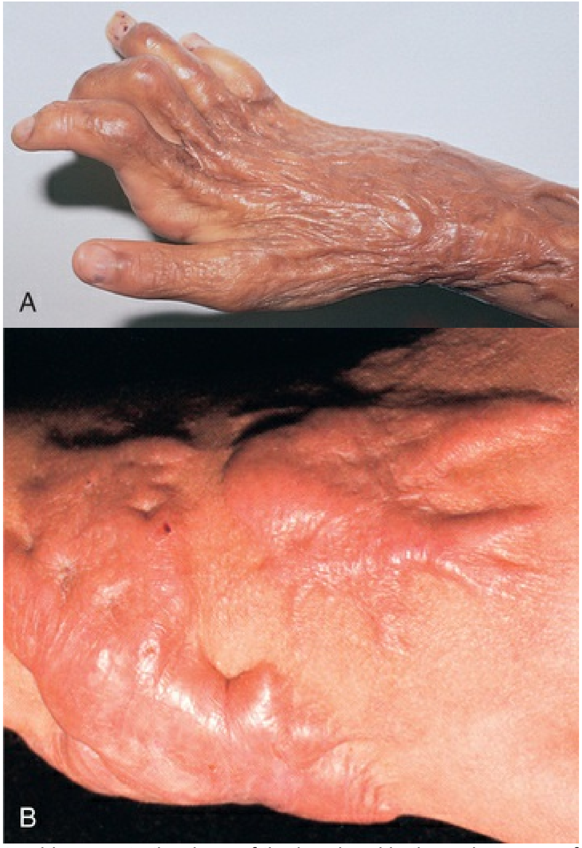

FIG 42.5 **A,** Hypertrophic scars to the dorm of the hand and in the web spaces of the hand result in a limited ability to grasp objects and impairs fine motor function. **B,** Severe keloid scars usually require surgical removal and aggressive compression therapy to help prevent recurrence. (*A,* Courtesy Michael Peck, MD, University of North Carolina Burn Center, Chapel Hill; in Copstead L, Banasik JL: *Pathophysiology,* ed 5, St. Louis, 2013, Saunders. *B,* From Lafleur Brooks M, LaFleur Brooks D: *Exploring medical language: a student-directed approach,* ed 9, St. Louis, 2014, Mosby.)

All scars initially have increased vascularity and a red appearance. Scars that remain erythematous for longer than 2 months are more likely to develop into hypertrophic scars. They become progressively firmer and thicker and rise above the original surface level of the skin. There is a marked increase in the production of fibroblasts, myofibroblasts, collagen, and interstitial material, all with contractile properties that help draw together the borders of a wound but can also result in scar tightness. Pain and skin tightness cause most patients to become less active. These patients prefer to rest in a flexed, adducted position for comfort. This allows the new collagen fibers in the wound to link and fuse together in the contracted position. The fibers become progressively more compact and coil up into the whorls and nodules that give the scar surface the textured appearance that often leads to disfigurement. If the scar extends over one or more joints, the progressive tightness leads to a scar contracture and loss of motion. Fortunately, collagen linkage is less stable in new scars, and restructuring of an immature hypertrophic scar contracture can be influenced by sustained mechanical forces such as proper positioning, exercise, splinting, and compression. Scar hypertrophy and contracture are most active for the initial 4 to 6 months after healing.[24]

Keloid scars are thick and raised scars that extend outside of the boundary of the initial injury. They can be unsightly and may take longer than a hypertrophic scar to mature fully. Some races are more likely to form both keloid and hypertrophic scars. If the patient has a tendency to form keloid-type scars, it is important for the treating therapist to be aware of this possibility, as the scars may disrupt daily functional movement more quickly than non-keloid-forming individuals.

In the case with Lee, who is of Korean background, the patient was observed to begin forming hypertrophic scars early in his healing. The appearance of the scars was shocking to him, especially that of the mesh graft. “It looks like fish skin” was how Lee described seeing his healed skin for the first time. Lee's interests were soccer and socializing with friends. The appearance of his skin made him very self-conscious and reluctant to leave home, significantly affecting his avocation pursuits and friendships.

Many burn survivors express the same apprehension as Lee. Consequently, they tend to be housebound because they want to avoid being seen in public. A significant number of burn survivors describe their regular burn clinic visit as the only time they leave their home during the day. This can foster feelings of isolation and create a barrier to the burn survivor's inclination to reengage in social activities and occupational roles.

The psychological impact of scar formation is long lasting. The patient will bear the scars of the burn for his or her whole life. They are very evident and unmistakable, especially in highly visible areas such as the hands, face, and neck. Occupational therapists working in burn care are uniquely qualified to address these issues because of their background in psychology as well as their understanding of physical disabilities. With care and support the burn survivor can find a sense of self-efficacy, self-worth, and self-sufficiency by reengaging in normal daily occupations. By reconnecting them with their occupational roles, occupational therapists help burn survivors to adjust to their environment and reintegration into society.

Initial Medical Management

Fluid Resuscitation and Edema

Immediately after a burn injury, during the inflammatory phase, the permeability of blood vessels increases. This causes rapid leakage of protein-rich intravascular fluid into the surrounding extravascular tissues.[60] In larger burns, extensive loss of intravascular fluid can result in hypovolemia or burn shock because of decreased plasma and blood volumes and reduced cardiac output.[37] Fluid resuscitation with an intravenous fluid such as lactated Ringer solution is essential for promptly replacing venous fluid and electrolytes. The fluid volume required is determined by various formulas, such as the Parkland and modified Brook formulas,[8] and is based on the extent of the burn and weight of the patient. The rate of fluid infusion is determined by monitoring the pulse rate, central venous pressure, hematocrit, and urinary output.

The lymphatic system, which normally carries excess tissue fluid away, often becomes overloaded, and subcutaneous edema develops. With circumferential full-thickness burns, loss of elasticity of the burned skin combined with increased edema can cause **compartment syndrome**, a condition in which interstitial pressure becomes severe enough to compress blood vessels, tendons, or nerves, which could result in secondary tissue damage. When blood vessels are compressed, **ischemia**, or restriction of circulation, could lead to tissue death in the areas of compromised circulation or even the entire distal end of the extremity. Tight burned tissue can also restrict chest expansion during respiration. **Escharotomy**, or incision through the necrotic burned tissue, is performed to release the binding effect of the tight **eschar** (adherent dead tissue that forms on skin with deep partial- or full-thickness burns), relieve the interstitial pressure, and restore the distal circulation (Figure 42.6, A). In deeper wounds, an incision down to and through the muscle fascia, or fasciotomy, may be required to achieve adequate relief of pressure (Figure 42.6, B).

FIG 42.6 **A,** Escharotomies performed on the dorsal surface of a hand with full-thickness burns. **B,** Electrical injury requiring fasciotomy, which will allow the muscle belly of the forearm to expand and prevent loss of blood flow to the hand. Note the distances between the edges of the incisions. (*A*, From Song DH, Neligan PC, editors: *Plastic surgery*, ed 3, London, 2013, Saunders. *B*, From Herndon DN: *Total burn care*, ed 4, Edinburgh, 2012, Saunders.)

Respiratory Management

A smoke inhalation injury is a common secondary diagnosis with thermal injury and can significantly increase mortality. When the face is burned, and the burn was caused by a fire in an enclosed space, or when other objective evidence of a possible inhalation injury is present, bronchoscopy, arterial blood gas readings, and chest x-ray examinations are used to confirm the diagnosis. Intubation and mechanical ventilatory support may be required in addition to vigorous respiratory therapy. A tracheostomy is performed if the airway is difficult to maintain or if ventilatory support is prolonged.[101] This procedure, which involves surgical incision through the trachea and relocation of the ventilation tube to the neck, is more comfortable for the patient, allows oral care, and helps prevent permanent damage to the larynx or vocal cords, which may occur with extended oral intubation.

Wound Care and Infection Control

After a patent airway and fluid resuscitation have been established, attention is directed to wound care. The burn injury itself can be a complex and dynamic injury that requires specialized wound care. The burn injury will often *convert* or change over time, healing a wound that is deeper or larger than initially thought. The initial burn injury is thought to *declare* itself in the first 72 hours if the patient is a healthy, well-nourished individual and received adequate resuscitation at the time of the initial injury. If the patient was not resuscitated properly, delayed treatment of the burn injury, received inappropriate wound care, or was malnourished, his or her wounds may continue to progress and will fail to heal. This leaves the patient at increased risk of infection, hypertrophic scar formation, and requiring surgery for wound closure.

Wound treatment may involve a combination of surgical and nonsurgical therapy.[45] Nonsurgical treatment involves the use of products to promote healing in a partial-thickness wound. These products are usually in the form of topical antibiotics, biologic dressings, and nonbiologic skin substitute dressings.

Topical Antimicrobial Agents

Topical antimicrobial agents have been shown to decrease wound-related infections and morbidity in burn wounds when used appropriately. The goal of topical antimicrobial therapy is to control microbial colonization, thereby preventing the development of invasive infections.

An ever-increasing variety of topical antimicrobials are used for burn wound care.[98] Neomycin/polymyxin B/bacitracin antibiotic ointments are often used for facial and superficial burns. The ointment is applied, and the burn wound is left open. Silver sulfadiazine (Silvadene cream, Keltman Pharmaceuticals, Inc.) is a commonly used antibacterial cream applied heavily over larger burns and held in place with layers of gauze dressings. Both of these agents are changed on a daily basis. Mafenide acetate (Sulfamylon, UDL laboratories, Inc.) and papain/urea (Accuzyme, DPT Laboratories, Ltd.) topical solution and creams are used to loosen eschar and facilitate débridement through enzymatic digestion.[64] Mafenide hydrochloride cream is hyperosmolar and can be painful when applied to larger areas. However, it is often used on the ears, where it can penetrate eschar to prevent chondritis, or inflammation of the ear cartilage. Mupirocin (Bactroban, GlaxoSmithKline) is an agent used to treat wounds infected with methicillin-resistant *Staphylococcus aureus* and *Staphylococcus pyogenes*.[92] Nystatin (Nilstat, Lederle Laboratories) may be used in combination with other topical agents for fungal infections caused by secondary immunosuppression. These fungal infections are often caused by long-term antibacterial use, usually originate in the gastrointestinal tract, and can be life threatening if they infect burns covering a large surface area or invade the bloodstream.

With the improved resuscitation measures developed for burns in the 1960s, infection became the predominant cause of morbidity and mortality. Silver salts and other chemically active silver compounds have been used in various forms because of their potent antimicrobial properties and ability to reduce burn wound infection. These substances have included silver colloidal solution, which was later replaced by silver nitrate solution, and silver sulfadiazine. Silver sulfadiazine is a water-soluble cream that is usually applied twice a day to the wound surface, as opposed to the continuous soaking required with silver nitrate. Since the 1970s, silver sulfadiazine has become the preferred option for antimicrobial silver therapy for burns.[25]

Major technological advances have resulted in the ability to crystallize silver in a nanocrystal form, which can release pure silver onto a wound surface in large quantities. This silver nanocrystalline delivery system is a three-ply dressing that may consist of an inner rayon/polyester core between two layers of silver-coated mesh.[13,104] Silver-infused dressings are also available in fabric-mesh or foam form. The ionic silver and silver radicals are released in high concentration when exposed to water. A layer between the wound and silver membrane maintains moisture for healing and decreases the formation of exudate.[25] The dressings, applied directly to the wound surface, promote healing by stimulating cellular dedifferentiation, followed by cellular proliferation. The dressings also have antibacterial, antifungal, and analgesic properties. These dressings have been found to be highly microbicidal against aerobic and anaerobic bacteria (including antibiotic-resistant strains), yeasts, and filamentous fungi[13] and can remain active and in place for up to 7 days instead of having to be changed every 12 to 24 hours.

Mepilex (Mölnlycke Health Care) is a silver-infused foam dressing that adheres to the area of the burn injury by a light adhesive. It can stay in place for 7 to 10 days. It provides antimicrobial coverage, and the foam is light and allows for movement of extremities. It is an expensive product, which can affect a burn unit's decision to use it. It is a very good product for children as it is comfortable and does not require a painful dressing change to be done at home. It is provided additional support by using Kerlix wrapping to secure it to the patient and then burn netting to hold the dressing together. It is most effective with superficial partial-thickness injuries.

Another silver-infused dressing is Acticote (Smith & Nephew) and Exalt (Exciton Technologies Inc.) dressing. This product is a silver-infused mesh product that can be secured to the patient with Kerlix wrap and burn net. Because it is a fabric, it is moldable and able to be secured over joints easily. It requires a light irrigation with water to release the silver into the wound and also to prevent the dressing from adhering to the wound bed and causing pain during movement. These products can be used in pre- and postoperative periods as burn dressing. These can be effective for up to 5 to 7 days between dressing changes.

Aquacel AG (ConvaTec Inc.) is a silver product that is different from the others. This product is a silver-infused fabric material that becomes a gel when in contact with a moist wound bed. When the dressing forms the gel, the silver aggregate is activated. It then hardens and forms an artificial "scab" that falls off when the burn injury reepithelializes. It comes as a sheet or as a glove. It is only effective with superficial partial-thickness injuries that do not require surgery. The product will harden and restrict movement in most cases, so this factor should be considered when deciding to use this product.

Biological Dressings

Biological dressings serve as temporary coverings to close a wound, prevent contamination, reduce fluid loss, and alleviate pain.[55] Theoretically, biological products may deliver growth factors to a wound as well. Traditional biological dressings, such as xenografts (porcine skin) and allografts (human cadaver skin), are still widely used in burn care. Xenografts may adhere to the superficial surface film of partial-thickness burns and facilitate débridement of eschar. Human amnion has also been used as a biological burn dressing, especially in developing countries.[87]

Biosynthetic Products

Biosynthetic products have been used widely for burn care. Closure of wounds with these dressings may lead to less pain, faster skin regrowth, and therefore less scarring. They are used until the wound is healed over, typically in 10 to 14 days, and then the dressing peels off.

Biobrane (Bertek Pharmaceuticals), a biosynthetic skin substitute wound-dressing sheet, has been used extensively. It is constructed of an outer silicone film (the epidermal analogue) with a nylon fabric partially embedded into the film collagen. The nylon components bind to the wound surface fibrin and collagen, which results in initial adherence (dermal analogue). Small pores are present in the structure to allow drainage of exudate and increase the permeability to topical antibiotics. However, if used improperly, the dressing can enclose dead tissue in the wound and provide a medium for bacterial overgrowth and invasive wound infection.[87]

Integra (Integra LifeSciences Corporation) is a biosynthetic wound dressing that is made up of an outer semipermeable silicone layer and an inner matrix of bovine collagen and glycosaminoglycan. According to Integra, "the collagen-glycosaminoglycan matrix provides a scaffold for cellular migration and capillary integration." This product is used for partial-thickness and full-thickness burn injuries. Because this product facilitates capillary growth into the wound area of coverage, it is often used for areas of tendon exposure, as the exposed tendon will have no blood supply of its own. This can allow for protection of the exposed tendon, maintaining the health and integrity of the tendon and allowing for eventual autograft placement over the area of exposed tendon, thereby preserving the overall function of the joint. In full-thickness injuries where the entire dermis is lost, Integra can facilitate the creation of a fertile wound bed in preparation for skin grafting, thereby creating the optimal environment for the skin graft to adhere and survive.

Biosynthetic products are becoming more widely used in burn care for wound closure. Some research indicates that use of these dermal substitutes can improve the appearance of the scar. However, there is no biosynthetic product that can substitute and provide all of the functions of real skin. It appears that biosynthetic products are emerging as a necessary part of burn care. However, most researchers agree that more research is needed on the functional outcomes of these products. Additionally, for a burn center careful consideration for the following must be made when using biosynthetic products: cost of the product (some products can be very expensive), its availability, and the skill required (surgical and wound care) for the product to be effective and safe.[18,35,86]

Hydrotherapy

Once the patient's condition is sufficiently stable, hydrotherapy is usually performed at least once a day to remove loose debris and "stale" topical antibiotics. It provides thorough cleansing of both the wound and the uninvolved areas. Hydrotherapy is generally accomplished by placing the patient on a "shower trolley" covered with a sterile plastic sheet and washing and showering the wound for 20 to 30 minutes. This nonsubmersive showering method of hydrotherapy has become the preferred technique of cleansing burn wounds to prevent cross-contamination of wounds among patients and has replaced the traditional whirlpool form of hydrotherapy.[2,29]

In hydrotherapy, the burn injury is cleaned, often with just a plain white soap (Ivory or Dove) and water. The wound bed is cleaned with soft washcloths. Dead skin, eschar, and pseudo eschar are removed from the wound, sometimes on a daily basis, and a new antimicrobial dressing can be placed. Fresh topical agents are then reapplied to delay colonization of organisms and reduce bacterial counts in the burn wounds. During hydrotherapy the patient has usually received some form of analgesics as well as antianxiety medications, as patients often have fear or anxiety surrounding the pain of a dressing change. Therefore the reduced pain and freedom-of-motion characteristic of the hydrotherapy intervention provides an excellent opportunity for the therapist to perform assessments and range-of-motion (ROM) exercises.

Sepsis

Burn wound colonization begins at the moment of injury, with gram-negative organisms replacing normal bacterial flora. Wound cultures and biopsies are performed to monitor such growth when signs of possible serious infection are present.[38] A severe infection can result in sepsis, in which the infection spreads from the original site through the bloodstream, a condition known as septicemia. Septicemia initiates a systemic response that affects the flow of blood to vital organs. Bacterial infections are the most common source of sepsis, but it can also result from fungal, parasitic, and mycobacterial infections, especially if the patient is immunocompromised. Broad-spectrum antibiotic therapy is typically initiated. However, if host defenses continue to be overwhelmed, the bacterial by-products or endotoxins accumulate in the bloodstream, a condition known as toxemia, which eventually leads to septic shock, a cardiovascular response that impedes blood flow to the organ systems, and to generalized circulatory collapse. Septic shock may be characterized by ischemia, diminished urine output, tachycardia, hypotension, tachypnea, hypothermia, disorientation, and coma. Septicemia and septic shock often require multisystem supportive measures for recovery, such as the use of cardiovascular medications, hemodialysis, and mechanical ventilation.

Surgical Intervention

There are different surgical interventions for a burn-injured patient. If a patient is unable to tolerate dressing changes or if the nursing staff is unable to clean the wound sufficiently in hydrotherapy, the burn unit team may decide to take a patient to the operating room for débridement. Some surgeons are certified or have access to conscious sedation in their burn units. In both cases, a surgeon will sedate a patient and then débride the wound down to a clean wound bed. This allows the surgeon to assess the clean wound and determine if the wound will heal on its own or if the patient will require a skin graft.

Although all burn wounds are treated with some type of topical antibacterial agent, when the depth and extent of the wound require more than 2 weeks for healing, surgical intervention is indicated to decrease burn morbidity and mortality. Surgical treatment of burns usually consists of excision of the nonviable burned tissue, or eschar, and placement of biological or synthetic skin grafts.

Essentially three types of biological grafts are available. A **xenograft**, or heterograft, is processed pigskin. A homograft, or **allograft**, is processed human cadaver skin. These grafts are used as biological dressings to provide temporary wound coverage and pain relief. An **autograft** consists of permanent surgical transplantation of the upper layers or a split-thickness skin graft (STSG) of the person's own skin taken from an unburned donor site.[79] The STSG is applied to the clean, excised tissues of the burn wound graft site. Skin grafts placed as a sheet have superior appearance and quality, but to cover large surface areas rapidly, the graft may be "meshed" to allow a single sheet of skin to be expanded for coverage of a larger surface area (Figure 42.7). The meshed graft attaches to the burn surface in the same manner as a sheet graft, but the interstices, or openings in the meshed skin, must heal by reepithelializing over granulation tissue. This leads to more scarring and a permanent mesh pattern on the skin.

FIG 42.7 **A** and **B,** Meshed skin grafts can be expanded to cover a larger surface area but have a higher risk of developing hypertrophic scars as they heal. The skin will also heal with the characteristic mesh pattern. **C,** Sheet grafts cover a smaller surface area but have a lower risk of developing hypertrophic scars as they heal.

Now that the size of a survivable burn has increased, the amount of available donor sites for autografting has conversely decreased. For this reason, alternatives to autografts have been developed. Examples of such alternatives are epidermal cultured skin substitutes,[36] cultured epidermal autografts,[9,87] and dermal analogues such as Integra (Integra LifeSciences Corporation) and AlloDerm (LifeCell Corporation).[87] A wound may be limited in size, but the defect may be so deep that survival of bone or tendon is at risk. In these instances, STSG adherence is difficult to achieve, and a full-thickness skin graft or microvascular skin flap may be indicated.[79]

Vacuum-Assisted Closure

Negative pressure wound therapy, also known as vacuum-assisted closure (VAC), is a treatment in which a sealed dressing and controlled negative pressure are used to evacuate wound fluid, stimulate growth of granulation tissue, and decrease bacterial colonization, especially in deeper wounds.[56] Since their introduction, VAC (VAC Therapy; KCI Concepts) dressings have been used in a number of surgical specialties, including burn care. By assisting in the débridement of necrotic tissue and removal of soluble inflammatory substances, VAC therapy reduces the number of dressing changes required and shortens the time interval between débridement and wound closure. This has been shown to facilitate the growth of granulation tissue even in deep wounds and thus make graft adherence more successful.[83]

Using a VAC device to secure a skin graft prevents fluid collection beneath the graft, ensures full contact between the wound bed and the transplanted skin, and distributes an even amount of pressure over the entire surface, regardless of the irregularity of the recipient bed. However, movement of the recipient surface could compromise the graft if it is not immobilized by proper positioning or splinting.[85] During treatment the therapist must be attentive to the VAC dressings and avoid activities with the patient that could disrupt the seal around the dressing and cause an air leak.

Nutrition

Adequate nutrition is essential during wound healing because the metabolic rate of a patient with a burn injury greatly increases with corresponding increases in protein, vitamin, mineral, and calorie needs.[54,81] Protein is especially important for wound healing and must be provided in substantial amounts. Nutritional requirements are calculated on the basis of the %TBSA and the patient's admission weight. Calorie counts and the patient's weight are closely monitored to ensure adequate nutrition. If the patient is unable to meet individual requirements through the diet, high-protein and high-calorie supplements are given either orally or through a nasogastric or gastric tube. If the gastrointestinal tract is compromised, intravenous hyperalimentation is frequently necessary for severe burns with extensive %TBSA. This solution contains sufficient amino acids, glucose, fatty acids, electrolytes, vitamins, and minerals to sustain life, maintain normal growth and development, and foster needed tissue repair. It is often infused through a central line catheter into the superior vena cava of the heart.

Later, as the wound closes and normal feeding resumes, nutritional demands decrease and the individual's eating habits must be normalized to prevent excessive weight gain. The occupational therapist and dietician will often work together when self-feeding is an issue. The occupational therapist can assist the dietician in understanding a patient's physical ability in the context of self-feeding so that food choices can be better tailored to suit the patient. For example, patients with mouth and face burns may find it painful to eat solid foods but may be willing to drink nutritional shakes to meet their needs as they are waiting to heal.

Associated Problems and Complications

Stress

Traumatic events associated with severe burns include natural and intentional disasters such as tornadoes, lightning, house fires, motor vehicle accidents, acts of war or terrorism, physical or sexual assault, and the sudden death of loved ones or friends. Burn treatment further traumatizes the patient because of associated painful medical procedures (e.g., wound care, limb amputations, multiple surgeries, and therapies). Mental health professionals are increasing their understanding of the factors associated with increased psychiatric risk and the ways in which burn patients, especially children, cope with the stress and pain triggered by traumatic events. Responses to major stress often include reliving the event, avoidance, and hypervigilance; these responses may continue long after the precipitating event. Post-traumatic stress disorder is a common psychiatric condition after traumatic experiences, including physical injuries such as burns.[22,27,28] Mood, anxiety, sleep, conduct, learning, and attention problems are often comorbid conditions, especially in children. Treatment involves pain assessment followed by specific interventions such as pain management, psychiatric consultation, and crisis intervention initiated promptly after the traumatic event. Intervention should also involve the burn survivor's family.[17]

Pain

Pain Assessment

Some of the most commonly used pain assessment tools include visual scales, color scales, word and faces scales, and adjective scales. A 1998 study indicated that patients prefer the faces and color scales over commonly used visual analog and adjective scales.[33] Pain levels should be assessed during a quiet time and again immediately after any painful activity.

Pain Management

Because pain has adverse physiologic and emotional effects, pain management is an important factor to achieve better outcomes. Developmentally appropriate and culturally sensitive pain assessment, pain relief, and reevaluation are essential in treatment. Pain control guidelines should address both background and procedural pain and associated anxiety. The occupational therapist should assist nursing staff in focused surveillance of burn pain and its successful treatment.[58]

Pharmacologic treatment is primary, strengthened by new concepts from neurobiology, clinical science, and the introduction of more effective drugs offering fewer adverse side effects and decreased toxicity. Opiates remain the most common form of analgesic therapy for patients with burns, but because these patients require increased opiate dosages, optimal relief of burn pain can be difficult. Alternative pain control methods include acetaminophen as a useful analgesic for minor burns. Nonsteroidal anti-inflammatory drugs and benzodiazepines are often combined with opiates. Antidepressants appear to enhance opiate-induced analgesia, whereas anticonvulsants are useful in the treatment of sympathetically maintained pain following burns. Ketamine has been used extensively during burn dressing changes, but psychological side effects, such as delirium and hallucinations, have limited its use.[63]

Nonpharmacologic intervention using various hypnotic, cognitive, behavioral, and sensory treatment methods is becoming more accepted. Transcutaneous electrical nerve stimulation, topical and systemic local anesthetics, and psychological techniques are also useful adjuncts.[64] Hypnosis may be a very useful alternative when opioid pain medication proves to be dangerous or ineffective; it has received strong anecdotal support from case reports.[62] The mechanisms behind hypnotic analgesia for burn pain are poorly understood; however, patients with burn injuries are more receptive to hypnosis than the general population, possibly because of increased motivation, dissociation, and regressive behavior.[65] Other methods of nonpharmaceutic pain reduction may be helpful. Relaxation techniques that may be of benefit include progressive relaxation, breathing exercises, guided imagery, aromatherapy, music therapy, and teaching individualized coping strategies.[72] As with hypnosis, distraction and relaxation techniques work best with alert, motivated patients.[59]

Patients with a severe burn injury naturally respond to pain by resisting painful motions or activities. Behavioral regression is also a normal response in most children (and many adults). When regression occurs, the therapist should be supportive and continually explain beforehand what needs to be done and why in terms that the patient can understand.

Most patients are usually more interested in whether the procedure will hurt and how long it will last than in lengthy explanations or technical information. Coordinating treatments with scheduled pain medications is often helpful and highly recommended, especially if active participation is necessary. The therapist should be aware of and use techniques to minimize preventable pain (e.g., applying adequate vascular support to the LEs before standing or ambulation). The therapist must also inform the nursing staff about any noted side effects from pain medication, as well as the observed effectiveness of the currently used pain management regimen. The need for short-term breakthrough pain relief should be coordinated with the nursing staff to reduce discomfort and stress during intensive therapy procedures. If a patient's anxiety or pain is disproportionate to the treatment, antianxiety medication may be indicated both to relieve anxiety and to increase the effectiveness of pain medication. Time limits on painful treatment sessions should be predetermined with all patients who are cognizant and capable of participation. The therapist should consistently adhere to these time limits to foster trust and a sense of control for the patient. By reducing the patient's anxiety, the therapist reduces the fear factor that can exacerbate perceived pain.[71] As the wound heals, the amount of narcotic analgesia is gradually decreased, and patients usually require minimal pain medication by discharge (see Chapter 28).

Psychosocial Factors

After a burn injury there is a potential for psychological reactions, including depression; withdrawal reactions caused by disfigurement; behavioral regression; and anxiety over the ability to resume work, family, community, and leisure roles.[31] The way in which a person copes with burn trauma is strongly influenced by his or her psychological status before the injury and whether the injury was a result of accident, arson, assault, or suicide attempt. The psychological ramifications can include guilt, anxiety, depression, regression, increased hostility, and existential crisis.[59] In the case of permanent loss of function and deformity, the patient may experience severe grief as a result of decreased physical abilities, changes in personal appearance and identity, loss of vocation, or loss of loved ones who were killed in the same accident. In the case of facial disfigurement and amputations, the patient's previous support system may also be reduced or lost as a result of abandonment by friends or significant others who cannot adjust to the physical changes in the patient.

Whether the permanent loss is social or physical, the patient may need to move through stages of grief similar to the five stages of grief in patients with a terminal diagnosis as described by Dr. Kübler-Ross in her book *On Death and Dying*.[49] The stages include the following:

- *Denial.* In this phase a burn-injured patient may express, "Why is this happening to me?" "The doctor said I'm going to have surgery to fix my burn." In this phase, burn patients may have the belief that their problems will be over once they heal the burn injury or have their surgery. They will not take into consideration the need for ongoing wound care, scar management, and therapeutic interventions to return to normal function.
- *Anger.* "Leave me alone!" Or "Stop hurting me!" Patients may express anger at medical staff, themselves, or at family or friends. They may refuse treatments or therapeutic interventions in their state of anger.
- *Bargaining.* In this phase, most burn-injured patients do not understand the length of time required for the burn injury to heal and to return to normal functioning. They may make statements such as "I'll do therapy later."
- *Depression.* When burn-injured patients realize that they are forever altered by their burn injury and that they must endure some amount of pain during their recovery, they will often experience sadness.
- *Acceptance.* The patient accepts the burn injury as part of him or herself. Patients learn to manage their pain without trying to avoid it. They acclimate to the new sensations of movement and touch. In this phase, patients will adapt to the bodily changes and return to work with modifications as needed; they will learn new physical and coping skills to deal with the burn injury and resume their place within their social/family circle, often creating new additional social supports.

If the patient does not reach the stage of acceptance, the rehabilitation process could be severely impaired. Providing emotional support and education and helping the patient develop coping mechanisms and self-direction can promote the psychological adjustment of patients with burn injuries. However, a severe burn injury occasionally results in a reassessment of personal values and relationships or a renewed appreciation of life. The complex interactions among premorbid personality style, extent of injury, and social and environmental contexts should be considered when determining how patients will adjust psychologically to a severe burn injury.[59]

OT Practice Notes

Occupational therapy intervention must address the psychological aspects from the initial assessment and onset of occupational therapy intervention and continue through discharge from occupational therapy services at the end of the rehabilitation phase. Even after discharge from rehabilitation, the client may continue to need psychosocial occupational therapy intervention as he or she attempts to become actively involved in the community, resume social activities and relationships, and return or enter the paid workforce.

Burn Rehabilitation

The Team

Successful care and rehabilitation of burn survivors require a multidisciplinary team approach that begins immediately after the patient's admission to the hospital and continues through and beyond hospitalization.[8,77] Ideally, the burn care team includes physicians, nurses, physical and occupational therapists, respiratory therapists, nutritionists, social workers, psychiatrists and psychologists, speech and language pathologists, orthotists and prosthetists, child care and recreational therapists, pastoral caregivers or clergy, interpreters or cultural support personnel, and vocational counselors. The most important members of the team, however, are the client and the client's family or support system.[82,88]

OT Practice Notes

All healthcare professionals must continue to update their knowledge and professional competencies and keep abreast of the rapidly changing treatments and therapies available for treating burned patients.[83] Recommended ways to continue professional development include the following:

- Review professional journals such as the *Journal of Burn Care and Rehabilitation, Burns, Journal of Wound Care, Journal of Trauma,* and *Journal of Burns.*
- Obtain membership in burn care associations such as the American Burn Association and the International Society of Burn Injuries.
- Attend local, regional, and national association meetings. Visit regional burn centers to confer with other burn therapists.
- Visit online websites of professional burn associations, and participate in online discussions with other burn care professionals.

Goals of Rehabilitation

The entire burn team is involved in some aspect of burn rehabilitation, whether it is providing verbal support, preparing the patient for self-care tasks, reinforcing the importance of active motion, or providing patient education. The long-term goals of occupational therapy are quite similar to the long-term goals of the entire burn team. Although specific goals may be the responsibility of various team members, everyone's efforts are focused on the same outcome. Occupational therapy treatment goals should therefore be compatible with all other treatment regimens and be established in collaboration with the patient, family, and entire rehabilitation team. Inherent in this concept is the need for close communication and cooperation of all burn team members. Occupational therapy should take the lead in helping all team members understand the client as a unique occupational being, along with all the relevant factors and contexts that will come into play. Role delineation between different disciplines, especially occupational therapy and physical therapy, differs among burn care facilities and may be determined by insurance reimbursement rather than by traditional roles or the specialized skills of the individual therapist. Therefore it is especially important that all disciplines work closely together with ongoing communication so that patients benefit from the skills and viewpoints of all areas of specialization. Occupational, physical, and speech therapists who specialize in burn rehabilitation increasingly use co-treatments that promote independence in both mobility and ADLs.

Phases of Recovery

Rehabilitation management of burn survivors can be divided into four overlapping phases to aid in categorizing and determining effective intervention goals. These phases of recovery are the acute care phase, the surgical and postoperative phase, the inpatient and outpatient rehabilitation phase, and the reconstructive phase.

The acute care phase is usually the first 72 hours after a major burn injury. However, if it is a superficial partial-thickness burn and heals spontaneously in less than 2 weeks without surgical intervention, the time from injury until epithelial healing is also considered an acute care phase.[76]

The surgical and postoperative phase follows the acute phase and continues for varying lengths of time, depending on the size of the burn injury and the presence of associated medical complications. During this period, vulnerability to wound infection, sepsis, and septic shock is especially great, and medical treatment is focused on promoting healing and minimizing infection.

The rehabilitation phase covers both inpatient and outpatient care and can extend for an indeterminate length of time. This phase follows the post-grafting period, when the patient is medically stable and most open wounds have healed. The quality of wound healing, scar formation, and need for aggressive rehabilitation make this the most challenging phase for burn patients, their families, and their therapists.

Acute Care Phase

During the acute care phase, medical management is of utmost importance for survival of the patient, and the goal of occupational therapy is primarily preventive. As the patient recovers and wound closure progresses, the nature of occupational therapy also changes, with treatment directed at restoring function. Initially, however, when the wounds are deep partial or full thickness, the acute care rehabilitation goals are as follows:

- Provide cognitive reorientation and psychological support.
- Reduce edema.
- Prevent loss of joint and skin mobility.
- Prevent loss of strength and activity tolerance.
- Promote occupational performance, such as independence in self-care skills.
- Provide patient and caregiver education.

Surgical and Postoperative Phase

Rehabilitation goals during the surgical and postoperative phase are focused on preserving or enhancing performance skills and patterns while supporting surgical objectives. Excision and grafting procedures usually require periods of immobilization of the areas treated to allow graft adherence. The preferred position and length of immobilization will vary by physician prerogative and burn center protocol, with the average period of immobilization being between 2 and 7 days.[16,42,79,84] Full-thickness skin grafts are immobilized for up to 10 days. When the patient requires biosynthetic grafting, the affected areas are immobilized from 10 to 14 days. The most advantageous postoperative position usually maintains the grafted area in the position that maximizes the surface area of the grafted site. For example, a hand with a dorsal burn should be splinted with the wrist in a neutral or slightly extended position, the metacarpophalangeal (MP) joints flexed, and the thumb radially abducted to protect the first web space.

During this phase, the goals of therapy include the following:

- Promote cognitive awareness by providing orientation activities when necessary, and continue psychological support.
- Protect and preserve graft and donor sites by fabricating splints and establishing positioning techniques that support the surgeon's postoperative care orders.
- Prevent muscular atrophy and loss of activity tolerance, and reduce the risk for thrombophlebitis by providing exercise for areas that are not immobilized.
- Increase independence in self-care by teaching alternative techniques and providing adaptive equipment as needed.
- Educate and reassure the patient and family members regarding this phase of recovery.

Rehabilitation Phase

The third phase of recovery is the rehabilitation phase, which begins as wound closure occurs. Individuals with large %TBSA burns frequently enter this phase needing further surgery. However, the majority of their wounds are closed, and scar maturation is commencing. The focus of intervention during this phase is on maximizing function and participation in occupations, promoting physical and emotional independence, and managing scar formation to prevent or correct deformity and contracture formation. Patient and family education is especially important for developing competence in wound/scar care and therapy programs in preparation for discharge.

The rehabilitation phase extends past hospital discharge and continues until maturation of all burn wounds and surgical sites is complete. Before discharge from the hospital, emphasis is placed on independence, self-management, and education. Once the client is home, emotional support and intervention must continue to help sustain the client's confidence, self-esteem, and motivation, qualities that the client needs to cope with the physical, social, and emotional consequences of a severe burn injury.

Intervention goals for this phase can be exhaustive given the potentially disabling effects of burn scars. Therefore it is important for the therapist to incorporate the patient's personal goals from the beginning of the rehabilitation process.

Treatment goals for the rehabilitation phase are expanded to include the following:

- Continue to provide psychological support as the patient progresses toward physical and emotional independence and faces new challenges.
- Improve joint mobility and reduce contractures by using correct positioning, sustained passive stretching exercises, and splinting as needed.
- Restore muscle strength, coordination, and activity tolerance.
- Initiate a compression therapy and scar management program with the use of vascular support garments, custom scar compression garments, and pressure adapters to minimize scar hypertrophy, contractures, and disfigurement.
- Promote independent self-care skills or the ability to direct others to assist when needed, including appropriate positioning, exercise, and skin care. Provide instruction and opportunities to practice IADLs, including vocational and home-care activities.
- Continue to provide instruction on scar development, including potential sensory and cosmetic changes, scar management techniques, and related safety precautions such as sun protection and skin care.
- Guide the implementation of a post-discharge plan that supports resumption of school, work, social, and leisure occupations.

Reconstructive Phase

In this phase of burn survivors' recovery, they have often reintegrated into their daily life and have assumed their occupational roles. They have effectively entered the acceptance phase of the grief process and are able to demonstrate hope for the future by learning new occupational skills and acquiring new occupational roles. These patients often return to the outpatient burn clinic for follow-up once or twice a year to assess their scars and functional ability. These patients are ready to discuss surgery to improve the appearance of scars. In this phase, the patients psychologically understand the limitations of surgery and scar management interventions to improve the burn scar appearance. They are able to have a conversation with the physicians about how they look and the concerns they have. They typically become active participants in the decisions on elective surgeries to improve the appearance of their scars. Though the occupational therapist's role during this phase is limited, he or she can empower the patient to initiate the conversation with the surgeon to discuss reconstruction.

Occupational Therapy Evaluation

Although medical status issues are a primary concern during acute care, whenever possible the occupational therapist should complete an initial evaluation within the first 24 to 48 hours after hospital admission. Burn etiology, medical history, and any secondary diagnoses are obtained from the medical record and team. The wounds are then visually assessed to determine the extent and depth of injury. Any areas affecting future occupational performance and context are noted and documented.

Whenever possible, both the client and family are interviewed to establish rapport and to obtain a history of the client's previous occupational performance. This history should include preinjury body structures and body functions (i.e., hand dominance, previous injuries, and performance-limiting illnesses or conditions) and specific information on past performance skills and patterns, daily routines, and activities (including professional, educational, and domestic responsibilities). Obtaining data concerning preinjury personality traits and psychological status is equally important. With this information, the therapist can monitor for changes in the client's behavior and cognitive functioning and choose the most appropriate interactive approach to encourage the client's involvement in goal setting and the therapy process. In the case of a severe burn requiring intubation and mechanical ventilation, this information must be obtained from family members and significant others to verify and supplement what the patient may relay nonverbally.

OT Practice Notes

Ideally, the client's history of occupational performance would be obtained before assessment of current client factors. However, the acuity of the injury, time constraints, and the need to coordinate physical assessment with pain medications, wound dressing changes, and other medical procedures may supersede completion of a detailed performance history.

Involved and uninvolved areas should be evaluated for joint mobility, strength, sensation, and functional use. However, before beginning this evaluation, the therapist should explain the purpose of occupational therapy and what the client should expect during the assessment, including the potential for discomfort. Preassessment instruction and ongoing encouragement help reassure clients and decrease anxiety so that they can perform at their best. Emphasis is placed on the ultimate long-term goal of resuming engagement in meaningful occupations and participation in life contexts.

The initial clinical evaluation should address all areas of potential occupational therapy intervention, including assessment of wound location and severity, presence and severity of edema, passive range of motion (PROM) and active range of motion (AROM), muscle strength, gross and fine motor coordination, changes in sensation, and level of cognitive awareness. Ideally, these assessments take place during a dressing change or hydrotherapy, when the involved areas are exposed and unencumbered.

During the initial evaluation, distinctions are made among superficial, superficial partial, and deep partial-thickness burns, as well as full-thickness burns, on the basis of appearance and presence of sensation. The therapist must view the wounds as soon as possible after the injury, before the development of burn eschar. Eschar causes deep partial-thickness burns to closely resemble full-thickness burns and makes an accurate evaluation of depth difficult. Attention should also be directed to burned joint surface areas and the presence of any circumferential burns. ROM assessment should be performed to evaluate joint mobility, and general strength should be tested before significant edema develops or restrictive dressings are applied.

Instructing the client regarding the types of movements and the number of repetitions expected while gently guiding the individual through the specific motion can help ensure achievement of full range. When possible, a goniometer should be used for assessing ROM to accurately document baseline deficits and future changes in recorded measurements. If pain, edema, tight eschar, or bulky dressings limit full ROM, such information should also be documented. Preexisting conditions that may alter expected AROM should be investigated during the patient and family interview. Although AROM is preferred, PROM should be measured if a client is unresponsive or unable to move the extremity sufficiently. When using PROM, care must be taken to not apply excessive force, especially with older clients who have degenerative joint disease or small children with hypermobile joints.

With deeper partial- or full-thickness dorsal hand burns, boutonnière precautions should be initiated until the integrity of the hand's extensor hood mechanisms can be verified. Boutonnière precautions involve avoidance of composite active or passive flexion of the fingers. Instead, isolated MP flexion is combined with interphalangeal (IP) joint extension to prevent stress and possible damage to a compromised extensor tendon mechanism. All passive proximal interphalangeal (PIP) flexion is avoided, and protective splinting is promptly initiated to maintain the PIP joints in extension.

A gross sensory screening that includes all sensory distribution areas should be performed. Such screening is especially important in individuals with electrical injury or a history of long-standing diabetes, in whom peripheral neuropathies may be present.

If the client possessed normal functional muscle strength before the injury, an initial test of gross muscle strength may not be needed if the AROM assessment reveals adequate strength to work against gravity. Manual muscle testing of major muscle groups is indicated if the burn resulted from an electrical contact injury, if the presence of severe edema might cause compartment syndrome, or if other musculoskeletal or neurologic injuries are suspected.[103] If the hand is unburned or if it is a superficial partial-thickness burn, a dynamometer and pinch gauge provide objective baseline measurements of grip and pinch strength.

ADL assessment begins by interviewing the client or the family to obtain the client's preinjury level of physical, cognitive, and social performance skills and patterns. When the burn injury is severe, the ADL assessment is postponed until the client is medically stable and able to participate in the pursuit of more advanced occupational goals. Clients with less severe burns and those who are not mechanically ventilated should be assessed for basic ADL skills, such as feeding, basic grooming, and donning and doffing of hospital gowns. Any compensatory actions or awkward movements used to complete the activity should be noted. Any abnormal patterns should be investigated and discussed to determine whether they were present before the burn injury.

After completion of the initial evaluation (Table 42.2), short- and long-term goals should be established with the client's collaboration. The client's previous context and lifestyle, personal long-term goals, and current priorities should be taken into account when establishing occupational therapy intervention goals. All short-term goals should be specific and realistic and have an established time frame for completion. After goals are agreed on, the intervention plan can be formulated. The occupational therapy intervention plan should be practical and should complement and support the goals of the other team members.

TABLE 42.2

Components of Evaluation for Burn Rehabilitation

Initial Evaluation	Inpatient Rehabilitation	Outpatient Rehabilitation
Cause of the burn	Graft adherence	Skin or scar condition
%TBSA	Skin or scar condition	Compression garment fit
Depth of the burn	Contracture concerns	Volumetrics if needed
Area(s) involved	Edema (if present)	ADL performance level
Age, hand dominance	ADL performance level	Work skills
Functional status	Work skills	Active and passive ROM, TAM
Occupation	Active and passive ROM, TAM	Strength and activity tolerance
ROM and strength	Strength and activity tolerance	Developmental level (child)
Mobility and activity tolerance	Developmental level (child)	Psychological status
Developmental level (child)	Psychological status	Social support
Psychological status	Social support	Leisure activities
Social support	Leisure activities	Compression garment needs
Leisure activities	Compression garment needs	Home management
	Home management	Home care understanding
		Return-to-work capacity
		Return-to-school potential and need for reentry program

ADL, activity of daily living; ROM, range of motion; TAM, total active motion; TBSA, total body surface area.

Two fundamental principles must be kept in mind when working in burn rehabilitation: (1) the main factor hindering post-burn functional recovery is the formation of scar contractures and hypertrophic scarring, and (2) severe scars and contractures are often preventable with prompt therapeutic intervention.[73] Therefore most burn rehabilitation intervention techniques and objectives are directed at prevention, as well as restoration.

Occupational Therapy Intervention

Acute Care Phase

Preventive Positioning

The purpose of preventive positioning is to reduce edema and maintain the involved extremities in an antideformity position (Table 42.3). Proper positioning is critical because the position of greatest comfort for the patient is usually the position of contracture.[50] The typical position of comfort consists of adduction and flexion of the UEs, flexion of the hips and knees, and plantar flexion of the ankles. The toes are generally pulled dorsally. Acutely burned hands are held by edema in a dysfunctional position consisting of wrist flexion, MP extension, IP flexion, and thumb adduction. This position, often called the “clawhand” or “intrinsic minus” position, can lead to severe dysfunction if not prevented during active scar formation.

TABLE 42.3

Antideformity Positioning for Specific Areas of the Body Following Burn Injury

Body Area	Antideformity Position	Equipment and Technique
Neck	Neutral to slight extension	No pillow; soft collar, neck conformer, or triple-component neck splint
Chest and abdomen	Trunk extension, shoulder retraction	Lower the top of the bed, towel roll beneath the thoracic spine, clavicle straps
Axilla	Shoulder abduction of 90 to 100 degrees	Arm boards, airplane splint, modified hip abduction pillow, clavicle straps, overhead traction
Elbow and forearm	Elbow extension, forearm neutral	Pillows, conformer splints, dynamic splints (when wounds healed/closed)
Wrist and hand	Wrist extension to 30 degrees, thumb radial abducted and extended, MP flexion of 50 to 70 degrees, IP extension	Elevate with pillows, volar burn hand splint
Hip and thigh	Neutral extension, hips in 10 to 15 degrees of abduction	Trochanter rolls, pillow between the knees, wedges
Knee and lower leg	Knee extension; anterior burn: slight flexion	Knee conformer, casts, elevation when sitting, dynamic splints
Ankle and foot	Neutral to 0 to 5 degrees of dorsiflexion	Custom splint, cast, AFO
Ears, face, mouth, eyes	Prevent pressure; maintain mouth opening, ability to close eyelids	No pillows; headgear, mouth splint

AFO, ankle-foot orthosis; IP, interphalangeal; MP, metacarpophalangeal.

Positioning needs are determined during the initial wound assessment by evaluating the surface areas burned and the presence of edema, considering the posture that the individual tends to assume, and assessing whether that posture would limit function if allowed. For example, if the burn injury involves the shoulder, chest, and axillae, the client's UEs should be elevated and positioned in approximately 90 degrees of shoulder abduction, 45 degrees of external rotation, and 60 degrees of horizontal adduction by using pillow inclines and arm boards or supporting the arms with sheepskin slings suspended from an overhead traction rig (Figure 42.8). Achieving full shoulder flexion and abduction with frequent exercise and activity is critical to prevent axillary contractures and subsequent loss of overhead reach as wound healing progresses. Once positioning needs are determined, illustrated guidelines should be posted at the bedside so that the nursing staff and team can assist in ongoing correct positioning (Figure 42.9).

FIG 42.8 Shoulder positioning postsurgery using a small hip abduction pillow.

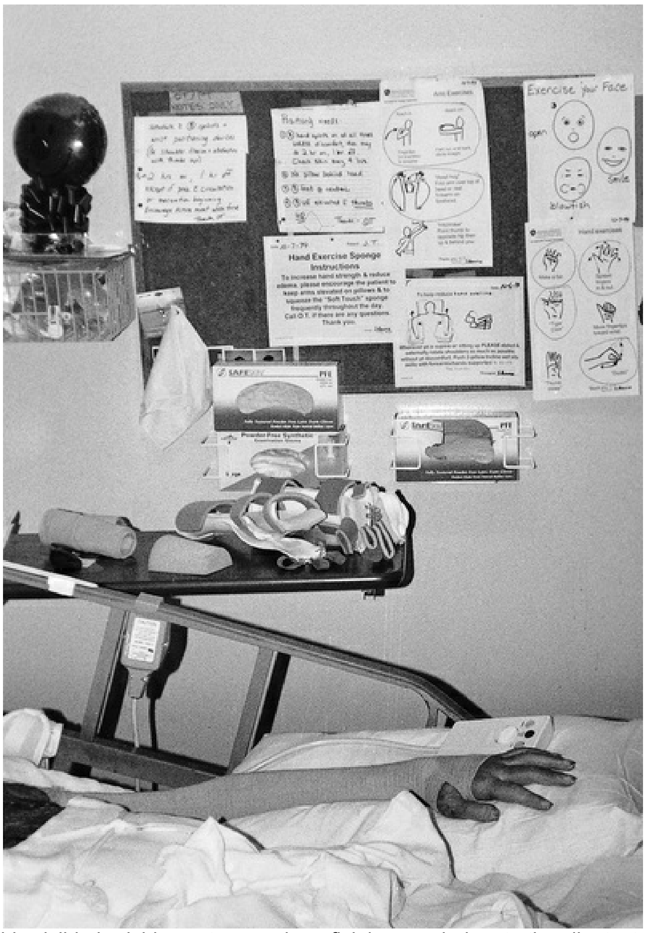

FIG 42.9 Highly visible bedside posters are beneficial as reminders to the client, staff, and visitors regarding positioning, exercises, and splinting instructions.

After admission, positioning is initiated primarily to reduce edema formation.[69] Elevation of the entire extremity above heart level can reduce the severity of distal edema formation, especially when paired with AROM exercises. As edema decreases and wound closure progresses, positioning goals should be directed toward prevention of skin tightness over joint surfaces (see Table 42.3).

Splinting

Splinting is initiated to maintain correct positioning and protect compromised tissues. It is not necessary for splints to be worn at all times to prevent contractures. When a splint is used during the acute phase, it is generally static in design and applied when at rest, with activity and exercise being emphasized during waking hours. Volar hand splints are indicated if a burned hand has chronic edema, active motion is limited, or unsupervised movement is contraindicated because of deep dorsal burns or other traumatic injury. The typical volar hand splint provides approximately 15 to 30 degrees of wrist extension, 50 to 70 degrees of MP joint flexion, full IP joint extension, and combined thumb abduction and extension (Figure 42.10).[24,74] Elbows or knees should be splinted at neutral position and secured with elastic wraps and taped on versus applying metal clips to prevent tears in grafts or surrounding intact skin.

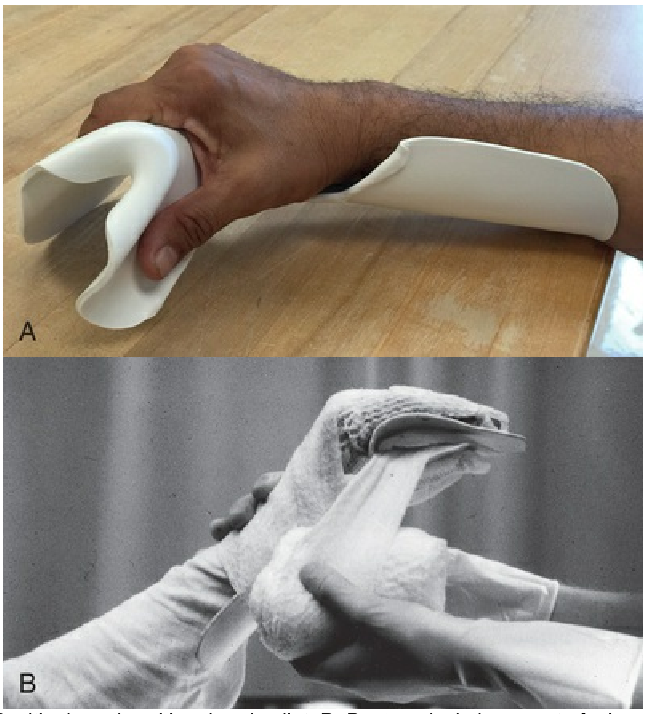

FIG 42.10 **A,** Positioning a hand in a hand splint. **B,** Postsurgical placement of a hand in a burn hand splint secured with elastic bandages.

When checking the fit of any splint, the therapist should consider potential pressure points and ensure correct placement. Splints fabricated shortly after injury require daily assessment and may require alterations to accommodate any significant changes in edema. Hand splints are secured in place with a figure-of-eight wrap of gauze bandage or elastic wraps, with the fingertips being exposed so that circulation can be monitored. Folded 4 × 4–inch gauze sponges are used over the proximal phalanges and under the wrap to keep the fingers extended and secured in the splint. Detachable straps, though convenient for later use, may be inappropriate for use with acute burn splints because of infection control concerns and the potential for constriction during fluctuations in distal edema.

During the course of Tonio's treatment, he was provided with a static-progressive hand splint for use throughout the day. His family was instructed on how to don/doff the splint so that he could continue to use the splint on the weekend to improve his functional ROM of (B) hands. The treatment was effective, and Tonio was able to form a more secure grasp with the right hand.

When the external ear has sustained a partial- or full-thickness burn, protection is desirable to prevent further damage caused by pressure from pillows, dressings, or endotracheal tubing. An ear protection splint should be fitted at the earliest opportunity and worn until the external ear burns have healed. The splint can be fabricated from two thermoplastic ear cups or cushioned oxygen masks secured in place with a dressing or a three-point stabilizing strapping technique.[23,46]

Activities of Daily Living

A client's ability to perform self-care is often limited during the acute care phase because of his or her current medical condition. The need for artificial ventilation, multiple lines, catheters, and other supportive equipment interferes with independence in ADLs, and clients are dependent on nursing staff for self-care.

While the client is maintained on the ventilator and orally intubated, ADL activity may be limited to self-suctioning of the oral cavity and, if no facial burns have occurred, basic facial hygiene. After extubation, oral care is often the next ADL attempted. When the client is medically cleared to take fluid or food by mouth, the occupational therapist should assess self-feeding abilities. Airway damage, accompanied by compromised speech and swallowing ability, often results from an extended period of intubation or direct damage during the burn injury. In these cases, the occupational therapist works in concert with the speech pathologist on common goals that promote effective communication skills and independent self-feeding. Burns involving the UEs and associated pain, dressings, and edema may interfere with self-feeding, hygiene/grooming, and writing motions and make temporary use of adaptive equipment necessary. This equipment may include built-up or extended handles on utensils, a plate guard, or an insulated travel mug with a lid and straw. Hair grooming and shaving are other self-care activities to initiate early, depending on the client's strength and activity tolerance. Adaptive equipment is sparingly used as the ultimate goal is for the patient to have and use the full range of motion of the upper extremities and hands.

In the acute phase, ADL tasks should be selected that are valued by the client and have a high probability of success even though temporary adaptations may be necessary. Modifications in the client's environment, equipment, or previous performance patterns may be necessary to support independence. However, eventual discontinuation of adaptive techniques and devices is a long-term goal of therapy and should be presented to the client as a sign of progress during the course of therapy. A goal shared by both the client and therapist alike should be independence in all ADLs using previous performance patterns, completed within an appropriate length of time and with minimal adaptations.

Therapeutic Exercise and Activity Tolerance

Sitting tolerance, transfers, and ambulation activities are initiated as soon as the client is medically cleared to get out of bed and bear weight on his or her LEs. If the client has burns on the LEs, elastic wraps should be applied before the client sits up and the feet become dependent. A figure-of-eight pattern should be used from the base of the toes, over and including the heel, to at least the knees, and up to the groin as needed. When the client is sitting in a chair, the LEs should be kept elevated. Any time spent dangling the feet or standing statically should be limited to prevent distal venous congestion and unnecessary discomfort.

In addition to functional activities, active exercise is a primary component in every burn treatment plan. The exercise techniques used during acute care are not unique to the injury. Active, active-assisted, or passive exercises are used, depending on the client's condition. The focus of exercise in acute care is to preserve ROM and functional strength, build cardiopulmonary endurance, and decrease edema.

Strengthening activities are introduced into the acute care intervention program as soon as the patient's condition allows. Such activities range from simple active movement to resistive activities, as tolerated, to counteract the deconditioning effects of hospitalization. Exercise after a severe burn injury was once thought to overstress an already hypermetabolic client. However, research and experience have shown that graded, progressive exercise is beneficial when recovering from acute burns.[43,100]

Client Education

Client education should be thought of as ongoing. Newly injured patients are often in a state of shock from the initial trauma. They can feel overwhelmed and have difficulty processing information. Cognitive studies show that stress can negatively impact the patient's frontal lobe or thinking brain. This can make providing education more challenging. The patient should be given multiple opportunities to learn information. Ward and home programs are good ways to begin educating a patient on his or her burn injury, expected ROM exercises, safety precautions, and contracture preventions. When the patient is given an array of modalities and opportunities to learn information in multiple ways such as handouts, verbal instruction, video presentations, and return demonstration, outcomes improve significantly. Exercise programs should be a part of the regular treatment session, as this is how patients learn to make stretching and movement a part of their daily routine upon returning home. Information should be given to patients as they can tolerate to prevent the patient from feeling overwhelmed. The therapist should assess the exercise program on a daily basis to continue to provide the patient with an adequate challenge toward progression in his or her goals.

Although client education is the responsibility of all burn team members, success of the occupational therapy intervention program depends on the client's recognition of long-term activity demands, contextual needs, and role responsibilities. Initial educational objectives should focus on developing an understanding of the stages of burn recovery, the need for and importance of independent activity and motion, and pain and stress management techniques. Meeting these goals promotes motivation, active participation, and engagement in occupation, which are essential for successful treatment outcomes.[32]

Surgical and Postoperative Phase

Positioning and Postoperative Splinting

Excision and grafting procedures usually require a period of postoperative immobilization to allow adherence and vascularization of the grafted skin.[23] It is beneficial for the occupational therapist to discuss postoperative positioning needs with the surgeon before surgery so that splints and positioning devices can be prefabricated and applied in the operating room immediately after the surgical procedure. Various materials and protocols are available. All have the common purposes of immobilizing the grafted area, preventing edema, and assisting in wound healing.[76]

Postoperative positioning may follow standard positioning techniques or may be unique and designed exclusively for the specific surgical procedure. Although standard burn splints position the extremity in the antideformity position, preoperative or postoperative splints should hold the extremity in the position that promotes the greatest surface area for graft placement. For dorsal hand grafts, the wrist is positioned in neutral, the MP joints in flexion, and the thumb in abduction to maximize the dorsal grafted surface area. Another example is that in which an axillary advancement flap is performed; the shoulder is abducted only 45 degrees. Gaining prior knowledge of the surgical procedure and determining potential postoperative complications enable the therapist to establish effective positioning and splinting procedures.

Although postoperative immobilization is often achieved through the use of bulky restrictive dressings and standard positioning equipment, splints are frequently needed to maintain the position. Most splints are typically made with plaster bandages or thermoplastic material (Figure 42.11). If a wet dressing will cover the graft site, a perforated or open-weave splinting material may be preferred to permit continuous drainage and prevent graft maceration.[23] In some instances, movement of adjacent joints may disrupt graft adherence even though the graft does not cover the joint surface. In these cases, the splint design should incorporate immobilization of those joints in a functional position. A postoperative thermoplastic splint can generally be made by using a drape-and-trim technique.[23] Most postoperative splints are molded into position for temporary use and are discontinued once graft adherence is ensured. However, if the splints are made of thermoplastic material, they can later be remolded into the antideformity position.

FIG 42.11 Thermoplastic total-contact ankle dorsiflexion splint to prevent plantar flexion contracture.

Therapeutic Exercise and Activity

Throughout the postoperative phase of care, active and resistive exercise of the uninvolved extremities should be continued when possible to prevent loss of ROM and strength. Immediately after excision and grafting procedures, exercises for adjacent body areas are usually discontinued for a short time. Although the time varies among burn centers, the average period of immobilization is 3 to 5 days for most STSGs and 7 to 10 days for cultured epithelial grafts.[16,32,42,79] Exercises can be resumed as soon as graft adherence is confirmed. Before resuming exercises, the occupational therapist should view the grafts and adjacent areas to determine graft integrity and whether any tendons are exposed or subcutaneous tissues are compromised.

Gentle AROM is the treatment of choice to avoid shearing of the new grafts. If the client exhibited normal ROM before surgery and was immobilized for only 3 to 5 days, baseline ROM should be expected within 3 days after resumption of activity. Active exercise of a body area with a donor site is generally permitted after 2 to 3 days if no active bleeding is present. Donor sites on the LEs are treated similar to burns on the LEs; therefore standard treatment involves elevation and wrapping with elastic bandage.

Ambulation following excision and grafting of the LEs is not usually resumed until 5 to 7 days after surgery. With the physician's written consent, the client is encouraged and assisted to ambulate for short distances and then slowly increase the distance. Before ambulation, double elastic bandage wraps should be applied over a fluff gauze dressing to prevent shearing of the graft or vascular pooling. Use of an elastic bandage, elevation, and a stance that discourages static positioning is particularly important for protecting grafts on the LEs. When the client is able to walk, exercise on a stationary cycle ergometer is beneficial for increasing activity tolerance.

Activities of Daily Living and Client Education

Self-care and leisure-promoting activities should be continued and increased in a way that is commensurate with the demands of the activity, the client's physical abilities, and the client's tolerance of activity. Self-care is often difficult during this phase because of the immobilization positions necessary to ensure graft adherence. If a UE is immobilized, creative ADL adaptations may be needed to allow clients continued involvement in their care and control over their environment. Though only temporary, simple techniques such as universal cuffs strapped over splints or extended-handle utensils help preserve newly reacquired independence and foster confidence and feelings of self-actualization. Continued psychosocial support and burn care education are also essential to ensure understanding of post-surgical precautions and procedures.

Rehabilitation Phase: Inpatient

The rehabilitation phase generally begins when a severely burned patient no longer needs the intensive wound care provided by the burn unit. Most of the wounds are now closed, and the patient may move to a step-down unit or transfer to a rehabilitation setting. Here, patients are expected to assume a more active role in establishing treatment goals, demonstrate more independence in their care, and fully participate in their therapy. An upgraded exercise program, a variety of self-help and rehabilitation equipment, and new techniques are introduced to help increase ROM, strength, activity tolerance, and independence in higher-level ADLs and IADLs. Intervention and patient education focus on work, recreation, and the self-care skills necessary to help prepare clients for returning to normal daily activity routines, including resumption of previous performance patterns and roles. Potential roadblocks to resuming participation in occupation in previous personal contexts, including community reentry concerns and psychological adjustments, are anticipated and addressed during this phase.

Reassessment and Intervention Goals

As the wound closes, scar formation develops, and clients frequently report increased skin tightness that restricts certain functional movements and inhibits completion of ADLs. Intervention techniques to counteract the effects of scar development include skin conditioning, scar massage, compression therapy, therapeutic exercise preceded by slow, gentle sustained stretching, and splinting.

During the inpatient rehabilitation phase, the occupational therapy evaluation should emphasize a thorough ongoing assessment of performance skills. Active and passive goniometric measurements should be taken to document any limitations caused by joint restrictions or scar tightness. Joint-specific measurements can be used to document individual joint restriction, but if skin tightness affects several joints in the same extremity, the total active motion measurements or total passive motion measurements of all the joints in a combined movement pattern should be documented. If the injury is unilateral, measurements taken from the unaffected side can be used to establish normal values for the injured extremity. Muscle strength can be measured by manual muscle testing (MMT). However, if MMT is used, caution is required when the therapist applies resistance to avoid shearing of newly healed skin. Other components of the evaluation should include muscular and cardiopulmonary endurance, performance of self-care and home management activities, skin integrity, presence of edema, and scar development indicating the need for scar compression garments (see Table 42.2).

Treatment goals during inpatient rehabilitation are to increase ROM, strength, and activity tolerance to achieve independence in self-care; begin skin conditioning; aid in psychological adjustment; and provide patient and caregiver education, including familiarizing the client with the care necessary for discharge from the hospital. Although these goals are continued and progressively increased during the outpatient rehabilitation phase, other goals are added as the client prepares for reintegration into the home and community.

Skin Conditioning and Scar Massage

Skin-conditioning techniques are used to improve scar integrity and durability against minor trauma caused by pressure or shearing forces, decrease hypersensitivity, and moisturize dry, newly healed skin. These techniques should be used for any burned areas or surgical sites that took longer than 2 weeks to heal. Lubrication and massage with a water-based cream or lotion should be performed three to four times a day or whenever the skin feels excessively dry, tight, or itchy. This action provides needed lubrication for skin that is dry because of damaged sweat and sebaceous glands. Massage is beneficial for desensitizing well-healed but hypersensitive grafted areas or burn scars and for softening tight scar bands during sustained stretching exercises. When massaging a scar band, the therapist should be sure that the scar is fully stretched and premoisturized to reduce shearing forces and prevent splitting of immature or unstable, problematic scar tissue. Massage should be performed in a circular motion, with more pressure applied gradually as tolerated over time. Because of damaged or lost skin pigment, burn survivors are at a greater risk for sunburn. Precautions, including the use of sun block and avoidance of prolonged sun exposure, are taught before the client is discharged.

Compression Therapy

Compression therapy should be initiated early in the inpatient rehabilitation phase, as soon as most of the larger wounds are closed. Temporary interim pressure bandages or garments assist in general skin desensitization, edema control, and early scar compression. The type of compression chosen and the degree of compression gradient applied depend on how much pressure and shear force that the client's newly healed skin can initially tolerate; both are upgraded as the integrity of the skin improves. Selection of an interim compression bandage or garment is based on the degree and consistency of pressure that it applies, the ease of application, and the potential for damage from shear forces during application.[15] Elastic bandage wraps, self-adherent elastic wraps, tubular elastic support bandages, presized elastic pressure garments, and commercial or custom-made elastic garments are all commonly used (Figure 42.12).[7,24] Approximately 5 to 7 days after removal of the postoperative dressings, temporary compression dressings or garments can usually be applied. Tubular elastic bandages, presized or ready-made temporary elastic garments, Spandex "bicycle pants," and Isotoner-style gloves can be worn over light dressings. When patients have small open areas requiring minimal gauze dressings, a standard knee- or thigh-high nylon stocking can be applied over the dressings before the donning of tubular bandages or garments to reduce shearing forces and prevent displacement of the dressings. Temporary compression dressings and garments are taken off only for bathing, dressing changes, skin care, and garment laundering. Independent donning and doffing of interim garments are incorporated into the client's ADL training.

FIG 42.12 Early compression techniques: tubular elastic dressings, ready-made gloves and chin strap, custom-fabricated foam collar, and padded clavicular strap to preserve the neck and axillary contours.

Therapeutic Exercise and Activity

Newly healed skin tends to blister as a result of shearing forces or to split as a result of overstretching, especially when the skin is dry. Every therapy session should therefore begin with massage of the scars with a moisturizing lotion to prepare the dry or tight skin for increased motion. Whenever possible, clients should learn to perform their own skin care independently before their scheduled therapy. Once the scars are moisturized and lubricated, stretching is performed to increase the flexibility and fluidity of movement. Stretches should be slow and sustained, and forceful dynamic stretching should be avoided, with attention given to the position of adjacent joints during the stretching motion.

Massage with additional moisturizers during stretching exercises helps relieve itching and discomfort. Stretching in front of a mirror provides positive visual feedback for the patient and is helpful in correcting abnormal posturing. The therapist and client should see blanching of the scar as confirmation of an effective stretch.

AROM exercises, strengthening, and tasks to increase activity tolerance should follow stretching exercises. During the rehabilitation phase, emphasis is placed on flexibility exercises using complex motions that require the movement of several joints simultaneously. An activity that requires hand manipulation skills while reaching overhead is an example of a complex motion for a burn injury that involves the shoulder, elbow, and hand. Most ADLs require complex motions, and exercise programs should emphasize not just individual joint ROM but also combined joint mobility in functional patterns of movement (Figure 42.13).

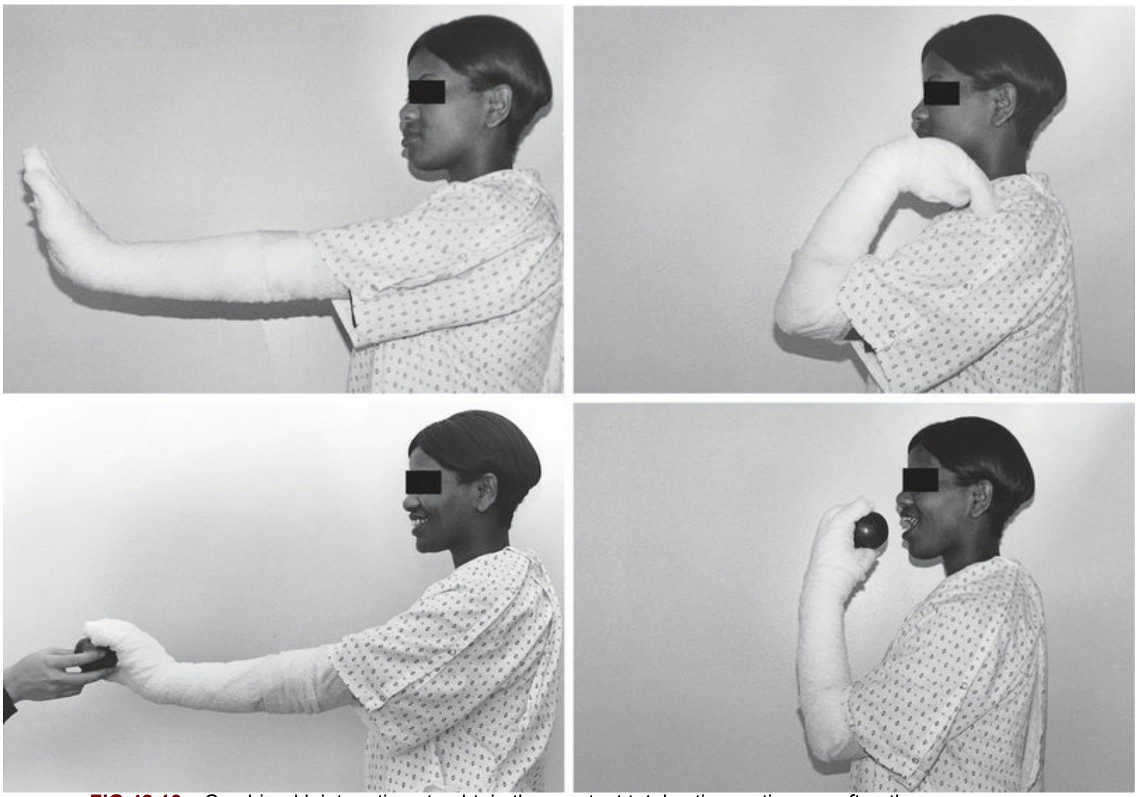

FIG 42.13 Combined joint motions to obtain the greatest total active motion are often the same functional patterns of movement used when performing activities of daily living.

For clients recovering from severe hand and UE burns, intervention activities may include a variety of exercise and activity treatment media. Strengthening activities may involve the use of cuff weights, dumbbells, resistive exercise bands, or work simulation equipment. Activities for hand strengthening and coordination may include using exercise putty, hand manipulation boards, work simulators and work samples, crafts, and meaningful activities such as typing on a computer, dialing a cell phone, and playing cards or board games with visitors.

Edema Management

During the rehabilitation phase, edema often continues because of decreased function, dependent positioning without adequate external compression, or circumferential scarring of the extremity with associated lymphatic damage. When edema is present, motion is limited and painful; if the edema becomes chronic, it may lead to fibrosis.[51] To treat edema of an extremity, elevation, progressive compression, and activity are recommended.

Self-adherent elastic bandage material (Coban or Coflex) is often used as an early form of compression for the digits, hands, and feet. It is applied in a spiral fashion, from distal to proximal, with the previous lap overlapped by a half overlap starting on each digit and continuing in this manner across the hand or foot and onto the wrist or ankle. Strips are also applied to each web space (Figure 42.14). The distal tips of digits are left open to monitor color, which should be rosy and not blanched or bluish. The rest of the extremity is wrapped with an elastic bandage or other form of temporary compression garment. The wrapped hand should be used during ADLs and other functional motions and elevated just above heart level when the client is resting. For edema of the LEs, use of a double layer of elastic wrap when ambulating, elevation when resting, active ankle exercises, and avoidance of static standing are recommended. Intermittent compression pump therapy is often used to treat chronic edema of the distal ends of extremities. Whenever compression therapy is used to treat edema of the hands or feet, before and after circumferential or volumetric measurements are recommended to monitor the effectiveness of the treatment (Figure 42.15).

FIG 42.14 Application of self-adherent elastic wrap to newly healed hands and feet provides external compression for the treatment of edema and early scarring.

FIG 42.15 In the treatment of extremity edema, sequential circumferences and volumetric

measurements are methods to monitor and document treatment efficacy.

Activities of Daily Living

As patients approach discharge from the hospital, the therapist must stress the importance of independent self-care. Eating, dressing, grooming, and bathing skills should be emphasized as part of the normal daily routine to increase independence and activity tolerance. When problems occur, the therapist must determine whether the dysfunction originates from a physical limitation, scar contracture, pain, edema, or an assumed abnormal postural reaction. Early identification of abnormal movements helps patients understand and relearn normal movement patterns before the abnormal patterns become habitual.

Practicing ADLs with personal care items and supplies from home fosters self-confidence in functional performance skills before hospital discharge. Clients with major burn injuries may initially require adaptations to support independence. However, when assessing the need for adaptive self-care, the therapist should differentiate between a physical limitation that can be rehabilitated and permanent loss of function.

In addition to basic ADL and self-care tasks, IADL tasks such as home management responsibilities should be practiced before discharge. Fear of items associated with the injury, such as hot water, the stove, or an electric iron, can hinder functional recovery. For clients injured during a home activity, the therapist should arrange counseling, support, and practice of the skills or activity in the clinic. Prevention techniques taught as part of the inpatient treatment program should also be part of the home program.[105]

Splinting

Splinting in the rehabilitation stage is used to limit or reverse potentially disabling or disfiguring contracture formations, increase ROM, distribute pressure over problem areas, or assist in function (Figure 42.16). Static splints, dynamic splints, and casting may be used,[11,47,77] depending on the location and severity of the contracture. Regardless of the purpose of the splint, every effort should be made to ensure that its purpose and method of application are fully understood. Splinting at nighttime and during rest periods is preferred because it allows functional use of the extremity during waking hours and provides treatment of contractures while the client is unoccupied. However, splints must fit comfortably, and corrective splinting should not cause discomfort that interferes with the client's rest. Although most clinicians agree about the value of splinting based on the strong rationale for splint use to provide counterforce to contracting scars or to lengthen scars when they limit joint motion, decision making on specifically when and how to splint remains controversial because of lack of strong clinical evidence.[75] The therapist must continually weigh the risk-to-benefit ratio and consider timing, design, and duration of splinting relative to each client's functional needs.

FIG 42.16 Static-progressive dynamic hand splints allow for a gradual progression of ROM of the joints of the fingers and wrist during an individual treatment session. Family members or patients can be instructed on how to apply these splints, and they can be incorporated into home exercise programs.

Client Education

Client and caregiver education becomes increasingly important during the predischarge phase to aid the transition from hospital to home. Increased understanding is needed in the areas of wound healing, the importance of preserving independence in ADLs and IADLs, the need for continued activity and exercise, the causes and effects of scar contracture, and scar management techniques and principles. Before discharge from the hospital or transfer to an inpatient rehabilitation facility, the client and family should receive a comprehensive home care education review (Table 42.4).[48] To reinforce learning, information should be presented through a variety of methods, such as verbal instruction, printed handouts, demonstrations, and educational videos. Most important, opportunities should be provided for the client and caregivers to practice wound care, garment and splint application, and all exercises under staff supervision in the weeks preceding discharge. Only with a detailed understanding of home care techniques and potential outcomes can clients be expected to assume responsibility for their own care and recovery.[105]

TABLE 42.4

Home Program Outline

Item	Information Needed
Wound care, positioning	Dressing change technique, precautions, elevation
Skin and scar care	Lubricant frequency, sun protection, trauma precautions such as no scratching
Self-care	Techniques and minimizing use of equipment
Splints and orthotics	Donning techniques, schedule, precautions
Pressure garments*	Purpose, washing, reordering, donning techniques, wearing schedule
Exercises	Frequency, techniques for specific areas, contracture prevention

*Custom-made garments are available from Jobst Institute, http://www.jobstcompressioninstitute.com; Barton-Carey, http://www.bartoncarey.com; Bio-Concepts, Inc., http://www.bio-con.com; Medical-Z, http://www.medicalz.com.

Rehabilitation Phase: Outpatient

Reassessment

Reassessment procedures take on greater significance after discharge. ROM, strength, activity tolerance, ADLs and IADLs, and skin and scar status must be assessed frequently to ensure early identification of specific problem areas. In addition to these rehabilitation components, the effectiveness of compression garments, the fit and need for continuation of certain splints, home care activities, emotional coping skills, and resumption of engagement in preburn occupations to support participation in contexts or life situations should also be closely monitored.

Reassessment of activity tolerance and work skills is indicated to help determine whether clients are ready to return to school or work or be referred for vocational rehabilitation. Driving evaluation and prevocational assessment by using simulated work activities or work sample testing may also be indicated for the more severely injured burn survivor. Vocational counseling and exploration should be undertaken in the later stages of recovery if residual dysfunction necessitates a change in the work environment or vocational role.

Therapeutic Exercise and Activity

Inpatient rehabilitation techniques, equipment, and therapeutic activities continue to be appropriate during outpatient therapy. However, progressive grading of exercise and the frequency, intensity, and duration of activity is necessary to successfully regain or improve the client's strength, activity tolerance, and performance skills and patterns, as well as abilities in performance in areas of occupation. Sequencing the order of intervention activities is necessary to prevent injury, minimize client discomfort, and prevent excessive fatigue. Skin lubrication, massage, and stretching should precede progressive strengthening exercises and activities.[52] Before being discharged, clients should learn how to prepare for exercise and activity by performing their own skin lubrication, massage, and stretching. Doing their own pretreatment skin care and stretching will allow outpatients to maximize actual therapy time and develop habits that promote consistent follow-through with their home activities and independent exercise program.

Scar Management

A primary objective of most burn rehabilitation techniques is prevention or treatment of hypertrophic scars and scar contractures. For effective treatment of scar problems, scar characteristics must be monitored so that one can recognize when maturation occurs. Active scars are erythematous, raised, and rigid. As they mature, scars become less vascular in color, with flatter and more pliable contours and a smoother texture. **Scar maturation** usually takes from 12 to 18 months after injury, depending on the length of time that the original burn takes to heal. However, it is important to remember that each patient heals differently. Some scars mature in less than 1 year, whereas others may take more than 2 years.[77]

A rating scale has been designed that allows serial assessment of scar pigment, vascularity, pliability, and height.[93] Although the ratings are somewhat subjective and time-consuming, the scale is a useful clinical tool. However, use of digital photography is a time-efficient and objective method of documenting changes in scar appearance; copies of the images can easily be inserted into the medical record.

Wearing intermediate-pressure garments prepares the skin for the later fitting of custom-made compression garments. Use of compression garments is indicated for all donor sites, graft sites, and burn wounds that take more than 2 weeks to heal spontaneously.[19,20] The occupational therapist is often responsible for measuring, ordering, and fitting of these garments. The occupational therapist must frequently make special on-the-spot modifications during a clinic visit or fabricate underlying conformers to ensure uniform pressure. All custom-made garments are measured and ordered according to the specific instructions of the manufacturer. Most compression garment manufacturers offer a variety of design options, including special zippers or Velcro closures, silicone lining, custom inserts, and assorted colors.

Ideally, clients should be fitted with custom-made compression garments no later than 3 weeks after wound healing; otherwise, interim garments are worn until custom garments can be applied. It may be necessary to order garments on a piecemeal basis because different areas of the client may be ready for compression treatment at different points in time. Custom-made compression garments are constructed to provide gradient pressure, starting at 35 mm Hg distally (Figure 42.17). They should be worn 23 hours a day and be removed only for bathing, massage, skin care, or sexual activity. Face masks and gloves may also be removed for meals. Compression therapy should be applied to the burned area for approximately 12 to 18 months or until scar maturation is complete. Donor sites may also require compression garments, depending on the thickness of the donor skin taken and whether healing occurred in less than 2 weeks.

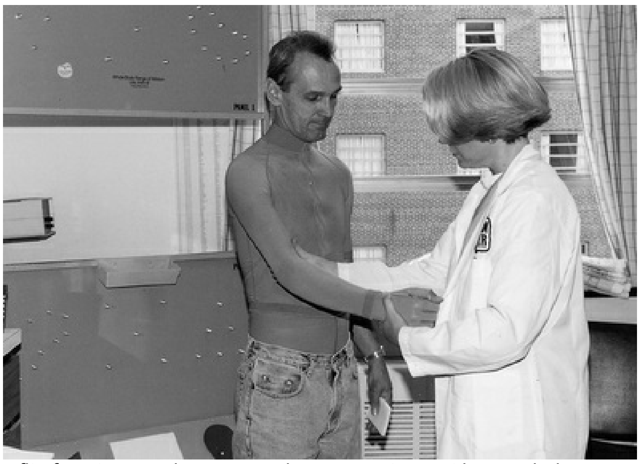

FIG 42.17 The fit of custom-made compression garments must be regularly reassessed to ensure adequate compression for effective scar management.

Once proper fit is established, it is recommended that the client possess a minimum of two sets of garments at any time to allow both around-the-clock compression therapy and laundering. Because of the elastic construction of the fabric, clients should hand-wash the garments with mild soap and allow them to air-dry unless otherwise advised by the manufacturer. To prolong the life of the garments, washing machines, dryers, direct heat, strong detergents, or bleach should not be used. If they are properly cared for, most garments will last approximately 2 to 3 months before replacements are needed. Children may need replacements more frequently as a result of their growth and active lifestyle. Toddlers undergoing toilet training and incontinent adults may need extra garments and design options that make independent toileting easier. Adults employed indoors are usually able to return to work and previous activities without interference from the garments. However, some individuals who work outside in warmer climates may find compression garments to be too hot in the summer months and may need to change their work setting until compression therapy is no longer required.

To be effective, compression garments must exert equal pressure over the entire burned surface area. Because of body contours, bony prominences, and postural adjustments, flexible inserts or pressure-adapting conformers are often needed under the garments to distribute the pressure more evenly. Areas commonly requiring pressure adapters are the supraclavicular region of the upper part of the chest, the areas between and under the breasts of women or obese men, the nasolabial folds, the midface and chin, the areas between the scapulae and over the axillary folds, the gluteal fold, the perineum, and the web spaces of the hands and feet.

Pressure inserts and conformers are now made from a variety of materials; the choice is based on the area to be treated and the need for flexibility when applied. As with compression garments, the fit of a conformer should be monitored at regular intervals for effectiveness and signs of deterioration and be replaced as needed to maintain exact contouring. Silicone gel pads, Silastic elastomer, Otoform-K (Dreve-Otoplastik GmbH), Plastazote (Zotefoams Inc.), and Velfoam (North Coast Medical, Inc.) are useful for hand scars. One-sixteenth-inch Aquaplast and Silastic (Qfix) elastomer work well on face scars; closed-cell foams, prosthetic foam elastomer, silicone gel pads, Plastazote, Otoform-K, and Velfoam are also useful for other body areas. In addition, Velfoam and silicone gel pads are effective at the flexion creases of the knees, elbows, and anterior aspect of the ankle to equalize pressure and prevent discomfort during activities.

It is important to note that although the use of pressure garments and silicone gel is commonplace, their effectiveness is not well established. A 2009 meta-analysis examining the effectiveness of pressure-garment therapy for the prevention of abnormal scarring after burn injury found sparse evidence to support its widespread use.[6] A systematic review of silicone gel sheeting reported weak evidence of its benefits in preventing or treating abnormal scarring.[61]

Activities of Daily Living

In addition to continued exercise, skin care, and scar management, the outpatient intervention plan should be directed at increasing independence in home care while also emphasizing resumption of prior life roles and context, including returning to previous work, school, social, and leisure activities. Scar contracture is often the primary cause of dysfunction (Figure 42.18). Therefore activities performed during therapy should not only promote strength, activity tolerance, and functional ROM to counteract the effects of scarring but also preserve independence in performance of occupations related to clients' personal contexts and interests.

FIG 42.18 **A,** A scar contracture occurs when tight scars limit free motion of a joint. This can be very limiting when the contractures are present in the hand. **B,** Surgical scar revisions can be done to reconstruct the hand and improve hand function.

Community Reentry

Returning to school or work becomes a primary objective during outpatient rehabilitation. However, most recovering burn survivors are capable of resuming normal daily routines and performance patterns long before their scars completely mature.

Returning to previous community settings (e.g., school, work, and social settings) and becoming reacquainted with friends and coworkers can be a difficult process for burn survivors who have cosmetic disfigurement, loss of functional performance, or restrictions in activity. A community reentry program should be implemented before the client returns to school or work. Correspondence sent to the community setting before the client's return helps educate employers, teachers, and peers about burn injuries and what the client has experienced. This correspondence should explain the purpose of compression garments, splints, exercise, and skin care precautions; digital photos are helpful. The goal of a reentry program is to reduce restrictions in the client's activities and ease the transition of returning to previous areas of occupation.[52]

Children may have a more difficult time reintegrating into their previous roles as students and playmates. Many burn centers offer school reentry programs to assist children in the emotional and physical challenges of returning to their school environment.[52] With prior parental permission, predischarge plans are made to send written information to the child's teacher, classmates, and (when available) a community-based therapist working in the school system to acquaint them with the child's changed appearance and special needs. A videotaped message recorded by the child to his or her classmates explaining what happened can be very effective, especially when delivered by a family member or healthcare professional, who can then answer the children's questions. The tape can show the child both with and, if appropriate, without compression garments to help satisfy classmates' curiosity and concerns before the burned child returns to the classroom. Such preparations ease resumption of the student role for the child and can help improve acceptance by other children, who may misunderstand the cause of the disfigurement and the need for splints, adapted equipment, and scar compression garments. Informed classmates often serve as advocates for the burned child by passing information to students in other grades or on the bus and providing support when misinformed students reveal their ignorance or fear by teasing or taunting the burned child. Regional burn summer camps, often sponsored by local firefighter organizations or burn centers, also help children adjust by placing them in settings where they can socialize with peers who have also been burned.

Preparing a burn patient for return to work does not have to be a long-term process. Burn rehabilitation and work skills training have many similarities; therefore it is possible to design treatment activities that simulate not only functional activities but also various work skills. Strength, activity tolerance, and flexibility, often identified as work tolerances, are obvious goals of burn rehabilitation. Physical demands of jobs, as described in the *Dictionary of Occupational Titles*,[96] are also components of functional skills; lifting, stooping, pushing, pulling, handling, and manipulating are a few examples. A job analysis interview, performed as part of the activity needs analysis, provides the type of information needed to integrate activities into the intervention plan, which should not only improve functional ability but also provide reconditioning for returning to work.

Preparing the client for community reentry after a burn injury also requires attention to two other types of tolerance: skin and temperature. Most clients will still need to wear compression garments and inserts, avoid prolonged sun exposure, and perform skin care while they are at school or work. Skin-conditioning activities and exercises performed while wearing garments will improve skin tolerance for friction and shear force demands (Figure 42.19). Education regarding the body's response to variations in temperature and precautions for dealing with extremes of temperature are necessary for the patient to plan for anticipated temperature tolerance problems. A systematic review of the literature reported that an average of 66% of patients returned to work following their burn, with the time taken to return to work ranging from 4.7 to 24 months. The extent and severity of the burn were the most significant barriers; others were longer hospital stays and the number of operative procedures.[70] (See Chapters 14 and 15 for further information.)

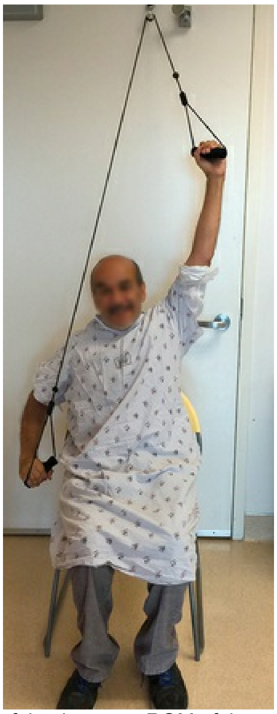

FIG 42.19 Overhead pulleys are useful to increase ROM of the upper extremities. They are also easily issued to patients for setup and use at home as a part of their home exercise program.

Psychological Adjustment

During outpatient rehabilitation, clients may undergo numerous physical and emotional changes. Once discharged from the hospital, they must face the overwhelming task of becoming responsible and self-reliant while dealing with the stress associated with developing scars and a changing self-image. They may not participate fully in therapy or adequately follow through with home care activities because of the physical and emotional effects of the injury. Apathy, avoidance of pain, scar tightness, and hypersensitivity all contribute to noncompliance and subsequent dysfunction after injury. Clients may experience symptoms of post-traumatic stress disorder, nightmares, and changes in appetite with subsequent weight gain or loss. They may become reclusive or disengage from previous relationships. Depression may occur even before discharge.[12,68,73]

In addition to established treatments such as counseling, support, and training in pain management and relaxation techniques, visits from a recovered burn survivor to a new patient are often of great benefit. Attending a burn support group can also help the burn survivor and family members in psychological adjustment. Research has shown that burn survivors at different stages of recovery tend to provide positive support to one another. Group discussions among burn survivors promote acceptance of what they have already experienced and realistic expectations of what they still need to accomplish.[12]

Discharge From Treatment

The outpatient therapy program should be reevaluated periodically to determine whether the frequency of treatment, program progression, or professional or educational status should be changed (e.g., return to work or school).[52] When clients have resumed their preinjury activities, outpatient therapy may be discontinued. Because burn scar maturation may take more than 18 months, a schedule of follow-up care, with appointments every 2 to 3 months, is needed until wearing of compression garments is discontinued. However, for children, annual burn clinic visits are recommended, even after discontinuation of compression garments, until full physical maturity is reached to ensure that growth is not impeded by scar inflexibility (see this chapter's case study).

Burn-Related Complications

Heterotopic Ossification

Heterotopic ossification (HO) is formation of bone in locations that normally do not contain bone tissue.[30,97] The underlying cause of HO is not yet fully understood. It typically develops either in the soft tissue around the joint or in the joint capsule and ligaments, and it often forms a bony bridge across the joint, resulting in a fused joint.[41] Although HO is frequently found in the posterior aspect of the elbow, it may occur in other joint areas such as the shoulder, wrist, hand, hip, knee, and ankle. It may occur in either extremity or bilaterally, even if the extremities were not burned. Signs that HO may be present usually appear during the latter stages of hospitalization, with the patient experiencing increased pain at a certain point in the joint's ROM. The pain is fairly localized and severe, and loss of ROM is usually rapid, with development of a hard, unyielding feel at the joint's end of available ROM. Inflammatory signs, such as redness or swelling, are not easily discernible within healing burn wounds. Once HO has been detected, frequent AROM exercise of the joint should be carried out within the pain-free range to preserve as much joint motion as possible.[21] Use of dynamic splints or forceful passive stretching of the involved joint should be discontinued. If the condition does not resolve with time, surgical intervention may be necessary to resect the limiting bony tissue, followed by therapy to preserve the regained ROM.

Neuromuscular Complications

Peripheral neuropathic conditions are the most common neurologic disorder observed in burn patients. They usually occur with high-voltage electrical burns or burns involving greater than 20% TBSA.[39] Peripheral nerve damage may be caused by infections, metabolic abnormalities, or neurotoxicities. A peripheral neuropathic condition is generally manifested as symmetric distal weakness, with or without sensory symptoms. Most conditions improve with time; however, patients often complain of fatigue and decreased activity tolerance that may last for months.[39]

In addition to peripheral neuropathic conditions, localized compression or stretch injuries of nerves are encountered during burn recovery. Causes of localized nerve injury include improper or prolonged positioning in bed or on the operating room table, tourniquet injury, and extreme edema. Common injury sites are the brachial plexus and ulnar and peroneal nerves. Prolonged frog leg positioning can cause a stretch injury, whereas prolonged side lying can cause a compression injury of the peroneal nerve.[39] The ulnar nerve is subject to a compression injury if the client rests on a firm surface with the elbows flexed and the forearms pronated. The brachial plexus is susceptible to stretch or compression injury if inappropriate shoulder-positioning techniques are used. To implement more effective prevention and intervention techniques, therapists should be aware of the causes and symptoms of various nerve injuries.

Contact with high-voltage electrical current often produces permanent damage to peripheral nerves as a result of thermal damage at the entrance and exit sites of the electrical current. Damage also occurs to peripheral nerves as a result of secondary compression of the blood supply caused by swelling of surrounding tissues. Delayed neurologic complications are caused by direct thermal damage, which results in demyelination and subsequent nerve cell death, or by vascular compromise of the brain or spinal cord. This generalized damage may be manifested as paralysis, cognitive impairment, aphasia, seizures, balance problems, or other neurologic symptoms. The therapist should be attentive to any developing symptoms of sensory or motor dysfunction in a client who was initially neurologically intact.[102]

Facial Disfigurement

Facial scars can be devastating, both functionally and psychologically. Tight or hypertrophic scars not only distort the smooth contours of the cheeks and forehead but can also flatten the nasal contours, evert the eyelids and lips, and constrict the optic and oral commissures. Vision, speech, feeding, and dental hygiene can be adversely affected by oral and eye contractures. Facial disfigurement is also damaging to an individual's self-image and inhibits social reentry. A significant amount of communication and social interaction depends on nonverbal facial expressions and eye contact. Severe facial burn scars not only distort the face and restrict expression but also undermine the patient's self-esteem when he or she is met by social rejection.

Two main compression therapy methods are used to prevent or manage hypertrophic facial scars. An elastic face mask can be worn with underlying flexible thermoplastic conformers. The other option is a rigid, total-contact transparent facial orthosis.[78] Each has advantages and disadvantages.

Because face masks are made of elastic fabric, generally enclose the entire head and neck, and use flexible conformers, they provide uniform multidirectional compression during movement or changes in position. However, because they occlude the face, they are cosmetically and socially less acceptable. The effectiveness of the compression is based on subjective feedback from the patient and observations made by the therapist during outpatient clinic visits. Most underlying conformers are easy to modify or replace to provide effective distribution of pressure over facial concavities and contours.

Conventional fabrication of a transparent, rigid facial orthosis is an involved and often expensive process. First, a cast is made with dental alginate over the surface of the face, and then the alginate is reinforced with a layer of fast-setting plaster strips. The patient must lie still and breathe through straws or small openings left in the alginate, which can be difficult for claustrophobic adults or small children. For this reason, some patients are unable to cooperate with this procedure unless they are under anesthesia. After the cast is removed from the patient, the breathing and neck openings are closed with more plaster strips and the facial cast filled with plaster of Paris. The resulting exact duplicate plaster model is polished smooth of scars and defects by hand. Additional plaster is carved off as needed to increase pressure on specific scarred areas of the face. Clear, high-temperature thermoplastic is then heated, stretched over the model, and either vacuum-molded to the model or manually stretched and molded by hand. The edges are finished, elastic straps are applied, and the orthosis is fitted to the patient. Because the material is clear, the rigid face mask has the advantage of allowing the therapist to view the face and objectively evaluate the amount of pressure exerted on the scars. By noting the presence of scar blanching under the clear mask, precise adjustments can be made as needed. The clear mask allows the face to be seen but has the disadvantage of exerting primarily unilateral compression, which may be compromised by speech, facial expressions, or side-lying positions. The mask does not allow perspiration to evaporate and must be removed and wiped clean regularly, especially in warmer climates.

Computer-aided design and manufacturing systems have been developed to efficiently and economically fabricate transparent face masks.[80] A software system integrates shape capture, mask design, and model fabrication with a linear scan noncontact laser imager for the acquisition of facial topography. The computer then integrates with a milling machine to fabricate a positive model out of urethane foam. The foam model is modified through use of the computer program and lined with a layer of polypropylene to smooth the foam texture. The model is then sprayed with silicone and the mold released and used basically in the same manner as the plaster model described previously. The rest of the fabrication process also works in a similar way. The advantage of computerized imaging and model fabrication is the speed of fabrication of the model and the ability to obtain a model without having to take a direct cast of the patient's face.

With either method, frequent alterations are necessary to achieve and maintain adequate compression of all facial scars (Figure 42.20). The choice of method is based on the preferences of the patient and physician. However, a combination of both types may be advantageous: the patient wears a clear, rigid face mask in social settings and a fabric mask with conformers at home. Appropriate skin care education is also important. Massage with lotion twice a day will aid in scar desensitization and provide the necessary lubrication. Facial massage and exercises are performed at least four times a day to help stretch tight facial skin, maintain eyelid and mouth flexibility, and preserve the nostril openings.

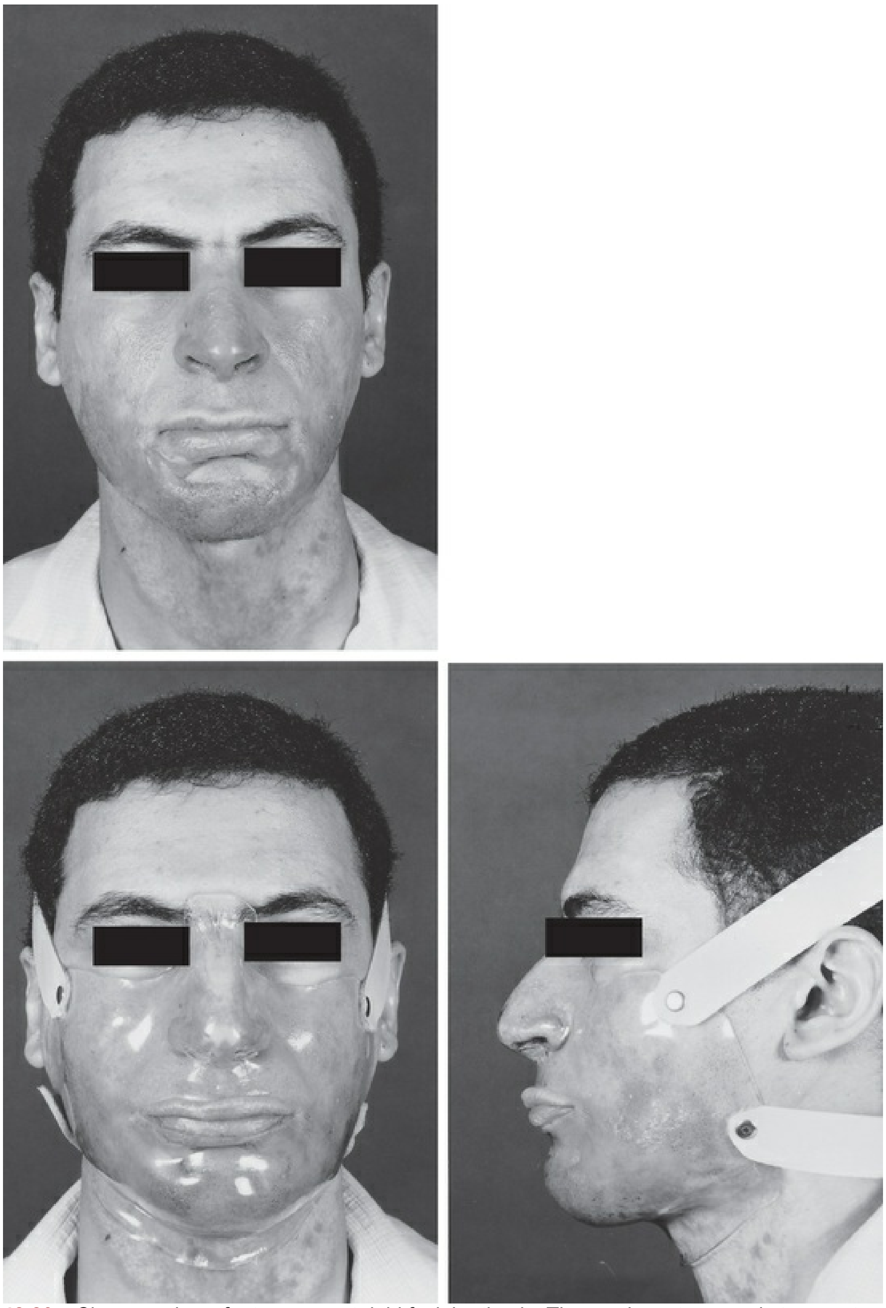

FIG 42.20 Close-up view of a transparent rigid facial orthosis. The mask contours and strap system are modified to adjust the amount of pressure over specific scarred areas (note the blanching of the scars on the lower lip and lateral aspect of the chin).

Just as with any compression therapy technique, patient compliance is essential for effectiveness of the treatment. The patient is instructed to wear the face mask at all times except while eating, bathing, or engaging in sexual activity. The patient should carry written verification from the burn physician verifying the medical necessity for the mask. Regardless, patients should always remove their masks before entering any public facility to avoid provoking suspicion that they are prepared to commit robbery or violence. This is especially important when entering banks, convenience stores, or government facilities, even if the patient is well known to the employees.

Individuals wearing either type of mask initially experience acute feelings of self-consciousness and may avoid going out in public. Parents may have difficulty putting the mask on their children and may experience feelings of guilt if the child rebels. Supportive intervention from family members and therapists is an important way to successfully manage these social and personal issues.

Consistent follow-through is especially critical in preventing or correcting facial scarring and disfigurement. Before applying the mask, the therapist must provide early education, ongoing encouragement, and continual support to ensure that the client wears the facial orthosis. Once the scars are mature and compression therapy is no longer needed, the client should be instructed in the use of special camouflaging cosmetics such as Covermark by Lydia O'Leary, which will cover minor flaws in texture and correct uneven pigmentation.

Threaded Case Study

Tonio, Part 2

Tonio experienced an inhalational injury to his lungs in the house fire and was subsequently placed on mechanical ventilation for several weeks. He eventually received a tracheostomy and was able to be weaned to trach mask oxygen and eventually to room air. The tracheostomy tube was removed (decannulated) one week prior to Tonio's discharge from the hospital and transfer to an inpatient rehab facility. At discharge, Tonio was able to eat a regular diet but still required maximum assistance for all ADLs. He had small, spotty open areas throughout his trunk and lower extremities that amounted to <5% TBSA open areas.

Evaluation and Goals

Tonio's initial evaluation consisted of a wound assessment, edema assessment, and ROM assessment of his (B) UEs. Because he was intubated and sedated, he was dependent for ADLs and mobility. His long-term girlfriend was very involved in his care and was able to provide a thorough occupational, environmental, and social history. Tonio's initial evaluation also included a cognitive component to see if he was able to awaken and to respond to simple commands.

As Tonio improved and was able to participate in occupational therapy sessions, he was observed to have great difficulty staying motivated to participate. This was discussed with both Tonio and his girlfriend. As a result, Tonio's family and friends became more active during his stay to help keep him motivated. Tonio's girlfriend informed visitors on how to encourage Tonio to participate in therapy and to follow through with his ward exercise programs. Tonio then became more motivated and was observed to participate more fully in his own therapy program. He was able to participate in goal setting and make progress in his self-care skills.

During the acute phase, treatment goals included reducing edema in the UEs, preserving and increasing UE ROM, maintaining and improving cognitive awareness, and regaining ADL independence. In the post-operative phase, the goals then included patient and family training in being independent using a continuous passive motion machine (CPM) to improve right hand function.

The following treatment interventions were initiated in the acute phase: To prevent and minimize edema, Tonio's UEs were elevated on pillows or a blanket above the level of his heart at all times. He engaged in cognitive reorientation activities every day with all staff members and his family. ROM exercises were graded based on his cognitive abilities. For example, while he was sedated, PROM exercises were performed to maintain flexible UE and hand joints. When Tonio was more awake and cognizant of his environment and situation, he participated in active assistive range of motion (AAROM) and AROM exercises and other therapeutic activities.

Once Tonio was cleared for out-of-bed activities and a regular diet, he engaged in self-care behaviors such as oral hygiene, self-feeding, and dressing while seated at edge of bed or in a wheelchair. A thin strip of Coban or Coflex was added to his utensils to provide additional grip.

During Tonio's operative phases, BUEs and hands were immobilized multiple times with (B) hand splints and (B) elbow splints. He required three surgeries to the UEs and was immobilized 5 days for each surgery. Tonio's hands were grafted first with STSG sheet grafts to preserve function. He then received meshed skin grafts to (B) UEs (forearm and upper arms). A third surgery was required to cover an area of the LUE where the skin graft had failed, resulting in an additional period of immobilization for that extremity.

Rehabilitation Phase

It was deemed early on that due to the 70% TBSA inhalation injury (a very large and extensive burn injury), multiple surgeries, difficulty with mobility, and associated medical complications Tonio would benefit from being transferred to an inpatient rehab program prior to returning home to improve his functional ability. Two key medical complications that Tonio had developed were heterotopic ossification (HO) in his left elbow and oliguric renal failure while in the ICU. HO in his left elbow limited his ability to perform B UE ADLs such as grooming, bathing, and dressing. The renal failure limited his level of participation in ADLs and ROM exercises, as he easily fatigued from being weak.

After surgery was completed, therapy focused on increasing the amount of time Tonio spent out of the bed and either walking or seated in a chair, wheelchair, or at edge of bed while engaged in a functional activity:

- Recreational activities such as board games and listening to music were incorporated into treatment sessions to improve Tonio's motivation as well as his functional movement.

- Tonio was encouraged to eat a normal diet so that he could sustain himself on PO intake without needing feedings via a nasogastric tube.

- Tonio and his family were educated on inpatient rehabilitation programs, the criteria for admission, and the need for him to participate in such a program in order to return home and function as independently as possible.

- A continuous passive motion machine was incorporated into Tonio's therapy program to improve ROM of the right hand for functional grasp. Tonio and his family were instructed on how to don/doff the machine so that ROM exercises could continue throughout the day and on weekends when the therapist was not available.

Outcomes

Tonio was able to be transferred to an inpatient rehab program after approximately 3 months in the burn center. He was placed at a facility close to his home where family and friends could be more involved in his recovery. He spent 1 month at the rehab facility. Upon discharge, he was referred to outpatient physical and occupational therapy, where he resumed treatment twice a week for both therapies. Tonio could ambulate independently with the use of a cane, and he was able to complete upper body ADLs independently and required only minimal assistance for lower body ADLs. In outpatient therapy, Tonio improved further and was able to ambulate independently without an assistive device. He was able to perform upper and lower body ADLs independently. Lower extremity edema continued to be an issue, causing Tonio occasional discomfort. His occupational therapy sessions transitioned to include strengthening and work-hardening activities to prepare him to return to work as an exterminator. His left elbow had limited ROM (25 to 130 degrees) due to the heterotopic ossification, but there was no functional limitation in the movement. Six months post discharge from inpatient rehab, Tonio was referred to an orthopedic surgeon and was preparing for surgery to remove the heterotopic ossification from the left elbow. His subsequent plan was to return to work. He returned to the outpatient burn clinic at 6 months post discharge from inpatient rehab and 10 months post burn injury. He was observed to be in good spirits and excited to return to work. Custom pressure garments were ordered for (B) UEs, and hands with grippers were added to the palmar surface of the gloves to improve grip in preparation for Tonio to return to work. No garments were ordered for the LEs due to continued edema. Tonio's main area of concern was the defect left in his chest and abdomen area from the tangential excisions and skin grafting. He is currently planning reconstructive procedures with the plastic surgeons of the outpatient burn clinic to correct defects. Reconstruction is planned for after the correction and rehabilitation of the left elbow.

Tonio continues to live with his family. He is planning to resume living on his own with his girlfriend after he is able to return to work and financially support himself.

His pain is well controlled and he reports no issues with pain management. His friends and social support system remain intact, and this support system has improved since his injury. Prior to his injury, Tonio reported being somewhat distant from his mother, but since his injury their relationship has improved; she is present with him during his outpatient burn clinic appointments and supports his choices and decisions.

Tonio reported feeling hopeful for the future and wanting to help other burn survivors. He was given resources to burn-survivor groups and organizations and encouraged to participate in programs that train burn survivors to counsel other survivors. He was also encouraged to attend the World Burn Conference to meet other survivors.

Tonio expressed being thankful to all of his caregivers. He acknowledged having a difficult time beginning the process of recovery but found it helpful to have the burn team of nurses, therapists, doctors, dietitians, and social workers all encouraging him not to give up and to keep moving forward. “I feel like myself again. I feel hopeful for the future. I can't wait to go back to work and get back to my life. Thank you all for everything you've done for me.”

Threaded Case Study

Nora, Part 2

The main focus of this case is to illustrate the importance of both the patient's needs (developmental stages) and the family's involvement in Nora's care and rehabilitation. Although Nora's injury was considered very small (1% TBSA to the palm), it had the potential to create major complications in her fine motor development as a growing 3-year-old.

During the initial stages of evaluation and treatment, focus was on wound status, ROM, and developmental age assessments; parent education on ROM exercises for the affected left hand; and prevention of contracture formation. The treatment plan and intervention included not only the child's participation in occupational therapy but also her mother's participation. Nora's mother was educated on age-appropriate play activities to encourage use of Nora's left hand and to facilitate normal fine motor development such as finger feeding and using crayons. Additionally, Nora's mother was educated on the importance of consistently following through with therapy recommendations such as attending all appointments in the burn clinic and with outpatient occupational therapy as well as actively participating in those therapy sessions.

Final Outcome

Nora is now 2 years post burn injury. She has had two scar revision surgeries for the left palm contractures. She continues to receive outpatient occupational therapy services one to two times per week for scar management, ROM exercises, and fine motor development. Because her family had been negligent in keeping Nora's appointments with the burn clinic and outpatient therapist, Nora developed significant central palm scarring that led to flexion contractors of her MP joints of all digits and a thumb adduction contracture. These deformities interfered with her ability to grasp objects effectively and led to her developing a strong preference for the right hand and diminished use of the left hand. With coordinated care between Nora's outpatient therapist and the outpatient burn clinic therapist, the burn clinic surgeons were made aware of both Nora's and her family's deficits. This allowed the physician to counsel the parents on the importance of following through with therapy and how surgery can be avoided or at least delayed with participation in therapy sessions. Ongoing discussions and education with the parent from the burn clinic staff enabled Nora's mother to better understand that while her daughter's hand wound would never look “normal,” it would be able to function normally if there was better compliance with therapy and outpatient clinic appointments. Once Nora's mother accepted this idea, her compliance with clinic visits, therapy sessions, and consistent use of compression garments improved. As a result, after Nora's last surgery, she regained full functional ROM and has normal fine motor development. At her last clinic assessment, the surgeons determined that Nora would not require surgical intervention at this time but would likely require further surgery to correct growth-related contractures of the left hand.

Threaded Case Study

Lee, Part 2

Lee's case illustrates the rare ideal patient case. His burn injury was considered classic and easy to manage medically. His occupational therapy needs were clear and straightforward because he was motivated and had a good support system. Lee seemed to accept support from all sources: from family, church, and his healthcare providers.

Lee was admitted to the burn center for complex wound care and pain management after his initial injury. He eventually required surgical interventions for skin grafting to the left hand and (B) LEs. After surgery, Lee was placed in (B) LE splints and a left hand splint for 5 days. Lee had been a very active young man and consequently found the 5 days of immobilization and bed rest difficult to tolerate. Given his history as a seminary student, a referral to the hospital Christian chaplain was requested, and he provided Lee with spiritual support at bedside. This helped to relieve Lee's feelings of boredom and inactivity. He had additional support from his friends and his wife in maintaining his spirits. They also provided nutritional assistance. On post-op day (POD) 2, the doctor assessed the surgical site of Lee's left hand. The skin graft was observed to be intact and well adherent for POD 2. However, Lee was discouraged by the way that his hand looked. When Lee vented about his anxiety, both the OT and registered nurse reassured him that his wound looked appropriate and would heal and regain normal function. He took comfort in knowing that the experienced burn team members felt that his skin graft looked very good and that in time the appearance would improve. On POD 5, Lee's dressings were taken down and he was able to be out of bed and resume basic ADL activities to tolerance. Lee was motivated to go home as soon as possible, which inspired him to work through his pain. He was discharged home on POD 8, and he ambulated with an FWW and was independent in all ADLs.

During his first follow-up clinic visit, he continued his ambulation and ADL status but admitted that he was mostly housebound. On his second return visit to the clinic, which was approximately 1 month post burn, Lee was walking without the walker, appeared to be in better spirits, and reported that he was still staying in the house most of the time but was attending church with his wife and was socializing by having friends over to his home. He reported that his school was on break but would resume in 2 months. At that time, he planned to complete his seminary training. He continued to be concerned about the appearance of his skin, especially the mesh graft that he described as looking like “fish skin.” Burn clinic team members reinforced their assertion that healing skin and color changes would occur in time. Lee was shown pictures of healed mesh and sheet grafts to reinforce the many changes that were described as occurring and appeared to be comforted by the information. On his third burn clinic visit, a custom pressure garment was ordered for his left hand. He expressed feeling better after seeing the healing that was occurring in his skin and the improved appearance. He attributed his recovery and improvements to his Christian faith and prayer. He was looking forward to resuming school and playing soccer again.

Summary

Burn injury is one of the most painful and devastating injuries that can be sustained. Advancements in trauma care and in surgical techniques have significantly improved the survival rate of patients with large burn injuries as well as those with accompanying multiple medical problems. Treatment of the burn injury is as traumatic as the injury itself at times and can lead to a negative psychological impact on the patient. The occupational therapist treating in a burn center is a valuable member of the team, not just for the patient's physical rehabilitation but also for his or her psychological rehabilitation. Reengaging in normal, valued daily occupations can improve not only a patient's functional ability and movement but also the feelings of competence in occupational performance. Burn survivors often endure more pain than they previously thought they could and must push themselves past what they believed their strength and ability could tolerate to accomplish their goals. As these patients engage in the therapeutic process and recover their functional abilities, they learn new skills to adapt and problem solve. This gives them a tremendous amount of self-esteem and self-efficacy. The word *survivor* then takes on a new meaning of having not only survived traumatic injuries but having learned new skills and created new occupational roles. They transition from the role of burn patient to that of the burn survivor—as exemplified by the narratives of Tonio, Nora and her parents, and Lee. They move past the negative feelings of denial, anger, and depression and onto the positive feelings of acceptance and hope.

Review Questions

1. Name the two layers of the skin. In which layer are the nerves and sebaceous glands located?
2. Which factors are considered in determining burn severity?
3. What is an escharotomy, and why is it performed? How does it differ from a fasciotomy?
4. Describe two factors that affect the quality of burn wound healing and promote excessive scar formation.
5. During the acute care phase, which factors may limit full ROM?
6. What is a boutonnière deformity, and what are boutonnière precautions?
7. What are the two basic principles underlying most burn rehabilitation treatment techniques?
8. What is the primary objective for positioning during acute care?
9. What are the indications for initiating splints during the acute care phase?
10. When a splint is indicated in the acute phase, what is the preferred wearing schedule and why?
11. When should client education about burn injury and rehabilitation begin?
12. What would cause a patient to require temporary adaptations for self-care during the acute phase?
13. Why are patients immobilized postoperatively? On average, how soon after grafting can gentle AROM exercises be resumed?
14. How soon postoperatively can an intermediate compression dressing or garment be applied?
15. What are the two main compression therapy options for the treatment of facial scars?
16. Why are skin-conditioning activities used in burn rehabilitation? What are examples of skin-conditioning techniques?
17. What is the average length of time required for scar maturation?
18. What are possible causes of limitations in ADLs during the rehabilitation phase?
19. What information should be included in predischarge education and a home program review?
20. What is the primary cause of dysfunction after a burn injury?

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Resources

American Burn Association: www.ameriburn.org

Burn Survivors Online: www.burnsurvivorsonline.com

Burn Therapist: www.burntherapist.com

Cool the Burn: www.cooltheburn.com/home.html

Covermark Cosmetics: A vender of special camouflaging cosmetics for burn patients. 157 Veterans Drive, Northvale, NJ 07647, (800) 524-1120, www.covermark.com

Model Systems Knowledge Translation Center: www.msktc.org/burn/model-system-centers

Phoenix Society for Burn Survivors: phoenix-society.org

World Burn Foundation: www.burnfoundation.com

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*In this chapter, the terms *patient* and *client* are both used, with *client* being used in occupational therapy contexts.

**It is important for the reader to recognize that although the American Occupational Therapy Association, to date, does not have an official burn specialization, the American Burn Association (for the burn center verification-type of accreditation) has indicated recommendations for occupational therapists to have the following experiences in order to work with burn patients: extensive experience in (1) intensive care unit and acute care, (2) hand therapy, (3) pediatrics, and (4) upper and lower extremity splinting.

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Amputations and Prosthetics

Annemarie E. Orr, Jennifer S. Glover, Chelsey L. Cook

CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

Sections 1 and 2

1. Understand the role of the occupational therapist in the evaluation and treatment of upper limb amputations.
2. Identify the upper limb amputation levels and describe the prosthetic systems and componentry associated with each level of amputation.
3. Identify the phases of upper limb prosthetic training and describe key characteristics of each phase of intervention.
4. Name the five types of prosthetic systems and explain the advantages and disadvantages of

each type of system.
5. Identify the outcome measures that are used specifically with upper limb amputations.
6. Recognize the emerging technologies and advances in the area of prosthetics and analyze how these may affect functional outcomes for individuals with upper limb loss.
7. Analyze how upper limb amputation affects an individual's performance skills and patterns as they relate to occupational performance.

Section 3

1. List the types and causes of lower extremity amputation (also known as lower limb amputation).
2. Describe the types of equipment that may be used by a person who has had a lower limb amputation.
3. Describe how lower limb amputation may affect a person's occupational performance.
4. Identify the effects that lower limb amputation may have on client factors, performance skills, and performance patterns.
5. Discuss the potential psychosocial repercussions of lower limb amputation.
6. Describe the role of the occupational therapist in working with a person who has had a lower limb amputation.
7. Explain how context and activity demands can be altered to improve a client's ability to participate in a given occupation.
8. Discuss possible additional concerns for an older person who has had a lower limb amputation.

KEY TERMS

Above-knee amputation

Acquired amputation

Below-knee amputation

Body-powered prosthesis

Disarticulation

Hybrid prosthesis

Interscapular thoracic

Myoelectric prosthesis

Myosite

Neuroma

Phantom limb pain

Phantom limb sensation

Preprosthetic phase

Prosthetic training

Pylon

Residual limb

Residual limb support

Separation of controls

Syme's amputation

Terminal device

Transhumeral

Transradial

Section 1 General Considerations in Upper Limb Amputations[a]

Annemarie E. Orr

Amputation can result from several causes, including disease, trauma, infection, tumor, or congenital limb deficiency. Individuals with congenital limb deficiencies and those whose amputations occur early in life usually develop sensorimotor skills and a self-image without the limb; therefore, these two populations present different problems for the rehabilitation worker.[7,99,100] This chapter discusses adults with **acquired amputations**; that is, surgical removal of a limb as a result of disease or trauma.

Causes and Incidence of Amputation

Approximately 1.6 million persons live with limb loss in the United States.[122] This number is projected to more than double to 3.6 million by 2050.[122] Annually more than 185,000 persons in the United States undergo an amputation. Dysvascular disease and diabetes are the primary reasons for amputation of the lower limb, and trauma is the primary cause of upper limb amputation in adults.[28] Approximately 75% of upper limb amputations are the result of trauma caused by work-related accidents, gunshot wounds, and burns.[59] The ratio of upper limb to lower limb amputation is estimated to be 1 : 3.[36] Limb loss as a result of trauma is increased during times of active warfare.[73] As of June 1, 2015, more than 1600 U.S. military service members had undergone an amputation as a result of the wars in Iraq and Afghanistan; this was the case for Daniel, described in the case study in Section 2.[19]

Classification of Amputation Levels

The classifications for levels of upper extremity amputation are illustrated in Fig. 43.1. The term **interscapular thoracic** (forequarter) describes an amputation of the entire upper extremity, scapula and clavicle; **transhumeral** describes an amputation through the humerus; and **transradial** describes an amputation through the radius and ulna. These levels of amputation are also commonly referred to by their relationship to the elbow joint: above elbow (AE) and below elbow (BE). The term **disarticulation**, at the shoulder, elbow, or wrist level, describes an amputation through the joint. The higher the level of amputation, the more difficult it may be for a person to use a prosthesis because fewer joints and muscles are available to control the prosthesis.

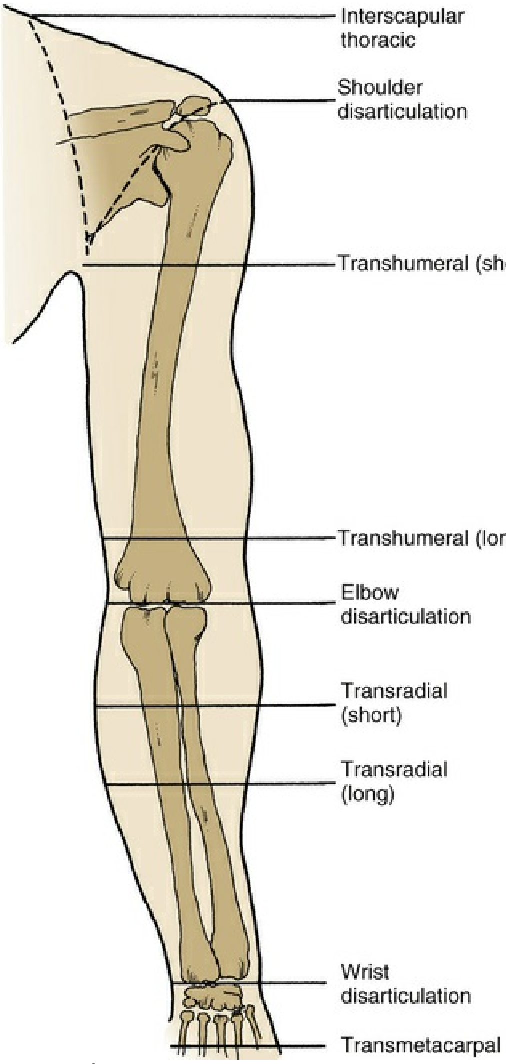

FIG 43.1 Classification levels of upper limb amputation. (From Saunders R, Astifidis R, Burke SL, et al, editors: *Hand and upper extremity rehabilitation: a practical guide,* ed 4, St Louis, 2016, Elsevier.)

Rehabilitation as a Team Approach

Rehabilitation after amputation requires a team approach. Members of the interdisciplinary team include the physician, occupational therapist, physical therapist, prosthetist, social worker, and psychologist. The client is the primary member of this team and should be encouraged to be an active participant in the rehabilitation plan of care. The primary role of the occupational therapist in the rehabilitation of amputations is to facilitate an individual's return to maximum performance of daily occupations and roles that lead to a meaningful life.[52,96]

Surgical Management

Although the mechanism of injury may vary, the primary goal of surgical management of upper limb amputations is the same—to maintain limb length and provide an opportunity for an optimal prosthetic fit that allows for maximal use of the prosthesis.[96,105] A longer residual limb typically leads to improved functional outcomes. Increased limb length and preservation of each progressive joint allows for greater opportunities for the person to position the residual limb in space and to feel, grasp, and manipulate objects in his or her environment. It is important for the surgeon and interdisciplinary team to understand the capabilities of each prosthetic device as they correspond to the amputation level, so as to maximize the functional outcomes and overall satisfaction of the client.[105]

Surgical management of muscles and nerves is critical with upper extremity amputation.

Myodesis, myoplasty, and myofascial closure are surgical techniques used to stabilize the muscle and tendons of the residual limb and to provide adequate soft tissue padding to the distal end of the bone. With myodesis the muscle and fascia of the residual limb are sutured directly to the bone, making it structurally stable. Myoplasty involves suturing the residual opposing muscle groups together over the transected bone end. Myofascial closure, the least stable technique, involves suturing the residual muscle and its fascia together.

Nerve management in the residual limb is also important to limit neuroma development and optimize myosite signals for myoelectric control. Traction neurectomy is a surgical technique that moves the eventual neuroma away from the skin and muscle closure by isolating all the major nerves and allowing them to retract proximal to the closure into the residual muscle.[96,105]

Surgical techniques vary with the level and cause of amputation.[97,99] A closed or open surgical procedure may be performed. The open method allows drainage as the surgical site heals and minimizes the possibility of infection. The closed method reduces the period of hospitalization but also reduces free drainage and increases the risk of infection.[99] The specific type of amputation performed is left to the discretion of the surgeon and is often determined by the status of the limb at the time of amputation. The surgery may be ablative only (removal of devitalized tissues) or reconstructive. In either case the surgeon must remove the part of the limb that has to be eliminated and allow for primary or secondary wound healing. The surgeon reconstructs a **residual limb** (sometimes referred to as a stump) to achieve the optimal prosthetic fit and function.[99]

Section 2 Upper Limb Amputations

Annemarie E. Orr

Threaded Case Study

Daniel, Part 1

Daniel is a 19-year-old combat engineer in the US Army. While on patrol in Afghanistan, his vehicle came under attack by enemy fire. Seated in the passenger side of the vehicle, Daniel was hit by a rocket-propelled grenade, resulting in the traumatic amputation of his nondominant left upper extremity below the elbow. Daniel was medically stabilized in theater and medevaced to a military hospital in the United States for continued medical treatment and rehabilitation. Daniel underwent multiple surgeries, including a myoplasty, to optimize limb closure and healing. He had no postoperative complications. Occupational therapy was consulted for an evaluation after closure of his residual limb.

Daniel is originally from California, where he enlisted in the Army directly after high school. He is engaged to his high school sweetheart and had planned to be married after his deployment. Daniel and his family lived in the desert of California, where he and his father would work together on restoring cars and riding dirt bikes. Before this deployment Daniel was stationed at Fort Stewart in Georgia. He was living in the barracks on base, and his fiancée remained in California. Before his injury Daniel was independent with all activities of daily living (ADLs) and instrumental activities of daily living (IADLs). He has a passion for motocross and expressed concern about his ability to participate in the sport he loves after the amputation. He identifies primarily with his role as a soldier and is unsure whether he will be able to stay on active duty as a combat engineer in the Army after the amputation.

Daniel's parents and fiancée are present for the initial evaluation. A comprehensive occupational therapy evaluation is performed at Daniel's bedside on the inclient unit. Upon arrival the occupational therapist notes that a compressive elastic bandage wrap has been applied to Daniel's left residual limb. Range of motion, strength, and sensory assessments are performed for both upper extremities. Daniel has full range of motion throughout all joints except his left elbow. His left elbow is limited in both flexion and extension as a result of postoperative edema and pain. Daniel is educated on the various forms of pain that occur after amputation. He is able to describe his pain as phantom pain; he reports that his hand feels as if it is in a tight fist position, and he is unable to move it. Daniel has sutures in place along the distal end of the residual limb and no other open wounds. Daniel and his family are educated on the use and application of an elastic shrinker to assist with residual limb volume reduction and shaping.

During the evaluation Daniel reports that he is initiating basic ADL performance (e.g., feeding, hygiene and grooming, and dressing) with his right arm using one-handed techniques. Overall he shows a positive affect throughout the initial meeting with the occupational therapist, and he is motivated to begin his therapy and preprosthetic training.

Critical Thinking Questions

1. For Daniel, how will each area of occupational performance (ADLs, IADLs, work, education, leisure, play, and social participation) be affected as a result of the loss of his left arm?

2. How will Daniel's occupational profile and contexts influence and guide occupational therapy treatment interventions?

3. What is the therapeutic role of the occupational therapist in Daniel's psychological and psychosocial adjustment to life after amputation?

Preprosthetic Training

The **preprosthetic phase** of training begins immediately after amputation and continues through prosthetic fitting. During the period between amputation and fitting of the prosthesis, the client participates in a program designed to prepare the residual limb for a prosthesis, facilitate adjustment to his or her loss, and achieve maximal independence in self-care.[77,114] The primary goals of this phase of rehabilitation are to promote wound healing and closure, pain management, initiation of basic ADL retraining, and client and family education.[95,96]

Evaluation

A comprehensive evaluation is administered to determine baseline information about the client's past medical history, functional status, and rehabilitation goals. An interview with the client and family members is performed to identify occupational roles, the home and work environments, and premorbid interests. The occupational therapist evaluates the client's medical history, upper quadrant range of motion and strength, sensation in the residual and intact limb, wound and skin healing, edema and limb volume measurement, residual limb and phantom limb pain, and psychological and emotional adjustment after amputation.[96] A baseline functional assessment is performed to evaluate the client's level of independence with basic ADL performance in such tasks as self-feeding, dressing, toileting, and bathing, and with IADLs, such as work and leisure.[1,2] The findings from the initial perioperative evaluation and a statement of the client's goals are important for guiding the rehabilitation program toward meeting these functional goals.[7]

Activities of Daily Living

One of the primary goals of occupational therapy is independence in basic self-care after amputation. During this acute phase of recovery, feelings of helplessness for the client are typical. It is important for the occupational therapist to provide the client with control over his or her environment and a sense of independence in basic ADLs. Modifications to the environment, such as adaptive call bells and pain-controlled analgesia (PCA), are a simple first step toward independence. Adaptive equipment, such as universal cuffs, bidets, and hook-and-loop–adapted clothing, can provide initial independence in basic ADLs (Fig. 43.2). The ADLs that should be addressed immediately after amputation are (1) self-feeding, (2) toileting, and (3) oral hygiene.[96] If the client is medically stable and the wounds have healed, training in additional ADLs (e.g., dressing and bathing) may be initiated. It is the role of the occupational therapist to creatively adapt and modify the client's environment to achieve maximum independence.

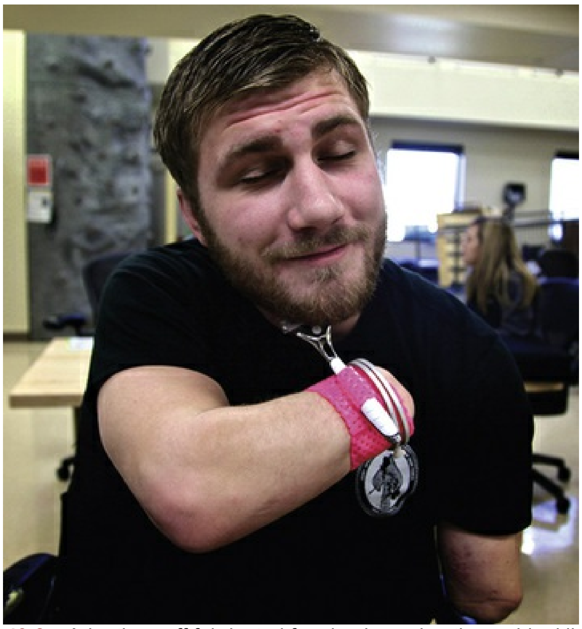

FIG 43.2 Adaptive cuff fabricated for shaving using the residual limb.

The change in hand dominance is introduced during this phase of recovery for persons with amputation of the dominant limb. Because a prosthesis has limited fine motor prehension and dexterity, it is important to transfer hand dominance in handwriting to maintain independence with written communication.[121] Clients learn and adapt quickly to limb loss and often begin to perform ADLs on their own with the nondominant hand. The occupational therapist will also educate the client on one-handed techniques for performing ADLs and will make recommendations for adaptive equipment as necessary. The occupational therapist educated Daniel in the use of adaptive equipment, such as a pump soap dispenser and a rocker knife, to increase his independence in bathing and self-feeding.

Wound Healing and Limb Shaping

During the initial wound healing phase the occupational therapist performs wound care and dressing changes according to the physician's guidelines. Immediately after surgery, limb wrapping is initiated to decrease edema and promote optimal limb shaping for the prosthesis. Figure-eight limb wrapping with an elastic bandage is performed for distal to proximal compression and shaping of the residual limb. The limb must never be wrapped in a circular manner because this restricts circulation and causes a tourniquet effect. Once the wound has stopped draining and clearance has been obtained from a physician, progression to use of an elastic shrinker or a compression garment can be initiated. Shrinkers come in a range of measurements; therefore progression of residual limb volume change can be documented accordingly. Use of a cylindrical tube, or donner, is recommended for ease of application of the shrinker on the residual limb (Fig. 43.3). If the shrinker loosens, a smaller size is indicated. A shrinker should be worn whenever the client is not in a prosthesis to maintain residual limb volume and shaping. The client is educated to remove the shrinker two or three times daily to examine the skin for any redness or pressure. The client and family are instructed in donning and doffing the compression garment with the goal of independence for the client in this technique.

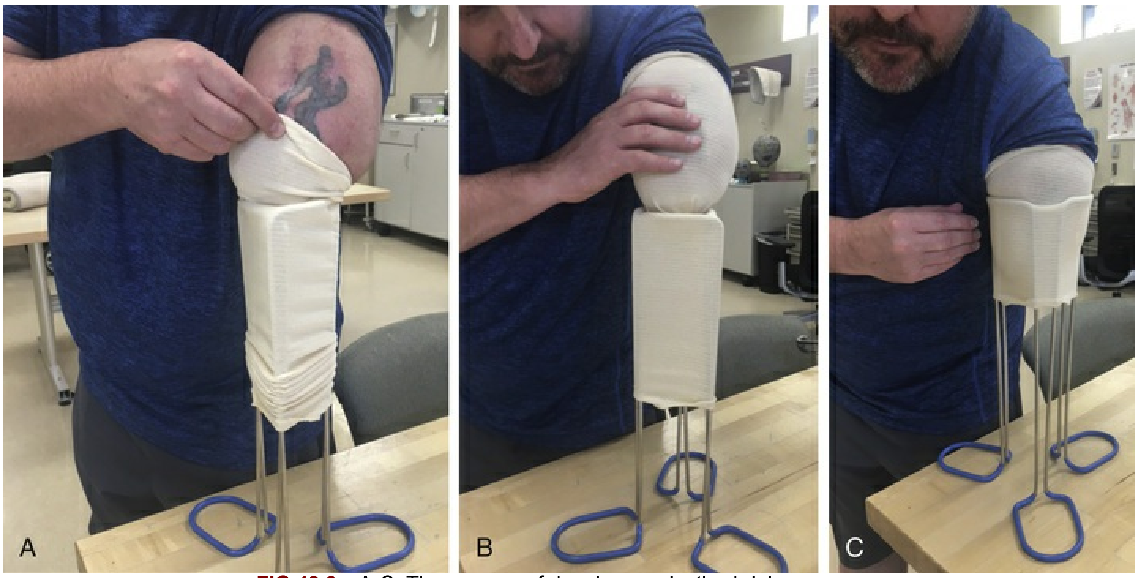

FIG 43.3 A-C, The process of donning an elastic shrinker.

Pain Management

Residual limb hyperesthesia, phantom limb pain, phantom limb sensation, and neuroma are common problems after amputation that can interfere with functional use of the limb with or without the prosthesis.

Desensitization

A residual limb may be hypersensitive after surgery, requiring a technique known as desensitization. Overstimulating a hypersensitive peripheral area with nonharmful stimuli teaches the central nervous system to accept these stimuli as nonharmful and to minimize aversive responses to them. Residual limb hyperesthesia, or an overly sensitive limb, limits functional use and causes discomfort. Reduction in hypersensitivity of the residual limb improves the client's tolerance to wearing of the prosthesis. Desensitization techniques are implemented after wound closure. Methods include tapping, vibration, constant pressure, and rubbing of various textures on the limb. The therapist introduces the tissue to soft, lightweight, smooth textures and progresses to rough, hard, uneven, heavier textures as the client is able to tolerate them. As the techniques are performed, the therapist teaches them to the client, family members, or caregivers to facilitate use of the techniques at home.[7,45,84] Desensitization is used to prepare the residual limb to tolerate the initial socket.

Phantom Limb Pain

Approximately 90% of individuals who have had an amputation experience **phantom limb pain**.[17] Phantom limb pain can have a number of varying characteristics, such as stabbing, cramping, burning, or throbbing.[30] Changes in the central nervous system and peripheral nerve damage are thought to be the cause of phantom limb pain.[30] Oftentimes psychological factors, such as stress, are the triggers for phantom limb pain.[23]

Phantom limb pain and its causes and treatment are highly debated topics. Research in this area continues to make progress, but no evidence strongly supports any one approach as clearly successful in the management of phantom limb pain. A team approach should be used to address phantom limb pain and to find the best method for the client in the management of this pain.

Treatment methods for those with phantom limb pain may include analgesics, acupuncture, electrical nerve stimulation, and mirror therapy, among others. Isometric exercises of the phantom and residual limb initiated 5 to 7 days after the amputation and performed several times throughout the day may help to minimize pain. Active movement of muscles associated with the phantom limb can be beneficial, especially when the sensations are described as stuck, cramped, or tight. Daniel experienced this kind of phantom pain, describing his phantom hand as stuck in a fist position. He had positive results from active movement and visualization exercises with the phantom limb. Mirror therapy has elicited some positive results in decreasing the pain of phantom limbs.[31,82] The use of mirror therapy in the management of phantom limb pain is now widely accepted as standard therapy after amputation.[112] Biofeedback, transcutaneous electrical nerve stimulation (TENS), ultrasound, progressive relaxation exercises, and controlled breathing exercises have also been used.[95] Activities such as massaging, tapping, and applying pressure to the residual limb may be beneficial. A physician may treat the pain by prescribing oral medications, injecting anesthetics into a specific soft tissue area, or performing sympathetic nerve blocks. Surgical revision of the residual limb is sometimes necessary to alleviate the pain.[7,24,110] An individual also may take nonpharmaceutical oral supplements to decrease the pain. Management of phantom limb pain requires an interdisciplinary team approach.

Phantom Limb Sensation

Phantom limb sensations are sensations of the amputated limb. In its simplest form, the phantom limb sensation is the sensation of the limb that is no longer there. The phantom limb sensation is present because the neural system in the brain still exists, even when the input to the body is interrupted by an amputation.[66] Almost all individuals who have undergone amputation report this painless sensation.[65] Although phantom limb sensation is more common after traumatic amputation, it has also been known to occur in persons with congenital limb absence.[81] The distal part of the limb is most frequently felt, although sometimes the person feels the whole extremity. The sensation may dissipate over time, or the person may experience it throughout life. The individual may feel that the distal portion of the phantom hand has retracted closer to the end of the residual limb, in a phenomenon called telescoping. Research has recently begun to focus on the use of phantom limb sensation and its potential to improve control with a **myoelectric prosthesis**.

Neuroma

Severed peripheral nerves may form neuromas in the residual limb.[63,67] A **neuroma** is a small ball of nerve tissue that develops when growing axons attempt to reach the distal end of the residual limb. As the axons grow, they turn back on themselves, producing a ball of nerve tissue. If the neuroma adheres to scar tissue or to skin subjected to repetitive pressure, it can be painful when pressed. The diagnosis is made by palpating the neuroma and is confirmed with ultrasound.[10] Most neuromas occur 1 to 2 inches (2.5 to 5 cm) proximal to the end of the residual limb and are not troublesome.[7] To minimize negative effects of a neuroma, surgeons perform a traction neurectomy to move the eventual neuroma away from the skin closure.[63,67]

One treatment option for a painful neuroma is local steroid injections. If surgical intervention is indicated, the options are to (1) redirect the nerve more proximally into a padded area, (2) tie the nerve ending into a proximal wound bed to protect it, or (3) tie two nerve ends to each other to prevent the development of a neuroma. In addition, the residual limb socket may be fabricated or modified to accommodate the neuroma.[7,110,114]

Upper Extremity Range of Motion, Strength, and Endurance

The days and weeks immediately after amputation are the most critical for implementation of a comprehensive exercise program. Once medical approval has been provided, the client begins exercises designed to maintain and increase range of motion (ROM) and to strengthen the upper quadrant and trunk muscles. Daily upper extremity flexibility training and strengthening are critical to preparing the residual limb for prosthetic use. Depending on the level of amputation, the client may perform specific exercises that mimic the movements required to operate the prosthesis. Of utmost importance is the maintenance of ROM and strength to the shoulder flexors, abductors, and rotators, as well as the scapular protractors and retractors, because limitations in these motions may result in an increased risk of rejection of the prosthesis.[28] The therapist manually positions and holds the residual limb in the desired posture and asks the client to resist the hold, facilitating increased strength of the appropriate muscles. Isometric exercises enable the client to engage in a strengthening program without equipment. Exercises may also be performed with rubber tubing, elastic bands, or strap-on weights. As the client progresses, adaptive cuffs with D-rings can be used on cable machines (Fig. 43.4). It is appropriate for the occupational therapist to guide the client through a home exercise program for self-stretching and use of modified home or gym equipment to perform exercises.

FIG 43.4 Weight-lifting cuff with D-ring used on a cable machine to perform upper extremity strengthening exercises.

Body symmetry and proper trunk alignment can limit the possibility of cumulative trauma or overuse injuries of the upper limbs, neck, or back.[96] Therapeutic activities are facilitated in front of a mirror to increase visual feedback and body awareness of the client. Verbal and tactile cues are provided as necessary to promote proper body mechanics and alignment during therapeutic activities. The client will participate in physical therapy, along with occupational therapy, to address core strengthening and cardiovascular fitness. After amputation the use of a prosthesis increases cardiovascular demands; therefore it is important for the client to maintain an active lifestyle and engage in regular aerobic activities.

Myosite Testing and Training

When early prosthetic fitting is not possible, preprosthetic training for a myoelectric prosthesis can be initiated. A myoelectric prosthesis functions by detecting electromyographic (EMG) signals produced by muscles in the residual limb. Locating appropriate superficial muscle sites (i.e., **myosites**) is the most important aspect of the successful operation of a myoelectric prosthesis. Physical examination of a person's arm often reveals sufficient strength in natural agonist-antagonist pairs, such as the wrist extensor and wrist flexor muscles in the person with a transradial amputation, and the biceps and triceps muscles in the person with a transhumeral amputation. Individuals with a short transhumeral amputation often have an effective myosite in the pectoralis or deltoid anteriorly and in the infraspinatus or trapezius posteriorly. Use of an agonist-antagonist pairing for control of the prosthesis is called two-site control. Preference is given to distal myosites that are adequate in signal to allow the prosthetist room to position the electrodes within a well-suspended socket. In some cases trauma or nerve injuries do not allow the choice of a natural pair. In such cases a single muscle site can be used to control two functions. A strong contraction controls one operation, a weaker contraction controls another, and relaxing the muscle turns the system off.[70] Alternative methods for control also have been developed (these are discussed briefly later in the chapter).

Both the therapist and the prosthetist can perform myosite testing. A biofeedback system or myotester is used to identify the amount of signal generated by the muscle. Surface electrodes are positioned on the residual limb and connected to the myotester or biofeedback system. Examples of commonly used systems are the Myolab II (Motion Control), MyoBoy (Ottobock), and a biofeedback computer program or electric demonstration hand (Fig. 43.5). It is important that all electrodes have good contact with the skin and are aligned along the general direction of muscle fibers. Moistening the skin slightly with water may improve the EMG signal by lowering skin resistance.

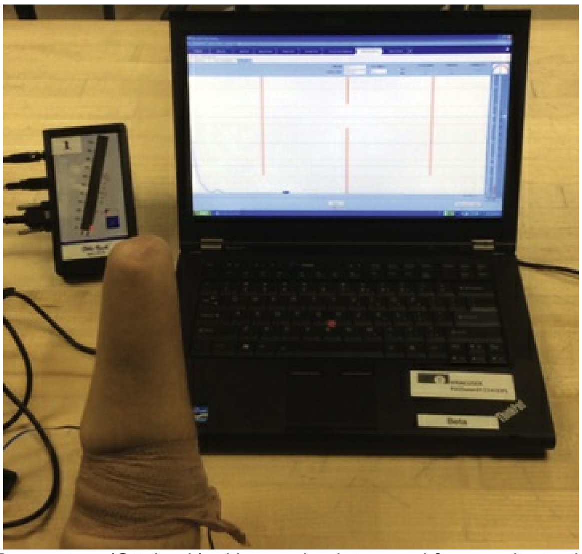

FIG 43.5 MyoBoy system (Ottobock) with myosimulator used for myosite testing and training.

The goal of myosite testing is to identify two muscle sites that would fit appropriately within the socket with the greatest microvolt difference between them, not necessarily the two muscle sites with the strongest signals. Selection is complete when the client is consistently generating sufficient signals to operate the prosthesis in its basic functions, such as opening and closing the **terminal device** (TD). The therapist should check with the prosthetist to determine the minimum signal required to operate the myoelectric system chosen for the client.[75]

The more proximal the level of the client's amputation, the more challenging it is for the prosthetist to fit the prosthesis and for the therapist to train the person to control the prosthesis. To help the client understand a desired muscle contraction, the therapist instructs the client to imitate the desired contraction or movement with both arms. For instance, the therapist can ask the client to raise the sound hand at the wrist (wrist extension) and imagine this motion with the phantom hand on the amputated side. Muscle groups are most frequently used according to their physiologic function. For example, the wrist extensors are used for hand opening and the wrist flexors for hand closing. The therapist often can palpate the wrist flexors and extensors on the residual limb during this exercise. The client is instructed to contract and relax each muscle group separately and on command. For this step a myotester is particularly useful because it indicates the magnitude of the EMG signal as the client contracts the muscle, in addition to the decrease in signal as the client relaxes the muscle. Many clients have difficulty relaxing a muscle completely; this causes a decrease in muscle signal separation.

The myotester can be used to train the muscles with both visual and auditory feedback. Various models are available to therapists. The goals of training at this point are to increase muscle strength and to isolate muscle contractions. As the client's confidence and accuracy improve, visual or auditory feedback should be removed. Practicing muscle contractions without feedback teaches the client to internalize the feeling of each control movement. The advantage of creating this internalized awareness of proper muscle control is that control and strengthening practice can be continued between treatment sessions without feedback equipment.[101] The therapist must learn to recognize muscle fatigue, which is frequently a side effect in this process, and should allow sufficient time for that muscle to recover during the treatment session.

Ideally the client with an amputation receives adequate training and practice in initiating these muscle contractions before receiving the completed myoelectric prosthesis from the prosthetist. Prosthetists commonly engage a client in muscle site training with the preparatory socket and prosthesis fitting. This training, which usually occurs when the prosthetist looks for optimal electrode placement and socket fit, is not adequate for most clients to operate a prosthesis immediately and successfully. Anxiety and frustration are common for clients during preprosthetic training in the use of a myoelectric prosthesis. A team approach during training with the therapist and prosthetist can minimize these responses. The client's success and effectiveness in using the prosthesis are closely related to the quality of the preprosthetic training.

Psychological Support

Psychosocial adjustment depends on various factors: the individual's character and essence, the quality of the social support systems available, sociocultural reactions to amputation, and the team's management of rehabilitation.[32] Social, personal, and spiritual contexts may be significantly altered for those who have experienced amputation. Through the interview with Daniel, the therapist identified successful adaptation and coping strategies already in place.

The process of adjustment to amputation is analogous to the grieving process. The client experiences identifiable stages of denial, anger, depression, coping, and acceptance.[32] Most clients move through these stages and ultimately adapt to the loss. It is important to note that depression rates in amputees are higher than general population rates for up to 2 years after amputation.[46] During any phase, clients may react with anger toward themselves, family members, and the medical team. The therapist should build a relationship of trust and respect with the client, one that encourages open discussion about the person's psychological adjustment to the amputation and loss of the limb. Positive reinforcement through involvement in the rehabilitation process and contact with people who have experienced similar amputations may help the client in returning to former life roles.[32] Meetings with a peer mentor or visitor are encouraged to facilitate a discussion about the rehabilitation process and the phases of recovery and psychological adjustment and also to provide problem-solving strategies. The client may be afraid to return to family, social, vocational, or sexual roles. Frequent discussions of fears and solutions to real or imagined problems are important for facilitating adjustment.[32] The therapist is encouraged to build a collaborative relationship with the client, to listen and understand his or her life roles, and to facilitate the rehabilitation to meet the individual's future goals.

Reactions after amputation are complex and unique to each individual. Although occupational therapists play a vital role in the psychological adjustment of the client, it is important that they communicate with and refer the client to a psychologist, spiritual counselor, or other behavioral health specialist as indicated.[109]

OT Practice Notes

The entire rehabilitation team is responsible for providing the client with the reassurance and motivation he or she needs. The team should focus on occupational therapy intervention and facilitation of participation and engagement in meaningful occupations.[76]

Choosing the Prosthesis

The occupational therapist and prosthetist begin by educating the client about the various upper extremity prosthetic systems available for and appropriate to each level of amputation. The client's age, medical status, amputation level, cognitive status, functional goals, and desire for a prosthesis are important factors in choosing the prosthesis. A discussion about the advantages and disadvantages of each prosthetic system and terminal device allows the team to make the appropriate recommendation. The prosthetist generally provides information about specific prosthetic options, and the therapist helps the client understand the options as they relate to his or her performance in areas of occupation. This discussion allows the client to stay informed throughout the entire prosthetic fitting and training process and establishes realistic expectations for the functional outcomes of the prosthesis.

Early fitting of a prosthesis has been shown to significantly enhance functional prosthetic use and acceptance.[79] Studies suggest that fitting an individual with a prosthesis within 30 days of amputation significantly increases the chances of acceptance of the prosthetic limb. This 30-day period is known as the "golden window."[14,62] Early fitting programs have been very successful in helping the client who has had an amputation incorporate the new extremity more rapidly into his or her daily activities.[4]

The importance of early fitting of a prosthesis cannot be overemphasized; it may be one of the most important factors in client acceptance and use of a prosthesis.

Types of Prosthetic Systems

The five most common upper extremity prosthetic systems are body-powered, electrically powered, hybrid, activity-specific, and passive prostheses. As discussed, the type of prosthesis recommended is based on many factors. Each type has its advantages and disadvantages; therefore more than one option is often required to maximize occupational performance.

Body-Powered Prosthesis

A **body-powered prosthesis** is cable driven and controlled by gross body movements. This type of prosthesis uses body motions proximal to the amputation to pull tension on a cable operating the terminal device. The client must have sufficient musculature and ROM in the upper quadrant to operate a body-powered prosthesis. He or she must be able to perform one of the following movements to control this prosthesis: (1) glenohumeral flexion, (2) scapular abduction or adduction, (3) shoulder depression or elevation, (4) chest expansion, or (5) elbow flexion.[68] Because of its simple design the body-powered prosthesis is durable, lightweight, and has low maintenance costs. The harness and cable system on the prosthesis also gives good proprioceptive feedback to the wearer on the position of the terminal device in space.[68] However, a body-powered prosthesis harness may restrict ROM and limit the functional envelope for operation of the terminal device. This design also limits the potential grip force of the terminal device, and for some users the hook may create an undesirable appearance (Box 43.1).

Box 43.1

Advantages and Disadvantages of a Body-Powered Prosthesis

Advantages

- Durable and can be exposed to environmental conditions (e.g., water and dirt)
- Provides proprioceptive feedback
- Lower maintenance costs than myoelectric prostheses

Disadvantages

- Restrictive harness
- Decreased grip force compared to myoelectric options
- Force is exerted on the residual limb
- Can be difficult to control for high levels of amputations

Electrically Powered Prosthesis

An electrically powered prosthesis, also known as a myoelectric prosthesis (mentioned earlier), uses muscle surface electricity to control the operations of the terminal device. The muscle generates an electric potential at the time of contraction. The myoelectric signal is sensed, amplified, and processed by a control unit that generates a motor, which in turn drives the terminal device.[21] Surface electrodes are embedded in the prosthetic socket, eliminating the need for harnessing or cable systems.

Myoelectric upper limb prostheses have opened a new world of freedom and function for persons who have had upper limb amputations. The advent of electronic microminiaturization has allowed the development of prosthetic devices with totally self-contained services of power, motor units, and electrodes.[49] Powered prostheses have existed for decades, but not until the 1960s were electrically powered prostheses introduced clinically. Ottobock, a firm based in Duderstadt, Germany, began this process by aiming for the development of an electromechanically driven prosthetic hand that would match the technical and cosmetic demands of a human hand.[72]

The electric motors used to operate the terminal device give myoelectric prostheses significantly increased grip force, upward of 20 to 32 pounds per square inch.[68] These types of prostheses provide a more natural appearance and increase the functional envelope of operation without the restriction of a harness or cable. Myoelectric prostheses are battery operated and therefore require regular maintenance for charging, repairs, and component replacement. The electrical components that drive the prosthesis also add to the overall weight of the device (Box 43.2).

Box 43.2

Advantages and Disadvantages of a Myoelectric Prosthesis

Advantages

- Improved cosmesis
- Increased and proportional grip force
- Minimal or no harnessing
- Provides a larger functional work envelope for use
- Minimal effort needed to control
- Can be fitted early in rehabilitation phase

Disadvantages

- Increased cost
- Frequency of maintenance and repair for battery
- Lack of sensory feedback
- Susceptible to interference from moisture or other environmental factors
- Increased overall weight

Daniel was first considered for a myoelectric prosthesis. He received myosite testing and training during the preprosthetic phase and demonstrated good strength and control. After discussions that included the prosthetist, occupational therapist, and Daniel, in which Daniel's age, level of amputation, and functional goals also were considered, a myoelectric prosthesis was recommended for him.

Hybrid Prostheses

A **hybrid prosthesis** combines body-powered and electrically powered components in one design. These prostheses are most commonly used with a transhumeral amputation. The components can be combined to create a variety of options. Often a body-powered elbow is used with an electrically powered terminal device, or an electrically powered elbow can be combined with a body-powered hook or hand.[12,68] All excursion of the existing cable is dedicated to one component, rather than to multiple components; this feature requires less overall force on the part of the wearer for operating the prosthesis. Advantages of hybrid prostheses include simultaneous control of the elbow and terminal device, decreased overall weight of the prosthesis, and decreased cost (Box 43.3).

Box 43.3

Advantages and Disadvantages of a Hybrid Prosthesis

Advantages

- Simultaneous control of elbow and wrist or terminal device
- Less weight than an entirely electrically powered prosthesis
- Increased grip force

Disadvantages

- Harness is required for operation of elbow
- May be difficult to operate with a short transhumeral or higher amputation because of the force required to operate the elbow

Passive Prosthesis

A passive prosthesis can serve in both cosmetic and functional restoration of the hand after amputation. A passive prosthesis is static and does not have an active grasp. Often the digits can be passively positioned to assist with stabilizing, carrying, or grasping objects. For example, for an individual who has undergone a thumb amputation, a static thumb post with a friction joint can be passively prepositioned to allow for opposition. Cosmetic restoration can be achieved with a rubberized glove or a custom-sculpted, painted covering that replicates the individual's remaining hand or fingers (Fig. 43.6). Typically these prostheses are made from flexible latex, rigid polyvinyl chloride (PVC), or silicone.[68] They are lightweight, require less maintenance, and can help promote a positive self-image for the user (Box 43.4).

FIG 43.6 Example of a passive cosmetic glove on a partial hand amputation. A, Without cosmetic glove. B, With cosmetic glove.

Box 43.4

Advantages and Disadvantages of a Passive Prosthesis

Advantages

- No harnessing or control cables
- Provides cosmetic restoration and positive body image
- Low maintenance
- Lightweight
- Digits can be positioned for static grasp or opposition

Disadvantages

- Does not provide active grasping function
- Cosmetic covers made of latex or polyvinyl chloride (PVC) can stain easily

Activity-Specific Prosthesis

Activity-specific prostheses are designed for a particular activity or task (Fig. 43.7). They are often used when body-powered or electrically powered prostheses cannot perform the needed function or provide the required durability for a specific activity. These prostheses are typically used for recreational or work activities, such as sports, hobbies, and tool use. The design is typically a lightweight socket with limited or no harness or control cable. Terminal devices specific to the activity can be easily interchanged using a Hosmer Dorrance quick disconnect wrist unit. Advantages of activity-specific prostheses are durability, decreased burden on the primary prosthesis, and increased independence and function in a particular activity (Box 43.5).[68]

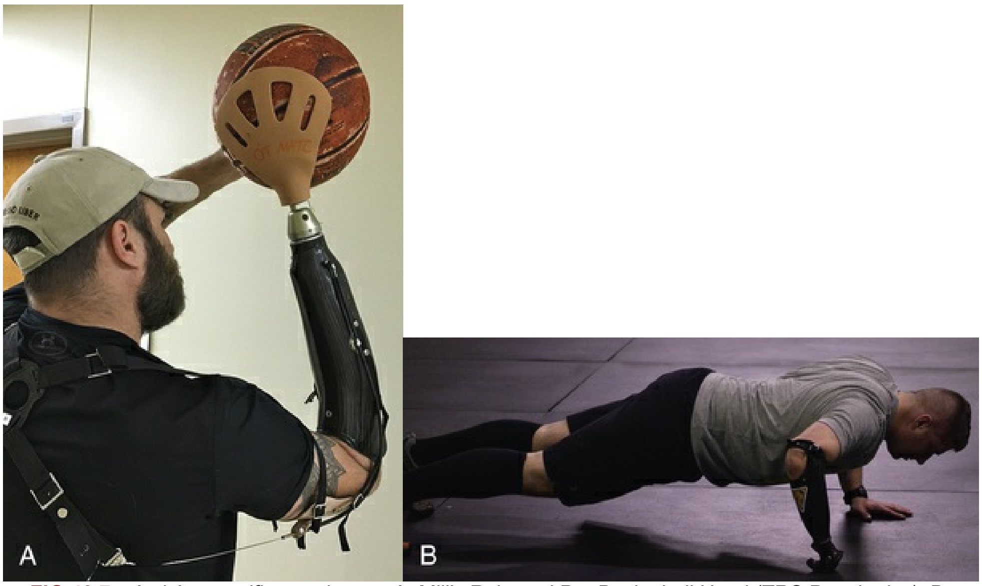

FIG 43.7 Activity-specific prostheses. A, Mill's Rebound Pro Basketball Hand (TRS Prosthetics). B, Shroom Tumbler for push-ups (TRS Prosthetics).

Box 43.5

Advantages and Disadvantages of an Activity-Specific Prosthesis

Advantages

- Allows enhanced function and task-specific participation in a variety of activities
- Minimal harness or cabling
- Durable and low maintenance
- Reduces wear and tear on primary prosthesis

Disadvantages

- Does not provide active grasp
- Appropriate for specific tasks only, not for a broad range of functions

Upper Limb Prosthetic Componentry

Various prosthetic components are available for each level of amputation. The higher the level of amputation, the greater the functional loss of the limb. Greater functional loss often necessitates a more complex prosthetic system. Each prosthetic system is custom made, individually fitted, and prescribed, according to the client's level of amputation, lifestyle, and goals.

Body-Powered Components

The first five components described in the following sections are common to all body-powered prostheses prescribed for the wrist disarticulation level and higher (Fig. 43.8). These components are the prosthetic sock, socket, harness and control system, terminal device, and wrist unit. (Components specific to each level of amputation are also discussed.)

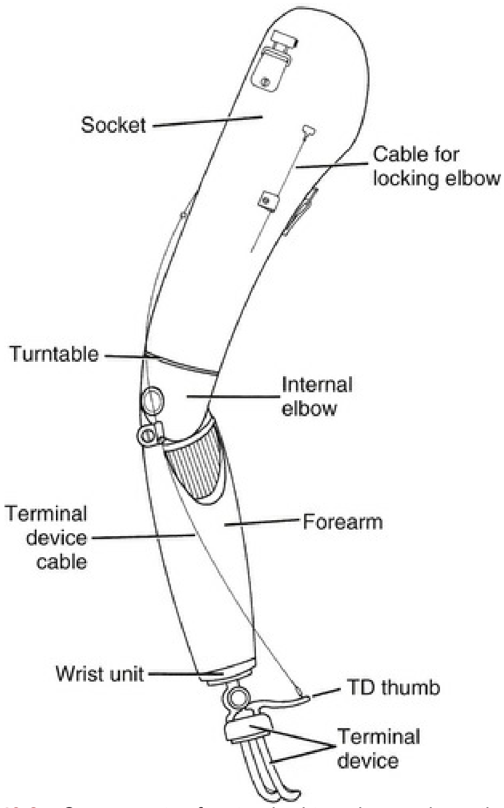

FIG 43.8 Components of a standard transhumeral prosthesis.

Prosthetic sock.

A prosthetic sock of knit wool, cotton, or Orlon Lycra is worn between the prosthesis and the residual limb. The function of the prosthetic sock is to absorb perspiration and protect against irritation that can result from direct contact of the skin with the socket. The sock compensates for volume change in the residual limb and contributes to fit and comfort in the socket.[98,117]

Socket.

The socket is the fundamental component, to which the remaining components are attached. A cast molding of the residual limb is used to construct the socket so as to optimize fit, comfort, and function. The original socket is made of a transparent, thermoform plastic material, which allows quick modification to accommodate changes in limb volume and to optimize fit. Once the limb volume has stabilized and a good fit has been found, the socket is made in its definitive form of carbon fiber. The socket should cover enough of the residual limb to be stable and provide suspension, but not so much that it unnecessarily restricts ROM of the residual limb.[98,114]

The socket is typically made of an inner flexible socket and an external rigid frame. The outer wall provides a structurally cosmetic surface and houses the hardware for the prosthesis. The inner wall maintains total contact with the skin surface of the residual limb to distribute socket pressure evenly. Flexible-frame sockets have been favored because they allow for volume and contour changes that occur when muscles contract and relax. In addition, wearers report that this type of socket is cooler than conventional alternatives.[5]

Harness and control system.

In a body-powered prosthesis the control system functions through the interaction of a Dacron harness and stainless steel cable. The harness is composed of a system of nonelastic straps, which provide suspension for the socket and house the cable system. Several types of harnesses are available, including the standard figure-eight, figure-nine, and chest strap models. The higher the level of amputation, the more complex the harness design system. Loss of muscle power and ROM may necessitate variations in the harness design. A properly fitted harness is important for both comfort and function.[89,98,114]

A transradial control system is a one-cable design (Fig. 43.9). A flexible, stainless steel cable, contained in Teflon housing, attaches to the harness proximally with a T-bar or hanger fitting and attaches distally to a prehension device or terminal device.[33] Recently Spectra fiber, an extremely strong material, has come into use in place of the stainless steel cable because it glides through the housing with less friction. The axilla loop is placed around the nonamputated side and serves as the primary anchor from which the other components originate.

FIG 43.9 Transradial body-powered prosthesis with a one-cable design and figure-eight harness.

A transhumeral prosthesis uses a two-cable design. One cable operates open and close of the terminal device, and the other cable allows the elbow unit to lock and unlock. Specific upper body movements create tension on the cables, thereby operating the various components of the prosthesis. A properly fitted control system maximizes prosthetic control while minimizing body movement and exertion.[4,89,114]

Terminal device.

The **terminal device** (or prehensors) is the most distal component of the prosthesis. Body-powered TDs are classified as either a voluntary open (VO) mechanism or a voluntary close (VC) mechanism.[71] The VO TD is held closed in a relaxed position, and it opens when the wearer exerts tension on the control cable that connects to the "thumb" of the TD. When the tension is released, rubber bands or springs close the fingers of the TD. The number of rubber bands or springs determines the holding force of the TD. The force of the pinch can be adjusted by changing the number of rubber bands (approximately 1 pound per rubber band). The VC TD is open in a relaxed position; it closes when tension is applied to the control cable, and it is automatically opened by a spring mechanism when the cable is relaxed. The amount of pinch force in a VC TD is determined by the amount of tension applied on the cable.[4,5,12,33,70]

Two styles of body-powered TDs are commonly prescribed, the hook and the hand (Fig. 43.10). The VO split hook is the most prescribed terminal device in the United States.[33] Hooks have two basic designs, canted or lyre shaped. "Canted" describes the slanted design of the hook fingertips, which provides visual feedback to the client during functional use. Lyre-shaped TDs provide symmetry for grasp (e.g., of cylindrical items). Because TDs do not provide sensory feedback, the client must rely on visual feedback during object manipulation.

FIG 43.10 Examples of body-powered terminal devices. *Right*, Model 5X Hook, adult size (Hosmer Dorrance Corp.). *Left*, Voluntary opening hand (Ottobock).

The hook design is made in a variety of materials, such as stainless steel or aluminum. Stainless steel TDs are prescribed for activities requiring a durable TD, such as yard work or construction. Aluminum TDs are recommended for lighter work and to reduce the total weight of the prosthesis for a person with a higher level amputation. Most TDs have a rubber lining or a serrated grid between the fingers. The rubber lining increases the holding friction and minimizes damage when the client holds objects.

A prosthetic hand is also available as a TD. It attaches to the wrist unit and is either passively operated or cable operated. The same control cable that operates the hook activates the prosthetic hand in either a VO or VC mechanism. As with the hook TD, the VO hand is preferred and prescribed more often than the VC hand. A flesh-colored rubber glove fits over the prosthetic hand for protection and cosmesis.[98] Body-powered hands offer limited pinch force. Additionally, the fingers that improve the cosmesis of the TD often block visual feedback during fine motor tasks.[33]

The client's lifestyle and activity demands determine the most appropriate TDs. It is important to provide the wearer with information about the advantages and disadvantages of each TD style. Many individuals who have undergone amputation choose interchangeable TDs, using a hand TD for social occasions and a hook TD for daily activities.[33]

Wrist unit.

The wrist unit connects the TD to the prosthesis. It serves as the unit for interchange and provides pronation and supination of the TD for prepositioning purposes. The wearer can passively or actively rotate the TD by turning it with the sound hand, by pushing the TD against an object or a surface, or by stabilizing the TD between the knees and using the arm to rotate it. The wrist unit for a particular client must be chosen according to its ability to meet the individual's needs in daily living and vocational activities.

Friction-held wrist units hold the TD in place by friction, which is provided by a rubber washer or setscrews. Tightening the washer or screws increases friction. The wrist is passively rotated and positioned by the other hand. Friction is sufficient to hold the TD against moderate loads while still allowing manual rotation of the terminal device. Friction-held units are mechanically simple but are not as strong as locking units.

The locking wrist unit allows the TD to be manually positioned and locked into place. In the unlocked position the TD can be prepositioned in almost any degree of rotation throughout a 360-degree range. In the locked position the locking wrist provides greater resistance under load than do the friction units.[33] The quick disconnect locking wrist unit is most common. The quick disconnect function allows the wearer to easily interchange TDs based on the needs of the activities performed.

The wrist flexion unit allows the TD to be manually flexed and locked into position. The wrist unit can be manually positioned into neutral, 30 degrees of flexion, or 50 degrees of flexion.[70] This unit is generally used on the dominant side of a person who has undergone bilateral amputation to facilitate midline activities close to the body, such as dressing and toileting.[4,71,98,114,117]

The N-Abler V Five-Function Wrist (Texas Assistive Devices) combines a rotational wrist with a flexion unit. It also allows quick disconnect of the TD.[104] This wrist unit provides the prosthetic user with flexibility in performing ADLs.

A ball-and-socket wrist unit is also available. This unit is unique in that it allows prepositioning in multiple wrist positions. It has constant friction, and the magnitude of loading is adjustable.[33]

As mentioned, the sock, socket, harness and control system, TD, and wrist unit are components common to all body-powered prostheses. The remaining body-powered prosthetic components—transradial hinges, elbow units, and shoulder units—maximize function at specific levels of amputation.

Transradial hinges.

A transradial prosthesis uses two hinges, one on each side of the elbow, that attach to the socket below the elbow and to a pad or cuff above the elbow. These hinges stabilize and align the transradial prosthesis on the residual limb. When properly aligned, the hinges help distribute the stress of the prosthesis on the limb.

Two hinge styles, flexible and rigid, are available for use with transradial amputations. Flexible hinges are used with amputations of the distal third of the forearm. They usually are made of Dacron and connect the socket to a triceps pad positioned over the triceps muscle. Their flexibility permits at least 50% of the anatomic residual forearm rotation, reducing the need to rotate the TD manually in the wrist.[33] Rigid hinges are used with amputations at or above the midforearm to protect the residual limb against torque load.[33] Rigid hinges usually are made of steel and are attached to a laminated Dacron biceps half-cuff positioned behind the arm, which is sturdier and provides more support than the triceps pad. They are now used less frequently, having largely been replaced by a design using a self-suspending socket, in which supercondylar flares mimic some of the function of the hinges and triceps pad. Team members consider the amount of residual function and the length of the limb when choosing the appropriate hinge style for the transradial prosthesis.[71]

Elbow units.

A prosthetic elbow unit is prescribed for the person who has had an amputation through the level of the elbow or higher. The elbow unit allows 5 to 135 degrees of elbow flexion and locks in various positions. The two main types of elbow units are internally and externally locking units. The more durable internally locking unit is prescribed for a person who has had an amputation 2 inches or more above the elbow. This unit connects the transhumeral socket to the prosthetic forearm. The locking mechanism is contained within the unit and attaches to a control cable. A lift assist, which consists of a tightly coiled spring attached to the elbow unit and forearm shell, helps reduce the amount of energy required to lift the forearm shell. The lift assist also allows a slight bounce in the forearm when the person is walking with the elbow unlocked, which enhances the appearance of a natural arm swing.

A friction-held turntable positioned on top of the elbow unit allows the prosthetic forearm to be rotated manually toward or away from the body. Lateral and medial aspects of a transhumeral prosthesis are shown in Fig. 43.11. The internally locking unit is 2 inches long and therefore not appropriate for an individual who has had an amputation proximal to the elbow.

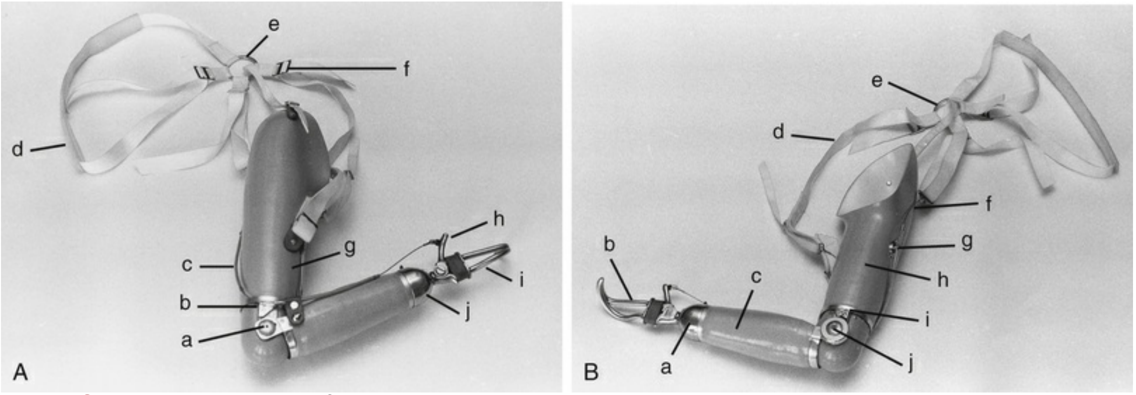

FIG 43.11 A, Lateral side of a transhumeral prosthesis: *a,* elbow unit; *b,* turntable; *c,* control cable; *d,* adjustable axilla loop; *e,* harness ring; *f,* figure-eight harness; *g,* elbow lock cable; *h,* terminal device (TD) thumb; *i,* hook TD; *j,* wrist flexion unit. B, Medial side of a transhumeral prosthesis: *a,* wrist unit; *b,* hook TD; *c,* forearm; *d,* harness; *e,* harness ring; *f,* control cable; *g,* baseplate and retainer; *h,* socket; *i,* turntable; *j,* spring-loading device.

The externally locking elbow unit is prescribed for a person who has an elbow disarticulation or an amputation within 2 inches above the elbow. This unit, which consists of a pair of hinges positioned on either side of the prosthesis, attaches the socket to the forearm. The cable attaches to one of the hinges, which locks and unlocks the unit.

Shoulder units.

With a high-level amputation, shoulder and back movements typically are not sufficient to allow use of a cable-operated shoulder unit. Therefore most shoulder units are manually operated and friction held. Two shoulder unit mechanisms that are often prescribed are the moveable friction-loaded shoulder unit and the locking shoulder unit. Shoulder units are classified by the degree of motion allowed in the prosthesis. A single-axis joint provides abduction; a double-axis joint provides positioning in abduction and flexion; and a triple axis and ball and socket joint allows for universal motion. A locking shoulder unit allows the prosthesis to be locked in various degrees of shoulder flexion. This shoulder unit allows for activities such as reaching for items in a cabinet or overhead.

With an interscapular thoracic amputation, all or a portion of the scapula and clavicle is removed with the arm. In these cases standard prosthetic components may make the prosthesis too heavy for practical use. An endoskeletal prosthesis, made from lightweight materials such as a single aluminum alloy surrounded by a soft foam shape, is often prescribed to decrease the weight. The system provides its own style of prosthetic joints, which will not withstand heavy-duty usage. An endoskeletal prosthesis with a lightweight cosmetic cover is commonly prescribed as a cosmetic prosthesis with limited functional value.

Electrically Powered Components

The two prosthetic components common to all powered prostheses are the terminal device and the wrist unit. (Elbow and shoulder units specific to each level of amputation are also discussed later.) Research and technological advances in myoelectric componentry are proceeding at a rapid pace. This section provides an overview of the components that are commercially available and readily used (Fig. 43.12).

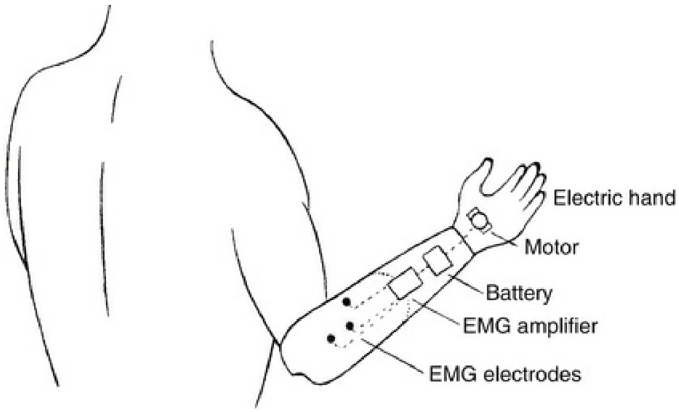

FIG 43.12 Typical electrically powered, myoelectrically controlled, transradial prosthesis with an electromechanical hand terminal device that is activated by electromyographic potentials. (From Billock JN: Upper limb prosthetic terminal devices: hands versus hooks, *Clin Prosthet Orthot* 10:59, 1986.)

Terminal devices.

Electrically powered terminal devices or prehensors are available in two speed systems: digital control and proportional control.[5] Digital control systems operate at a constant speed. In a proportional control system the myoelectric signal (power) to the hand is proportionate with the level of muscle signal the wearer generates; therefore the intensity of the muscle contraction directly controls the speed and pinch force of the hand.[5]

Myoelectric terminal devices come in two designs, the hook or the hand (Fig. 43.13). The electric hook has two "fingers" to provide precision pinch. Myoelectric TDs combine powered pinch force with a tip pinch for manipulation of small objects. The Electric Terminal Device (Motion Control) is designed with one nonmoving finger and a second, which opposes it. The System Electric Greifer (Ottobock) has two fingers, which move symmetrically together in opposition.

FIG 43.13 Examples of electrically powered prehensor terminal devices. *Left,* System Electric Hand (Ottobock). *Center,* Electric Terminal Device (Motion Control, Inc.). *Right,* System Electric Greifer (Ottobock).

The development of the electric hand has served to preserve the anthropomorphic nature of the human hand. The belief is that our environment is made up of objects designed to be handled by the human hand. Therefore, it would follow that a device designed with the same qualities as the human hand would offer the most function.[94] Electric hand terminal devices also provide an aesthetic quality and appeal. The cosmesis of a hand prehension mechanism has been shown to be a strong determinant for acceptance of the prosthesis.[13,18,69,74] One of the most commonly prescribed electric hands is the SensorHand Speed (Ottobock). This hand has a mechanism that drives the hand to open and close into a three-point prehension pinch. The motor also has a feature in the thumb that automatically increases pressure applied to an object being held if the device detects slippage.[70]

Advances in technology and myoelectric control have brought about the advent of multiarticulating prosthetic hands. Multiarticulating hands are defined by the multiple degrees of freedom they provide to assume a variety of grasp patterns. These TDs, which have powered articulating digits, offer prosthesis users increased functional grasp patterns that are unavailable with previous myoelectric hands designed with a single degree of freedom.[111] Individual motors in each digit drive the movement of the hand into a variety of preset pinch and grasp patterns. The two most common commercially available multiarticulating prosthetic hands are the bebionic 3 (RSL Steeper) and the i-limb ultra revolution (Touch Bionics). The bebionic 3 has 14 selectable grip patterns and hand positions, in addition to a manually positioned thumb.[9] The i-limb ultra revolution offers 24 preset grasp patterns and a powered thumb that switches between lateral pinch and opposition. This hand also offers the option for mobile app control.[47,48] Additional multiarticulating hand systems include the VINCENTevolution 2 (Vincent Systems) and the Michelangelo prosthetic hand (Ottobock). Product details are available from each manufacturer.

Multiarticulating hands provide the opportunity for advanced functionality combined with the natural appearance of the human hand. The prosthesis user can activate the preset grasp patterns by sending a signal associated with that selected grasp. For example, co-contraction, single impulse, or double impulse may trigger the hand to move into tip pinch or mouse grip. Education by the occupational therapist and prosthetist on the benefits and limitations of these advanced terminal devices should be provided to the client before a device is recommended and prescribed.

Wrist units.

Electric wrist rotators are used to provide an attachment point for the TD to the forearm. The rotator also provides the important function of forearm supination and pronation for prepositioning of the TD for functional use.[5,40] The rotator is not recommended for work that generates high torque[40]; it should be used only for TD orientation and prepositioning. Currently no electrically powered wrist flexion units are available. Wrist flexion is an important function for individuals who have undergone bilateral upper extremity amputation. It allows the user to reach midline for tasks such as dressing and eating. Manufacturers offer various options for wrist flexion units. For example, Motion Control's wrist flexion unit allows the wrist to be manually locked in three positions: 30 degrees of extension, neutral, and 30 degrees of flexion. Ottobock's System Electric Greifer wrist unit uses a friction joint for manual positioning of the wrist from +45 degrees to −45 degrees.[40] The need for wrist motion that replicates the requirements for prepositioning of the human hand will continue to drive development efforts with electrically controlled wrist units.[40]

Elbow units.

Electrically powered elbows reduce the need for the glenohumeral ROM or strength that typically is needed to operate body-powered prostheses.[68] Myoelectric elbows position the forearm and TD in space for activity performance. For manual humeral rotation a friction joint or turntable is used in addition to the elbow unit.[40] The functional advantage of a myoelectric elbow comes with the cost of increased weight. Locking of the elbow unit is performed in two ways: when the elbow is held for a stationary set of time or when a momentary switch is activated. Unlocking the elbow is controlled by the following: rapid contraction of the controlling muscle known as rate control, slow contraction of the controlling muscle known as threshold control, or by actuation of the momentary switch. When the elbow is locked in position, the myosites used to control the elbow are transmitted to control the TD.[40] Although advances have been made in the design and performance of electrically powered elbow units, functional performance still needs improvement.

Shoulder units.

Currently no electrically powered shoulder joints are commercially available. The LTI-Collier Locking Shoulder Joint (Liberating Technologies) can be fitted with an electric lock actuator. This locking shoulder joint has two degrees of freedom, flexion-extension and adduction-abduction. Manual operation of flexion-extension involves actuating a nudge control that disengages the lock on the joint, allowing it to swing freely. Releasing the nudge control engages the lock to hold the shoulder in a fixed degree of flexion. If the wearer cannot operate a manual nudge control, a myoelectrode or force-sensitive resistor can control the actuator.[40]

Prosthetic Training

Upper extremity **prosthetic training** begins after the final fitting of the prosthesis. The final fitting may be done with a preparatory prosthesis rather than a definitive prosthesis. The occupational therapy intervention is occupation based and includes purposeful activity and preparatory methods to facilitate therapeutic goals.

Evaluation of the Prosthesis

When the prosthesis is received, team members check to ensure that it meets the prescription's requirements, functions efficiently, and is mechanically sound. The prosthesis is checked for fit and function against specific mechanical standards developed from actual tests on prostheses worn by individuals. The tests performed are comparative ROM with the prosthesis on and off; control system function and efficiency; TD opening in various arm positions; amount of socket slippage on the residual limb under various degrees of load or tension; compression fit and comfort; and force required to flex the forearm or open/close the TD.[4,89,114] Ideally the prosthetist and the therapist coordinate fitting of the prosthesis and initiation of therapy. Communication among the client, therapist, and prosthetist is essential to ensure that the prosthesis fits and functions optimally.

Donning and Doffing the Prosthesis

Donning and doffing the full prosthetic system is a critical first step in training for the user. It is important for the client to be able to don and doff the prosthesis as independently as possible. The full prosthetic system includes the residual limb sock, prosthetic donning liner, prosthetic socket, and/or harnessing.[95]

The two most common methods of donning and doffing the body-powered prosthesis are the coat method and the pullover (or sweater) method. Either method can be used for unilateral or bilateral amputations. The method used depends on the client's choice and ease of use. The coat method is similar to placing one arm in a coat sleeve and manipulating the coat to a position where the other arm can reach the other sleeve. The residual limb is inserted into the socket while the harness and axilla loop dangle behind the back. The sound hand reaches around the back and slips into the axilla loop. The person then slips into the harness as if putting on a coat. The shoulders are shrugged to shift the harness forward and into the correct position. To remove the prosthesis, the person uses the TD to slip the axilla loop off the sound side and then slips the shoulder strap off the amputated side. The harness is slipped off like a coat.[4,89,114]

The person who has had bilateral amputations can use the coat method by placing the prostheses face up on a surface, placing the longer residual limb in the socket, and elevating the prosthesis, allowing the other prosthesis to hang across the back. The person then leans to the side and places the shorter limb in the prosthesis.[89,117] To remove the prosthesis, the person shrugs the harness off the shoulders and removes the prosthesis from the shorter side first. Before removing the prosthesis on the longer side, the person should position the prostheses somewhere convenient for the next donning.

For the pullover method the client positions the prosthesis face up, places the residual limb in the socket, and threads the opposite arm through the harness. The person then raises both arms above the head, allowing the axilla loop to slide down to the axilla and the harness to be properly positioned across the back and on the shoulders (Fig. 43.14). To remove the prosthesis the person raises both arms above the head and grasps and removes the prosthesis with the sound arm while allowing the axilla loop to slide off the arm.[89]

FIG 43.14 A and B, Pullover (or sweater) method for donning a transradial body-powered prosthesis.

A person who has had bilateral amputations dons the prostheses using the pullover method by placing the prostheses on a surface, face up. With the longer limb stabilizing the socket, the shorter residual limb is positioned under the harness and in the socket. The longer limb is positioned similarly under the harness in the socket, and the arms are raised, allowing the harness to flip over the head and across the back and shoulders. The person removes the prostheses by shrugging the shoulders to bring the harness up, grasping it with one TD, and pulling it over the head while allowing the residual limbs to come out of their sockets.

In the case of donning an electrically powered prosthesis, the client may use a pull sock to facilitate an intimate interface between the skin and socket. For this method a pull sock is placed over the residual limb, and a weighted cord from the pull sock is guided through a hole in the bottom of the socket. The client then pulls the sock off the arm and through the hole in the socket, creating optimal contact with the surface electrodes. Daniel preferred the pull sock method to don and doff his prosthesis because it provided a tight fit and good suction in his myoelectric socket.

Donning of the prosthesis should be performed with the electronic components in the OFF position to prevent any uncontrolled movements. Applying a silicone-based skin lotion to the skin before donning the pull sock enables the person to remove the pull sock with less effort. It may be necessary to experiment with different sock materials, powder on the skin, and various donning techniques until the most successful materials and techniques are identified. Good electrical contact is achieved after approximately 1 minute of donning. A wearer can moisten the skin at the electrode sites to eliminate the waiting period for skin warmth to occur. The prosthetic arm should be stored in the OFF position with the batteries removed. The hand should be fully opened when stored to keep the thumb web space stretched.

Wearing Schedule

A wearing schedule for the prosthesis is established and reviewed during the first training session. The client increases the wearing time gradually to develop a tolerance and decrease the likelihood of skin breakdown. The prosthesis initially is worn 15 to 30 minutes three times a day. Each time the prosthesis is removed, the skin must be inspected for redness or irritation. The skin must be closely monitored, and the wearing time is increased only if the skin remains in good condition. If no skin problems develop, the three scheduled wearing periods may be increased by 30-minute increments until the prosthesis can be worn all day. If skin problems occur, the therapist, prosthetist, or physician must be notified, and the prosthesis should not be worn until the problem has cleared. Restarting the initial wearing schedule may be necessary to decrease the risk of additional skin problems.[6]

Residual Limb Hygiene

The client is instructed in residual limb hygiene in the early phase of prosthetic training.

Perspiration is common when a prosthesis is worn because the residual limb is enclosed in a rigid socket. Excessive perspiration can cause irritation or maceration of the skin; therefore, it is important to teach the client to inspect the skin of the residual limb, each time the prosthesis is removed, to look for areas of redness or breakdown. The client is also instructed to wash the residual limb daily with mild soap and water and to pat it dry. To minimize sweating, education is provided to the client in the application of antiperspirants, socks, or liners which will not compromise the fit of the prosthesis or interfere with myoelectric surface electrodes.

Operational Prosthetic Knowledge

The wearer should learn and demonstrate knowledge of the terminology and function of each prosthetic component. A basic knowledge of the following terminology is recommended: socket and harness design and use; types of control systems; and basic mechanics of the prosthesis. This allows the client to communicate with the rehabilitation team, using terminology understood by all, about the operation of the prosthesis and any difficulties with or repairs needed for the device.[6,114,117]

Care of the Prosthesis

Instructions regarding care of the prosthesis are provided and reviewed. Generally the prosthetist educates the person in this area, and the therapist reviews and reinforces the information with the wearer. The socket should be cleaned daily with mild soap and water, or weekly with rubbing alcohol. Cleaning at night is recommended to allow the prosthesis to dry completely. Wearing the prosthesis when the socket is wet may lead to skin problems. The components should be cleaned and maintained according to the manufacturer's specifications. Daily inspection of the prosthesis helps prevent problems.[6] The client should be proficient in basic maintenance procedures, including daily socket cleaning and inspection; battery charging procedures for the prosthesis; component maintenance; harness adjustment; and cable system changes and rubber band replacement.[70,95] It is the role of the occupational therapist to ensure that the client is trained and independent in the maintenance and care of the prosthesis.

Intermediate Prosthetic Training

Controls Training

Therapy progresses through two phases of training: (1) prosthetic controls training and (2) use training. The goal of prosthetic controls training is to achieve smooth movement of the prosthesis with minimal delay or awkward movements with task performance.[6] Functional use training is designed to apply the skills learned during controls training and apply them to functional use of the prosthesis. Acquiring skill in the operation of the prosthesis is emphasized in controls training. The therapist educates the wearer on the importance of the practice drills that will ensure more successful function with the prosthesis in daily activities. Joint protection, energy conservation, and work simplification principles and techniques should be stressed during this phase of training. Each prosthetic component should be reviewed separately and understood before the components are combined into functional activities.

Body-Powered Prosthesis

Controls training for a body-powered prosthesis begins with the operation of each component, starting with the TD. For a transradial prosthesis there is a single control system to activate the TD. Scapula abduction and glenohumeral flexion are the motions used to open and close the TD. The client is instructed to activate the TD with the arm in various positions in space, such as overhead and leaning over toward the floor.[117] The client is instructed in how to exchange the TD if more than one is prescribed. To complete controls training with a transradial prosthesis, the client demonstrates the motions required to position and operate the TD until they are performed in one continuous, smooth, and natural sequence in both sitting and standing positions.[114]

Transhumeral prostheses operate through the use of a dual-control cable system. When tension is applied on the cable attached to the elbow unit, the unit locks and unlocks. The motions necessary to lock and unlock the elbow are a combination of scapular depression, humeral extension, and abduction. This movement places tension on the cable that attaches the harness to the elbow unit. The reminder “down, out, and away” may be repeated until the client develops a proprioceptive memory. The client is then asked to practice locking and unlocking the elbow in various ranges of elbow flexion and extension.[4,6,117] The client may also learn to operate the turntable that manually rotates the arm medially and laterally, allowing for internal and external rotation. The same motions of shoulder flexion and scapula abduction that flex the forearm with the elbow unlocked control the TD when the elbow is locked. The person is instructed to lock the elbow, first at 90 degrees, and to perform the motions to operate the TD. The sequence of elbow positioning, elbow locking, TD operation, elbow unlocking, elbow repositioning, and locking is repeated at various points in elbow ROM from full extension to full flexion.[4,117]

A prosthesis used for a shoulder disarticulation may have a manually operated, friction-held shoulder unit that the client pre-positions using the sound arm. A chin-operated nudge control may be used to operate the elbow unit if the client does not have the shoulder movements necessary to lock and unlock the elbow. The client still is instructed in the dual-control cable system of operation, as described for a transhumeral prosthesis. For clients with higher levels of amputation, such as shoulder disarticulation, chest expansion is used to assist with TD operation.

The progression of controls training for body-powered prostheses at each level of upper limb amputation is described in Fig. 43.15.

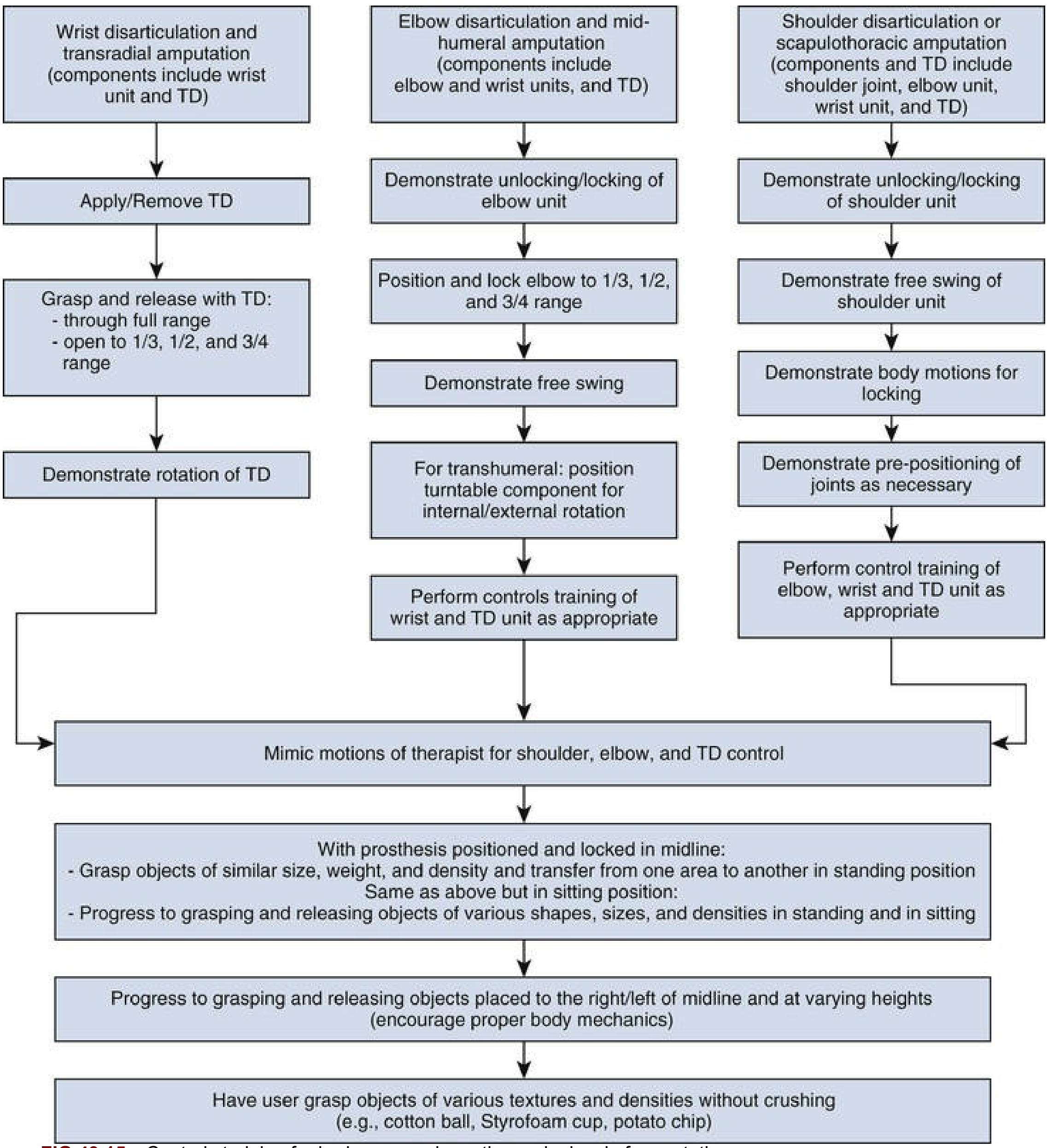

FIG 43.15 Controls training for body-powered prostheses by level of amputation. (From Smurr LM, Yancosek K,

Gulick K, et al: Occupational therapy for the polytrauma casualty with limb loss. In Pasquina PF, Cooper RA, editors: *Care of the combat amputee,* Washington, DC, 2009, Department of the Army, the Borden Institute.)

Electrically Powered Prosthesis

Each myoelectric prosthesis has a unique control system based on the manufactured componentry and/or the person's musculoskeletal integrity. Typically a two-site system is used, in which two separate muscle groups operate the TD. For transradial prostheses, wrist flexors and extensors are commonly used to open and close the TD; the biceps and triceps are often used with a transhumeral prosthesis. With higher level amputations (e.g., shoulder disarticulation), the muscles used for control are typically the pectoralis or infraspinatus.

Controls training typically begins with opening and closing of the TD. Simple opening and closing of the terminal device is practiced in various arm positions to ensure that the electrodes maintain contact with the skin in each position. Next, the client practices opening the TD through one-third, one-half, and three-fourths of range. If a proportional control system is used, the client may also practice opening and closing quickly and slowly. Daniel demonstrated difficulty with proportional control initially during training. To offer more practice, the therapist often will design a home program of specific patterns of terminal device action that the person performs. Control of the TD improves in accuracy and speed with practice and use throughout the other phases of training. The progression of controls training for myoelectric prostheses at each level of upper limb amputation is described in Fig. 43.16.

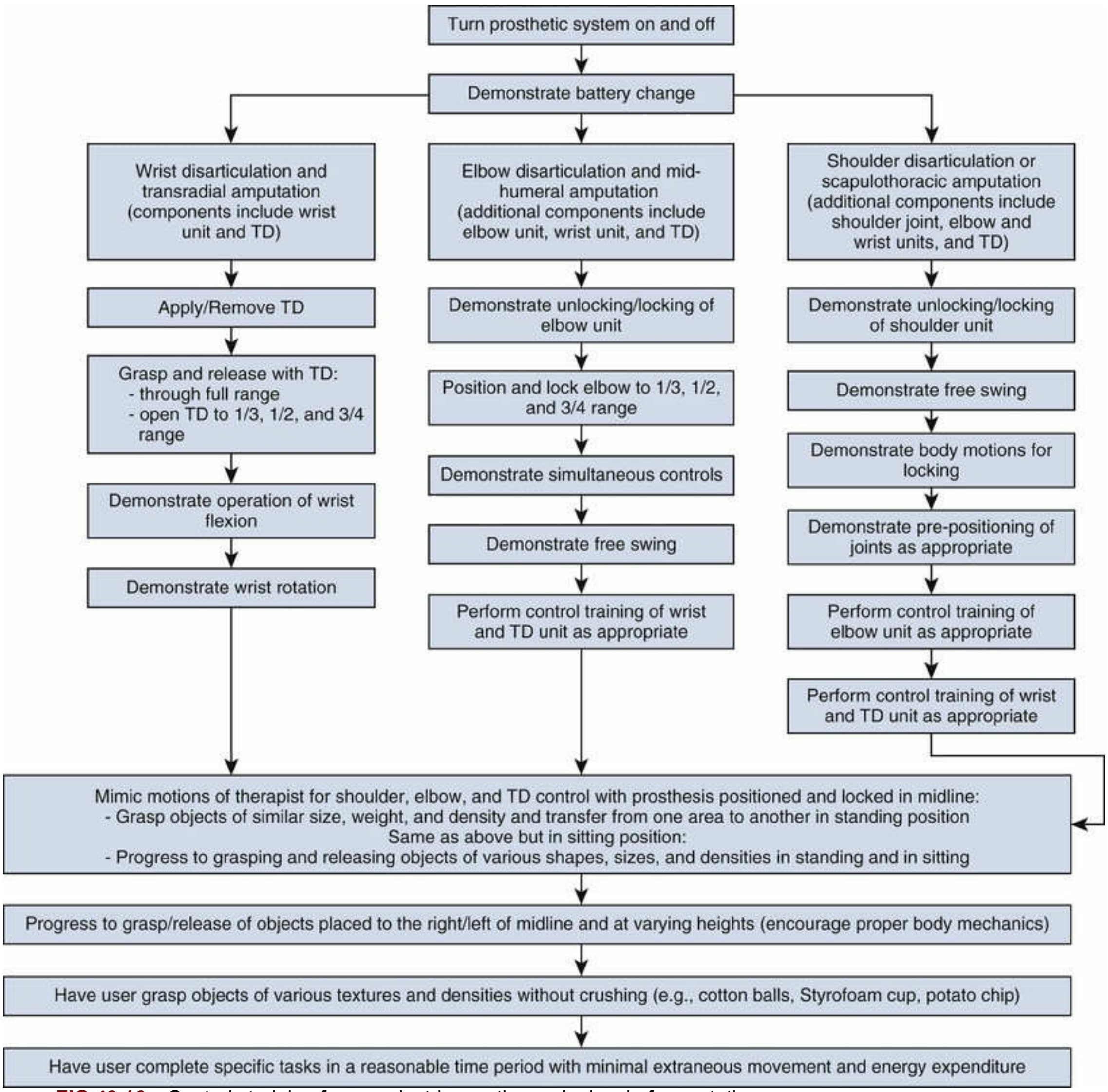

FIG 43.16 Controls training for myoelectric prostheses by level of amputation. (From Smurr LM, Yancosek K, Gulick K, et al: Occupational therapy for the polytrauma casualty with limb loss. In Pasquina PF, Cooper RA, editors: *Care of the combat amputee,* Washington, DC, 2009, Department of the Army, the Borden Institute.)

Use Training

Once the client understands how to operate and control the prosthetic components, he or she can begin to apply the mechanics of operation to activities. Instruction on pre-positioning the prosthesis is important because this involves moving the prosthetic units in their optimal position to grasp an object or perform a given activity in the most efficient manner, thereby avoiding awkward body movements used to compensate for poor pre-positioning.[89] The client is instructed in control drills in patterns of reach, grasp, and release of objects of various sizes, weights, densities, and shapes. The sequence (and progression) typically is from large, hard objects to smaller, softer ones. These objects should be placed in positions that require elbow and TD pre-positioning and TD operation both for prehension practice at tabletop or at various heights around the room. Working on reach, grasp, and release in multiple arm positions then follows. The client will attempt to grasp objects at counter height, at table height, overhead, on the floor, at cupboard height, alongside the body, and behind the body. This area of space in which the client can operate the prosthesis is referred to as the functional envelope.

Another goal of use training is mastering pressure control, or the gripping force of the TD. Particularly with myoelectric control, this skill involves close visual attention to appropriately grade the muscle contraction for a specific result in the TD. The client must learn how to pick up the object without applying too much force and crushing it. Good grasp control through training with foam, cotton balls, or wet sponges will help the client develop the control necessary to handle paper cups, vegetables, boxes, lotion bottles, and sandwiches, or even to hold someone's hand.[101]

The client with a transhumeral amputation who uses a body-powered or myoelectric elbow should ensure that the position of the terminal hand and the angle of elbow flexion are appropriate to complete the grasp in a natural manner. Often the client automatically adjusts the body using compensatory body motions (e.g., bending forward rather than adjusting the elbow position or prepositioning the hand). It is important to discourage this adjustment because it looks unnatural, becomes habitual, and may lead to secondary musculoskeletal problems in the neck, shoulder, or trunk. The ability to perform specific movements will eventually take less conscious effort, and movements will become automatic.

The wearer now has increased muscle endurance and prosthetic tolerance. Next, functional activities are introduced into the therapy program.

Advanced Prosthetic Training

Functional Training

Functional training applies the concepts of control and use of the prosthesis for completion of functional and meaningful activities. The goal is to perform functional tasks with automatic, spontaneous, smooth movements. Five characteristics of advanced prosthetic training can help guide therapy. First, a person's rehabilitation is individualized, and each client has a unique set of goals. Second, the client uses tools or interacts with an object such as a cooking utensil or a piece of sports equipment (Fig. 43.17). The third characteristic of advanced prosthetic training is that it involves complex, multistep tasks that are typically bimanual in nature (Fig. 43.18). The fourth characteristic is that the training involves the prosthesis of choice for the client. Training should focus on advancing and refining the control of the preferred prosthesis for functional use. The final characteristic is that the training and activity selection are meaningful to the client.[95] The key to successful functional training is to teach the client problem-solving techniques and ways to analyze each activity with respect to the environment in which it is performed. The client recognizes the altered environment and learns to successfully complete activities within it.

FIG 43.17 Example of functional training: interacting with an object such as a cooking utensil.

FIG 43.18 Individual with bilateral upper limb loss removing credit cards from a wallet. This is an example of a multistep, bimanual task that is taught during advanced prosthetic training.

Although there is no specific technique to accomplish most tasks, the therapist will offer guidance to enable completion of activities in an efficient way. A client with a unilateral amputation quickly learns to perform activities with one hand. Therefore when incorporating a prosthesis into bimanual tasks, the prosthesis is primarily used for stabilization or support.[114] Table 43.1 offers suggestions for ways some activities can be accomplished with a prosthesis.[120]

TABLE 43.1

Roles of Prosthetic Terminal Device and Sound Hand in Bilateral Activities of Daily Living

Activity	Prosthetic Terminal Device	Sound Hand
Cutting meat	Hold the fork with prongs facing downward; hold the knife as grip strength increases.	Hold knife. Hold fork.
Opening a jar	Hold the jar.	Turn the lid.
Opening a tube of toothpaste	Hold the tube.	Turn the cap.
Stirring something in a bowl	Hold the bowl with a strong grip.	Hold the mixing spoon or fork.
Cutting fruit or vegetables	Hold the fruit or vegetable firmly.	Hold the knife to cut.
Using scissors to cut paper	Hold the paper to be cut.	Use scissors in normal fashion.
Buckling a belt	Hold buckle end of belt to keep it stable.	Manipulate long end of belt into buckle.
Zipping a jacket from the bottom up	Hold anchor tab.	Manipulate pull tab at base, and pull upward.
Applying socks	Hold one side of sock.	Hold other side of sock, and pull upward.
Opening an umbrella	Hold base knob of umbrella.	Open as normal.

During advanced prosthetic training, therapy will focus on incorporation of the prosthesis into ADL and IADL performance. Practice in handwriting and activities requiring dexterity and fine motor coordination may be useful in this phase of the training process.[77,98,114] A rating guide developed by Atkins, the Unilateral Upper Extremity Amputation: Activities of Daily Living Assessment, provides a comprehensive checklist of functional activities that can be used as a reference to show progression with advanced prosthetic training (Fig. 43.19).[6] Vocational and recreational activities, including driving, community reintegration, and adaptive sports are introduced during this phase. The occupational therapist should bring the client into the actual environment, when possible, to encourage realistic, deliberate training with the prosthesis (Fig. 43.20). By the end of this phase of training, the client will have learned to perform functional tasks and meaningful occupations in the most efficient way. This would result in saved energy for the body and decreased biomechanical stress on the sound limb.[95]

Name:	Age:	Occupation:	Date(s) of Test:
Therapist:	Sex:	Type of terminal device:	

RATING GUIDE KEY:

0 Impossible	1 Accomplished with much strain, or many awkward motions	2 Somewhat labored, or few awkward motions	3 Smooth, minimal amount of delays and awkward motions

ACTIVITIES OF DAILY LIVING	0	1	2	3
PERSONAL NEEDS:				
Don/doff pull-over shirt				
Dress button-down shirt: cuffs and front				
Manage zippers and snaps				
Don/doff pants				
Don/doff belt				
Lace and tie shoes				
Don/doff pantyhose				
Tie a tie				
Don/doff brazier				
Don/doff glove				
Cut and file finger nails				
Polish finger nails				
Screw/unscrew cap of toothpaste tube				
Squeeze toothpaste				
Open top of pill bottle				
Set hair				
Take bill from wallet				
Open pack of cigarettes				
Light a match				
Don/doff prosthesis				
Perform residual limb care				
EATING PROCEDURES:				
Carry a tray				
Cut meat				
Butter bread				
Open milk carton				
DESK PROCEDURES:				
Use phone and take notes				
Use pay phone				
Sharpen pencil				
Use scissors				
Use ruler				
Remove and replace ink pen cap				
Fold and seal letter				
Use paper clip				
Use stapler				
Wrap package				
Use computer: typing, access Internet				
Demonstrate handwriting				

COMMENTS:

ACTIVITIES OF DAILY LIVING	0	1	2	3
GENERAL PROCEDURES:				
Turn key in lock				
Operate door knob				
Place chain on chain lock				
Plug cord into wan outlet				
Set time on watch				
HOUSEKEEPING PROCEDURES:				
Perform laundry				
Fold clothes				
Set up ironing board				
Iron clothes				
Hand-wash dishes				
Dry dishes with a towel				
Load and unload dishwasher				
Use broom and dustpan				
Operate vacuum cleaner				
Use wet and dry mops				
Make bed				
Change garbage bag				
Open/close jar				
Open lid of can				
Cut vegetables				
Peel vegetables				
Manipulate hot pots				
Thread a needle				
Sew a button				
USE OF TOOLS:				
Saw				
Hammer				
Screwdrivers				
Tape measure				
Wrenches				
Power tools: drill, sander				
Plane				
Shovel				
Rake				
Wheelbarrow				
CAR PROCEDURES:				
Open and close doors, trunk and hood				
Perform steps required to operate vehicle				

COMMENTS:

FIG 43.19 Assessment of activities of daily living for a client with unilateral upper extremity amputation. (From Atkins DJ. In Atkins DJ, Meier RH, editors: *Comprehensive management of the upper-limb amputee,* New York, 1989, Springer-Verlag.)

FIG 43.20 Instrumental activities of daily living. A, Individual with bilateral upper limb amputation and bilateral lower limb amputation grasps a plastic bag for produce while grocery shopping. B, Father dresses his son using a body-powered prosthesis. C, Individual putting gas in a car using bilateral upper limb prostheses. D, Individual uses a myoelectric prosthesis to push a grocery cart while sipping a cup of coffee.

Adaptive Sports and Recreation

Adaptive sports and recreational activities are an important part of rehabilitation after limb loss. Various levels of recreational activity and adaptive sports options are available, from low to high intensity, and a number of activity-specific and customized prostheses are available to facilitate participation in these activities (Fig. 43.21). It is the role of the occupational therapist and interdisciplinary clinical team to encourage participation in adaptive sports and to train the client in the use of activity-specific prostheses. Modifications can be made to all types of sporting and recreational equipment. Additionally, a number of nonprofit organizations have been established to support individuals with amputations in their participation in adaptive sports and recreation. Participation in adaptive sports has been shown to promote social and psychological health and also helps individuals with a disability focus on their abilities rather than their functional limitations.[93,115] Studies have shown that adaptive sports participation for persons with disabilities improves overall quality of life and satisfaction across physical, social, and psychological domains.[119] The interdisciplinary team of health care providers should educate the client on the benefits of participation in adaptive sports and recreation, assist with modifications to equipment, and provide information on available resources to support reintegration into meaningful activities.

OT Practice Notes

Encourage the client to try a new sport or activity that may be outside his or her comfort zone. Reinforce the positive idea of finding a “new norm” in the context of occupational performance after amputation.

FIG 43.21 A, Mountain biking using an activity-specific terminal device. B, Individual with multiple limb loss rock climbing using activity-specific terminal devices.

Driver Training

The ability to drive is a valued occupation in today's society. For many clients, returning to driving after amputation is a primary goal. Driving is a complex process, involving an individual's physical, cognitive, visual, and behavioral abilities. The occupational therapist will make a referral for a comprehensive driving evaluation when appropriate. A driving rehabilitation specialist will do a clinical assessment and will make recommendations for adaptive equipment or vehicle modifications. The driving rehabilitation specialist may also provide behind the wheel training with the client as necessary. Modifications can be made to improve safety and comfort. For example, a person with a unilateral upper extremity amputation can have a spinner knob or driving ring installed (Fig. 43.22). Clients are always encouraged to contact their state's Department of Motor Vehicles or driver's licensing agency to determine whether any driving restrictions apply to persons with amputations.

FIG 43.22 Individual with left upper extremity amputation and bilateral lower extremity amputations uses hand controls and spinner knob for driving.

Considerations for Bilateral Amputations

In the case of bilateral amputations, adaptive equipment should be introduced as soon as possible to increase the client's level of independence. The equipment may include a universal cuff secured by elastic or Velcro to the residual limb to aid in eating, writing, and hygiene; a dressing tree with hooks to hold articles of clothing in a position conducive to donning them, to improve dressing independence; and loops added to items such as socks and towels. Individuals with bilateral amputations can learn to complete activities using foot skills, such as holding items between the toes in a functional pinch for dressing, eating, and reaching items. The therapist can also encourage the use of the chin, knees, and teeth for activity performance.[26] The therapist and client will problem-solve and analyze activities together, with emphasis placed on how to maximize the individual's environment to accomplish a particular task.

The use of an immediate or early postoperative prosthesis (IPOP or EPOP, respectively), is strongly recommended in bilateral upper extremity amputations.[107] Fitting an individual with an early temporary prosthesis not only promotes immediate participation and independence in ADLs, but also may facilitate acceptance and use of the permanent prosthesis.[29,56]

Bilateral upper extremity amputations present unique challenges for prosthetic selection, fitting, and training. A person with bilateral upper extremity amputations commonly is fitted with a combination of systems (Fig. 43.23). For example, an individual may be fitted with a body-powered system for one side and a myoelectric system for the other. It is important to include the client in this decision-making process and to include his or her goals when discussing prosthesis selection with the rehabilitation team. The progression and phases of training for bilateral upper extremity amputations are the same as for unilateral amputation. Techniques for donning and doffing, componentry, and controls training vary slightly to accommodate variations in the designs of the two prosthetic systems. Refer to donning and doffing techniques for bilateral upper extremity amputations presented earlier in this chapter under Prosthetic Training.

FIG 43.23 Individual with bilateral upper limb loss using a combination of prosthetic systems. On the right side he is using a transhumeral body-powered system with an activity-specific terminal device. On the left side he is using a transradial myoelectric system with an electric hook.

A client with bilateral amputations typically receives two prostheses that are attached to one harness. Operating one of the prostheses may transmit tension through the harness to the other prosthesis, causing it to operate. The client must learn to operate each prosthetic component without affecting the components on either side. This skill is called **separation of controls**, and the client may need extensive practice to master it. Each prosthesis operates according to the level of amputation, as described in the previous sections.

Outcome Measures

Outcome measures for upper limb amputations are used to assess progress and analyze the effectiveness of a prosthetic device.[85,118] Evaluation of upper extremity prosthetic use presents a unique challenge because only a limited number of measures have been validated for adults.[85] Traditional dexterity assessments, such as the 9-Hole Peg Test and the Purdue Pegboard, provide occupational therapists with a measure of progress in performance over time but are not validated as true determinants of the effectiveness of prosthetic use. Efforts continue in the development of outcome measures for prosthetic use through the Upper Limb Prosthetic Outcomes Measures (ULPOM) Working Group, whose goal is to develop a toolkit of validated outcome measures for upper limb amputees.[44,85]

For the purpose of this chapter, five assessments that have been recommended for use will be discussed. The Assessment of Capacity for Myoelectric Control (ACMC) is a measurement of an electrically controlled prosthesis in the performance of bimanual tasks. The assessment evaluates performance with the prosthesis in the areas of gripping, holding, releasing, and bimanual manipulation.[42,43] The Trinity Amputation and Prosthesis Experience Scales–Revised (TAPES-R) is a self-report measure that evaluates psychosocial adjustment, activity restriction, and satisfaction with the prosthetic device.[34] The Southampton Hand Assessment Procedure (SHAP) examines upper limb prosthetic use during manipulation of 8 objects and 14 ADL tasks (Fig. 43.24).[61] The Orthotics and Prosthetics User Survey (OPUS) is a self-report instrument that assesses for functional status, quality of life, and client satisfaction with the prosthetic devices and services. The survey is used to examine both upper and lower extremity function.[41] The final outcome measure that will be addressed is the Activities Measure for Upper Limb Amputees (AM-ULA); this is an observational measure of activity performance for adults with upper limb amputation that evaluates task completion, speed, movement quality, skillfulness of prosthetic use, and independence.[85]

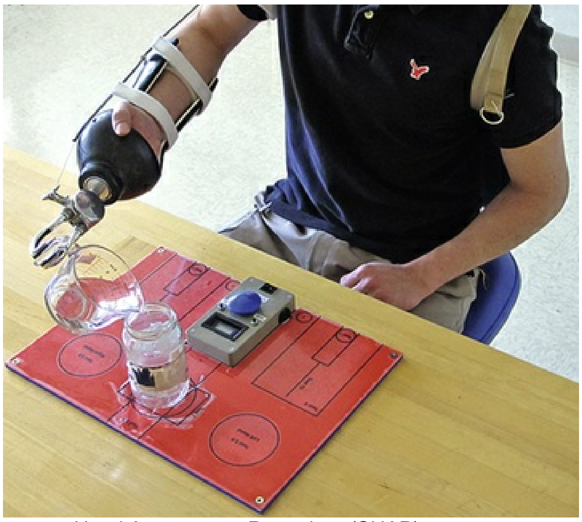

FIG 43.24 Southampton Hand Assessment Procedure (SHAP). (From Berning K, Cohick S, Johnson R, et al: Comparison of body-powered voluntary opening and voluntary closing prehensor for activities of daily life, *J Rehabil Res Dev* 51:253–261, 2014.)

Work is still needed in the development of normative data and outcome measures for upper extremity prosthetic use. Continued development of standardized assessments for this population would serve to identify standards of performance and provide an evidence base for intervention and practice.[16]

Current Research and Emerging Technologies

Research in the field of upper limb prosthetics continues to grow, thanks in part to the program

Revolutionizing Upper Extremity Prosthetics, which was established by the Defense Advanced Research Project Agency (DARPA), an agency of the U.S. Department of Defense.[22] The goal of the project is to improve upper extremity prosthetic function and "to create a fully functional (motor and sensory) upper limb that responds to direct neural control, within this decade."[22] As a result of this program and collaborations with various institutions, a number of advances have been made in signal control schemes, socket design, and prosthetic componentry.

Targeted muscle reinnervation (TMR) is a surgical technique used to increase the number of myosites (control signals) available for use, thereby increasing the potential for improved prosthetic function. This procedure maximizes the function of the intact residual nerves by transferring them to unused muscle in the residual limb. The goal is reinnervation of the "target" muscle so that the myosites physiologically correlate with the prosthetic movements.[53,102] TMR has also elicited a targeted sensory reinnervation response in which sensory nerves from the residual limb can be directed to the chest, resulting in perceived touch of the phantom limb. Targeted sensory reinnervation can provide sensory feedback while a prosthesis is used for enhanced control.[54] TMR has also been shown to have a promising effect in pain and neuroma management.[55]

Pattern recognition, a new development in myoelectric control, offers individuals with upper limb loss a natural, intuitive method of control with a myoelectric prosthesis.[80] Instead of the typical two-site control scheme, pattern recognition uses multiple electrodes to control several degrees of freedom for more complex movement. Various numbers and configurations of electrodes are used, based on the level of amputation and whether TMR surgery has been performed, which requires precise electrode placement. The goal of pattern recognition is to increase the overall picture of muscle activity in the residual limb by allowing the prosthetic user to perform a large number of movements with the prosthesis by simply reproducing the intuitive movements of the amputated limb.[39,53,80,90,92]

OT Practice Notes

An occupational therapy protocol for clients who have undergone TMR has been developed and should be used throughout their rehabilitation.

Currently surface electrodes only provide up to four channels of control in the forearm for myoelectric prostheses. A new control scheme is being researched that uses implantable myoelectric sensors (IMES), which are surgically implanted into various muscles in the residual limb. The goal is to improve the accuracy of signal reception, provide intuitive control, and enhance simultaneous control of multiple degrees of freedom of the prosthetic hand.[113]

Osseointegration is a surgical procedure in which an implanted device is fixed to the bone of the residual limb. A component of the implant protrudes from the skin and anchors the prosthesis directly to the residual limb, eliminating the need for suspension.[38] Osseointegration has been performed in Sweden and was recently approved by the U.S. Food and Drug Administration (FDA) for a feasibility trial in the United States at the University of Utah, under the auspices of the Utah Amputation Research Team (UART).[87] The procedure was developed as an alternative for individuals who cannot use a conventional prosthetic socket because of skin breakdown, residual limb length, shape and volume fluctuation of the residual limb, or poor maintenance of suspension as a result of perspiration.

The DEKA arm system was developed by DEKA Integrated Solutions Corp. (Manchester, New Hampshire) and funded by DARPA's Revolutionizing Prosthetics Program.[11,103,108] The prosthesis is controlled by a combination of mechanisms, including EMG signals, switches, and movement sensors. The movement sensor uses inertial measurement units (IMUs) attached to the user's shoe. The position of the foot operates the terminal device.[86] This prosthesis provides the individual with the ability to use multiple, simultaneous movements; in addition, it has up to 18 degrees of freedom, 10 of which are powered.

The Johns Hopkins Applied Physics Laboratory (APL), in collaboration with DARPA, has developed a prosthesis with 26 degrees of freedom, known as the Modular Prosthetic Limb (MPL). The prosthesis has 17 motors and contains more than 100 sensors, which provide a neural interface for intuitive and natural closed loop control.[51] The goal of this prosthesis is to replicate the human hand as closely as possible in terms of performance in a variety of metrics, including strength, dexterity, form factor, weight, and tactile feedback.[15]

An emerging practice in the area of upper extremity restoration is vascularized composite allotransplantation (VCA), also known as composite tissue allotransplantation (CTA). VCA is defined as "transplantation of multiple tissues such as muscle, bone, nerve and skin, as a functional unit (e.g., a hand or face) from a deceased donor to a recipient with a severe injury."[3] Hand transplantations are performed with the aim of achieving improved functionality, cosmesis, and psychological recovery, compared to prostheses.[27] Although this is a feasible therapeutic option, the risks of this surgical procedure must also be considered. Hand transplantation carries a risk of rejection, necessitates the lifetime use of immunosuppressive therapies, and requires dedicated time in intensive rehabilitative therapies.[25,27] As of June 1, 2011, 46 clients have received 66 hand transplants worldwide.[3]

Section 2 Summary

The rehabilitation process for individuals with upper limb loss can be challenging and rewarding. In the case of upper extremity prosthetic training, expertise on the part of the therapist and interdisciplinary rehabilitation team is essential. Occupational therapists play a vital role in the rehabilitation process by addressing residual limb management and care, in addition to preprosthetic and prosthetic training. Desired outcomes of occupational therapy include a positive self-image after limb loss, independent management of ADLs; and resumption of work, social, and leisure roles that support the client's health and occupational performance.

Careful assessment of the client's needs, a creative approach to therapeutic intervention, an emphasis on problem solving, and close communication with the rehabilitation team can make the challenge rewarding and the outcome successful.

Threaded Case Study

Daniel, Part 2

After the initial evaluation, regular occupational therapy treatment sessions were initiated on an outclient basis. Daniel was educated on the use of adaptive equipment, such as a rocker knife and buttonhook, and one-handed techniques to perform basic ADLs. He was a quick learner and adapted well to his loss, physically and psychologically. His family members were present throughout each treatment session and were active participants in his rehabilitation. His fiancée encouraged him to maximize his functional independence. The social support network that he had was critical in his rehabilitation success.

The occupational therapist educated Daniel and his family on the various prosthetic options available, and the advantages and disadvantages of each prosthetic system. Preprosthetic training was initiated while Daniel was still in the perioperative phase and sutures were intact. His residual limb was tested for possible myosites to use to control a myoelectric prosthesis. The occupational therapist, along with the prosthetist, was able to identify strong myosites for the flexors and extensors in the forearm. Preprosthetic controls training began with the use of a myotester and simulator. Daniel was educated in strengthening the muscles in his residual limb and performing isolated contractions for increased control. Daniel had good muscle tone and strength in his residual limb but had difficulty isolating the muscle contractions that control the terminal device. With practice and repetitive training and cueing, Daniel was able to accurately control the signals for hand open/close and wrist rotation on the myosimulator.

Once the sutures were removed, Daniel was casted and fitted with his initial myoelectric prosthesis. Because Daniel's arm was amputated through the forearm (transradial), he was fitted with a two-site myoelectric control system with a wrist rotator, a wrist flexion unit, and an electric hand terminal device. Daniel used the pull sock method to don his prosthesis to ensure a tight prosthetic fit and good skin contact with the surface electrodes. The names and operations of all of the component parts of the prosthesis were reviewed. Daniel's mechanical history of working on cars helped him to quickly learn and understand the operations of the prosthesis.

The next phase of therapy for Daniel was controls training with the prosthesis. This included practice in open/close of the terminal device in various arm positions, wrist rotation in both supination and pronation, and pre-positioning of the terminal device in various degrees of wrist flexion and extension. Training in grasp and release of objects of various sizes, shapes, and densities was completed with good performance. Daniel had difficulty performing proportional control during training but was able to improve with continued practice.

Once Daniel had mastered the basics of controls training, ADL training was initiated. This included tasks such as cutting food, buttoning a shirt, using a computer, and manipulating a wallet and credit cards. Daniel was encouraged to use his prosthesis as a stabilizer and functional assist during bimanual tasks. IADL training specific to Daniel's vocational and recreational interests included weapon manipulation, working on cars, woodworking, and driving.

One of Daniel's goals for occupational therapy was to continue to participate in the various sports that he loved, such as mountain biking and motocross. To maximize his functional independence in adaptive sports, Daniel was prescribed an activity-specific prosthesis. The activity-specific prosthesis had a quick disconnect wrist unit to allow easy interchange of terminal devices. Daniel brought his mountain bike into the clinic during therapy, and the occupational therapist and prosthetist educated him on the various sport-specific terminal devices available for this activity. Daniel's understanding and use of the terminal device was assessed in the clinic to ensure his safety with this high-level activity.

Throughout his time in occupational therapy, Daniel was able to reach his goals of functional independence with ADL and IADL performance with a prosthesis. During his rehabilitation Daniel reevaluated his goals for his career. He reported that he would always identify as a solider, but realized that he had the opportunity to pursue other occupational roles and opportunities through participation in adaptive sports. Daniel was connected with a nonprofit organization during his rehabilitation that specialized in motocross sports for disabled veterans. Through this peer mentorship and participation in various adaptive sports activities during his rehabilitation, Daniel was able to pursue his dream and began competitively racing in motocross events around the country. He medically retired from the army, married his high school sweetheart, and moved back to California to begin life after the military.

Section 3 Lower Limb Amputations

Jennifer S. Glover, Chelsey L. Cook

Threaded Case Study

Lena, Part 1

Lena is a 72-year-old woman who lives by herself in a one-story house near downtown. She was widowed 5 years ago and has two adult children who also live in town. Lena has adult-onset diabetes and chronic obstructive pulmonary disease (COPD). She worked part-time as a clerk at a department store until her 50s, when she retired because she could no longer stand comfortably for long periods of time. After retirement Lena would drive for shopping and appointments and would walk the short distance to church. The circulation in Lena's legs got progressively worse over the years, and she began to spend increasing amounts of time at home. Lena's day usually involved watching television, bird watching through the window, and occasionally painting ceramic figurines.

At age 62 Lena stubbed the toe on her left foot, cutting the toe. The circulation in her foot was not sufficient for it to heal, and the toe was amputated. She had another toe amputated 2 years later, and 2 weeks ago she had a below-knee amputation (transtibial) of her left leg because of wounds that would not heal.

Lena has just been transferred to a skilled nursing facility in her hometown. The occupational therapist met with Lena for her initial evaluation today, after which the two set goals for Lena's course of treatment.

Critical Thinking Questions

1. What is an occupation that will make Lena feel like herself again?
2. What treatment activities can be used to best address challenges presented by Lena's amputation and help her return to participation in her chosen occupations?
3. How can the occupational therapist help Lena prepare not only to return home, but also to reduce her risk of rehospitalization?

Levels of Lower Limb Amputation

Lower limb (LL) amputations are typically discussed as above-knee or below-knee; however, variability exists even within these categories (Fig. 43.25). Generally, the more proximal an amputation, the greater the functional challenge the person faces. Proximal LL amputations include hemipelvectomy and hip disarticulation amputations, resulting in loss of the entire lower limb; such severe amputations are typically performed in cases of trauma or malignancy. Wound healing from such proximal amputations is often slow, and skin grafting may be required for full healing. In cases of hemipelvectomy, a muscle flap covers the internal organs.

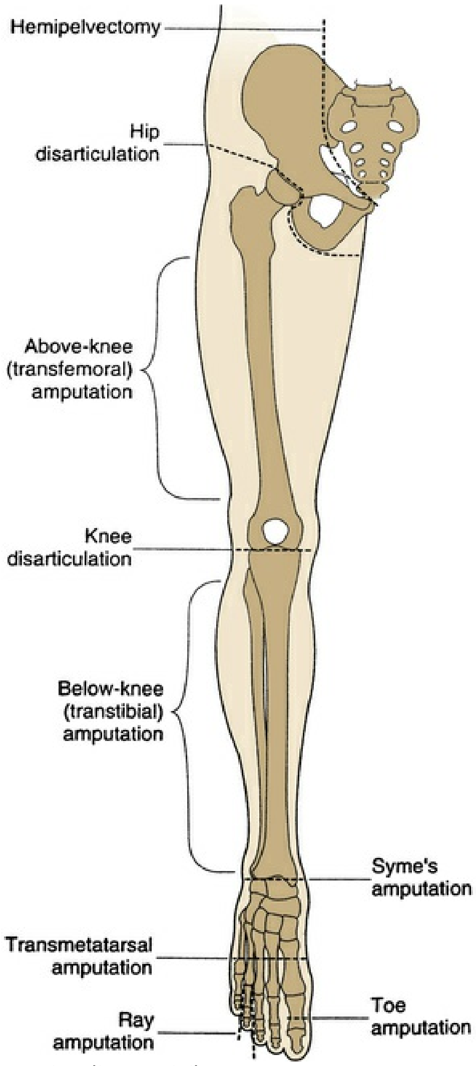

FIG 43.25 Levels of lower extremity amputation. (From Cameron MH, Monroe LG: *Physical rehabilitation: evidence-based examination, evaluation, and intervention,* St Louis, 2007, Saunders.)

A transfemoral amputation, or **above-knee amputation** (AKA), results in loss of the knee and everything distal to it. Residual limb length from an AKA typically varies from 10 to 12 inches (25.4 to 30.5 cm) from the greater trochanter[8]; transfemoral amputations can also be classified as upper, middle, or lower third, indicating the amputation distance from the ischium. A through-the-knee (disarticulation) amputation results in loss of knee joint function but allows a high level of prosthesis control and mobility.

A transtibial amputation, or **below-knee amputation** (BKA), preserves the knee and thus eliminates the necessity for a mechanical knee joint in the prosthesis. The residual limb from a BKA typically varies from 4 to 6 inches (10.1 to 15.2 cm) from the tibial plateau.[8] A **Syme's amputation**, or ankle disarticulation, results in loss of both ankle and foot function and is typically performed in cases of trauma or infection. A transmetatarsal amputation results in severing of the foot through the metatarsal bones, but the ankle remains intact. Clients may experience amputation of toes; although amputation of the first toe impairs ambulation by preventing toe-off (which is the end of the stance or support phase of gait), loss of the small toes does not usually result in impaired ambulation. In Lena's case, the amputation is considered a BKA because her left leg was amputated approximately 5 inches below the tibial plateau.

Causes of Lower Limb Amputation

In the United States 95% of LL amputations are performed as a result of complications of peripheral vascular disease (PVD)[50]; ultimately, 25% to 50% of these cases are caused by diabetes mellitus.[83] Trauma is the second most common cause of amputation in the United States, but it is the leading cause in developing countries because of land mines and other environmental hazards.[83] Amputation may also be performed in cases of malignancy in an effort to prevent it from spreading to other sites or systems in the body.

In Lena's case, diabetes mellitus and PVD resulted in poor circulation in her lower limbs. Because of this complication, blood flow to her left foot and leg was not adequate for her limb to heal, even from what initially appeared to be a small wound. Therefore, she was obliged to undergo progressive amputations of her left lower limb, eventually leading to the recent BKA.

Postsurgical Residual Limb Care

Skin care and positioning are extremely important throughout the course of rehabilitation, especially immediately after surgery. Once the surgical wound has begun to heal, some form of specialized postsurgical dressing will be used to help prevent swelling and to shape the residual limb for ease of future prosthesis use. Wrapping with an elastic bandage (e.g., Ace wrap) is a common method to control edema after surgery. However, smooth wrapping does require a skilled and consistent technique, which is necessary to prevent poor shaping of the residual limb. A series of gradually smaller residual limb shrinkers can be worn as an alternative to elastic bandage wrapping to encourage constant, even shrinkage of the residual limb to facilitate fitting with a final prosthesis. Both elastic bandages and shrinkers can be used early after surgery, even if the client's surgical wound still has a dressing on it. In such a case a nylon stocking would first be applied to prevent the bandage or shrinker from dislodging the dressing. Once the final prosthesis has been made and adjusted, the client frequently will continue to wear a shrinker during the day when he or she is not wearing the prosthesis and also at night. This shrinking and shaping process can take up to 3 months or longer in some cases, depending on the client's condition.

If the client (or his or her caregiver) is unable to demonstrate proper technique with wrapping or shrinker use, a Jobst compression pump may be used. The pump is an air-filled sleeve that surrounds the residual limb, placing constant, equal pressure on all sides, quickly shrinking and shaping the residual limb. A rigid dressing or cast is frequently used for active clients after surgery. The end of the cast is made to work with a simple training prosthesis, so the client can begin training for standing and walking immediately. Scar massage may be necessary later in the healing process to prevent adhesions and enhance comfort around the surgical site; this massage technique can be taught to the client.

The Ace wrap bandaging of Lena's residual limb was performed by nurses in the hospital. After Lena's arrival at the skilled nursing facility, the nursing staff consulted the occupational therapist to determine whether Lena had the cognitive and visual function and the necessary motor skills to learn how to apply her own wrap or shrinker and to perform her own scar massage.

Lower Limb Equipment and Prostheses

Movement and time out of bed are typically reduced immediately after LL amputation. The surgery itself can make movement uncomfortable, and many persons who have undergone amputation surgery have preexisting conditions that may further reduce mobility. For these reasons clients may require the use of bed rails or a metal trapeze bar hanging over the bed to help reposition themselves in bed and to transition between supine and sitting. Wheelchairs also present a challenge because the client is no longer able to support the affected limb by resting the now absent foot on the floor or on the footrest of the wheelchair. A **residual limb support** is basically a padded board that is placed on the seat of the wheelchair; it has an extended component on the side of the affected limb that projects forward from the seat of the chair (Fig. 43.26). This extension provides a surface for the residual limb to rest upon, thus placing the limb in a nondependent position and reducing stresses on the hip joint. A person with a BKA is often at risk for developing a flexion contracture of the knee joint, and residual limb support can facilitate extension of the knee in sitting, thus helping to prevent both edema in the residual limb and contracture of the knee joint.[116] A residual limb support is sometimes still referred to, in less acceptable terminology, as a stump support. For a person with bilateral LL amputations, the large wheels on the wheelchair must be placed farther back to accommodate the change in body weight distribution. Antitippers, which are commercially available wheelchair accessories, can also be used on the back of the chair to reduce the likelihood of tipping backward during weight shifting.

FIG 43.26 Wheelchair with support for residual limb. (Courtesy Comfort Company, Bozeman, MT.)

Most clients will use a walker during at least the initial phases of their rehabilitation. Some clients with LL amputations will go on to use a walker at all times for ambulation. Both four-footed (standard) and two-wheeled (rolling) walkers may be used, depending on the client's individual characteristics and needs. It has been suggested that using a two-wheeled walker may allow those with prosthetic limbs to ambulate more quickly and with less interruption,[106] but walker choice should always be made on the basis of a total assessment of the client's abilities and needs.

Many types of prostheses are available for the lower limbs, and technology is improving daily. For all prostheses, comfort, ease of application, appearance, and functioning of the prosthesis, including the client's ability to perform ADLs and IADLs with use of the affected limb, correlate significantly with the client's walking distance and with his or her perceived quality of life after an LL amputation.[64] It is very important for the rehabilitation team to keep this in mind during a client's fitting for and training with a prosthesis.

The main components of an LL prosthesis are the socket, a sock or gel liner, a suspension system, a pylon, and a terminal device. For some prostheses an articulating joint is also necessary. The socket is the direct connection between the residual limb and the prosthesis. A person's residual limb may change in volume during the day and over the course of time, presenting challenges for maintaining an adequate fit within the socket. This challenge is frequently addressed by adding socks to, or removing them from, the residual limb to adapt to its volume changes. Smart variable geometry socket (SVGS) technology was developed to help reduce this challenge.[37] An SVGS adds and removes liquid from the intrasocket environment on the basis of intrasocket pressure during wear, continuously accommodating residual limb volume changes and thus maintaining the fit of the socket without having to remove the prosthesis. Static elastomeric liners are also used for the prosthesis socket; the choice of liner is based on variables such as fit, comfort, friction tolerance, and price.[88] Various suspension mechanisms are used to attach the socket to the residual limb, including belts, straps, wedges, or suction; sometimes mechanisms are combined to ensure the appropriate fit.

The **pylon** is the structure that attaches the socket to the TD (Fig. 43.27). Vertical shock pylons function as shock absorbers for LL prostheses. Many clients who have had an LL amputation express a preference for walking with these devices.[35] Such shock absorption is especially beneficial during high-impact activities, such as running, and for other activities that are part of daily life for many clients, such as descending curbs and stairs. A pylon can be a basic, static device that provides minimal cosmetic benefits; it can also be a dynamic device, such as that outlined in the preceding paragraph, and can be modified to provide a close cosmetic match with the client's unaffected limb.

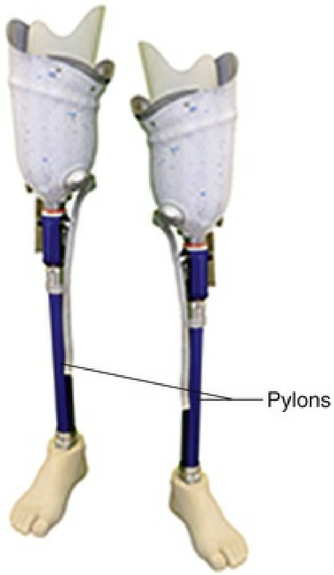

FIG 43.27 Typical pylon, the internal frame or skeleton of the prosthetic limb. (From GettyImages.com.)

The TD is the prosthetic foot, which provides a stable, weight-bearing surface and can itself function as a shock absorber. The many types of available TDs provide varying degrees of mechanical ankle movement and dynamic response, according to the needs and abilities of the client. Specialized TDs (indeed, entire LL prostheses) are designed to accommodate the challenges presented by various sports and activities (Fig. 43.28). To help select the best prosthesis, Lena's prosthetist consulted with her occupational therapist to explore the activities and lifestyle to which Lena wished to return.

FIG 43.28 Athlete with a specialized running prosthesis competing in a marathon. (From GettyImages.com.)

Participation in Occupations

OT Practice Note

A thorough occupational profile obtained during the initial evaluation, along with evaluation and analysis of occupational performance, will help the occupational therapist identify areas of strength and of challenge for the client who has undergone a limb amputation.

For some clients, particularly those who have undergone a traumatic amputation, the activities to which they wish to return are ones they engaged in right up to the point of injury or illness. However, given the nature of PVD and diabetes, many clients with LL amputations experience a progressive decline in function over the course of several years. For these clients, amputation and subsequent rehabilitation, although difficult, may allow a return to fulfilling occupations that had been absent from the clients' repertoire for quite some time.

Participation in most ADLs will be affected by LL amputation. Although a client with an LL amputation will be learning new mobility techniques in physical therapy, he or she must also participate in occupational therapy to learn new functional mobility techniques with which to accomplish familiar tasks. Bathing, dressing, personal hygiene, grooming, and toilet hygiene will likely need to be addressed as part of an occupational therapy intervention program. Personal device care must be addressed if the client is using an LL prosthesis. Participation in IADLs will also be affected. Particular attention should be paid to care of others, care of pets, childrearing, community mobility, health management and maintenance, home establishment and management, meal preparation and cleanup, safety and emergency maintenance, and shopping. The areas of rest and sleep may also present challenges to a person with a new LL amputation. For example, a client's evening routine may be disrupted by having to perform it from a wheelchair instead of at an ambulatory level (sleep preparation). A client may experience difficulties interacting with his or her spouse in the sleeping space as they both adjust to a new amputation (sleep participation). The occupational therapist should assess how these occupations may be affected by the amputation and should help the client develop adaptations that facilitate improved rest and sleep. Treatments addressing phantom sensations may also benefit the client's rest and sleep (see Chapter 13 for further information).

Participation in educational, work, play, and leisure activities is usually affected by LL amputation and should be addressed during occupational therapy, as should social participation. Although intervention often assumes a greater role with these occupations later in the rehabilitation process, they still can be addressed even during the acute rehabilitation phase, thus reinforcing to the client that these are occupations in which a return to active participation is indeed possible. It is essential that the occupational therapist help clients to explore all avenues of an occupation in which they may wish to participate, ensuring that even activities that had been abandoned in the past are possible again.[58] As a result of changes in function after amputation, clients may not be able to return to participation in prior work or leisure activities or to participation at the level to which they were accustomed. In such cases the occupational therapist should help clients explore other opportunities that they might find fulfilling through identification of interests, skills, and opportunities.

Early in her course of occupational therapy at the skilled nursing facility, Lena spoke with her therapist about how much she missed walking to her church and helping to bake pies for its annual autumn festival. Lena said that she stopped doing this about 10 years ago because it became so difficult; she then discussed feelings of isolation and uselessness. Lena said that she had been known throughout her town for her pies, and she proudly recounted how each year people would tell her that she should open her own restaurant. Although Lena and her occupational therapist had initially set her long-term goals for independence with self-care and basic home management, they decided to add a goal for community reentry that focused on being able to reengage in this occupation.

Client Factors

Structures affecting movement, in addition to skin and related structures, are always altered by an LL amputation. However, the status of other body structures must also be assessed to determine the level of support or challenge these structures might present during the rehabilitation process.

Neuromuscular and movement-related functions will be altered by LL amputation, and this will affect occupational performance after surgery. This alteration of function may occur not only in the affected limb, but also in other parts of the body. Because of changes in the affected limb, greater stresses will be placed on the rest of the body; a person's unaffected leg and his or her arms will experience increased weight bearing during many functional activities, and both surgical wound healing and increased time in bed will place greater demands on skin functions.

Of particular importance is attention to sensations of pain. Up to 84% of persons who have had an LL amputation have experienced phantom limb pain.[20] In such an instance the client may experience sensations in the part of the limb that has been removed, such as feelings of cramping, squeezing, shooting, or burning pain. In these cases the therapist can use desensitization techniques (e.g., massage of the residual limb), exercise, hot and cold therapy, or electrical stimulation[83] to help decrease these sensations and allow the client to more easily and comfortably participate in chosen occupations.

Clients with PVD already have compromised cardiovascular function, and care must be taken to determine how much activity can safely be tolerated during therapy. A client's mental and sensory functions will affect the way therapy, including education, is delivered; they will also affect the types of prosthesis and equipment used.[57] Some clients may be able to incorporate new techniques quickly, recalling information from one session or even from reading material, and may be able to independently apply this learning to new situations. However, other clients will require adaptation of training and may require prolonged treatment to turn the new techniques they have learned into habits. Understanding a client's values, beliefs, and spirituality will further help the therapist to develop a treatment program and to choose interventions that are tailored to that client and best meet his or her needs.

The occupational therapist found that Lena would need to increase her upper body strength to help support herself during transfers and ambulation with the walker. She also needed to improve her postsurgical postural alignment and gait patterns to participate in her chosen occupations. Lena was experiencing pain and sensitivity in her residual limb. However, Lena's mental functions were found to be strengths, and her vision and the sensation in her hands, although slightly diminished, were functioning at a level sufficient to support her desired functional activities. Additionally, Lena's belief that good efforts yield results, in addition to her commitment to her spiritual and social communities, would facilitate her engagement in her occupational therapy program.

Performance Skills

The most overt effects of LL amputation will be evident in the area of motor skills. Adjusting posture, coordinating movements, maintaining balance, and bending are altered after surgery, and the client must address each of these skills in therapy to return to a full repertoire of occupations. Sensory and perceptual skills may also be affected by the amputation, and a client may have had prior difficulty with these skills caused by impaired sensory function. The client's processing skills (e.g., judging, sequencing, and multitasking) and communication and social interaction skills will affect his or her participation in treatment and the therapist's choice of treatment methods.

Lena's occupational therapist found that, as she had expected, Lena exhibited impairment in stabilizing, aligning, positioning, walking, reaching, bending, moving, transporting, lifting while standing, and pacing. The therapist also found that processing skills were at functional levels for Lena. However, Lena did exhibit difficulty with adaptation as she began attempting to perform activities with a changed body structure and in different positions. The therapist also noticed that Lena was having difficulty with social interaction skills, exhibiting trouble focusing and collaborating during many occupations. The therapist would need to address these areas in therapy to help Lena return to her optimal level of participation in occupations.

Performance Patterns

Whatever a client's performance patterns were before the amputation, they are likely to be altered after amputation. The client may already have useful habits, routines, rituals, and roles that can be drawn upon in therapy to facilitate his or her return to prior levels of occupational performance. However, for many clients, the occupational history will reveal prior impoverished habits and lack of or maladaptive routines that may present challenges to the rehabilitative process. Although Lena's diabetes and PVD placed her at increased risk for poor wound healing, she had never developed the habit of routinely checking her feet and legs for cuts or infections. This impoverished habit led to three amputations on her left leg. Lena's morning routine in her kitchen involved crossing the room many times and carrying multiple items in her hands at once. In conversations with her occupational therapist, Lena did indicate that she had already begun to drop things during this routine, that she had nearly fallen a few times, and that she worried about being able to safely make her own breakfast at home.

Psychosocial Repercussions

Amputation of a limb represents a loss and therefore involves a grief process. This process involves dealing with one's feelings regarding change in body structure, functional abilities, and participation in occupations. It can also involve anger, acknowledgment of unpleasant realities regarding one's health status, and fears about one's functional and financial future. Social acceptance and community function are also significant concerns for a person who has undergone an amputation. These are all areas that can be addressed by an interdisciplinary rehabilitation team in an effort to help the client adapt and should inform all aspects of occupational therapy intervention.

The occupational therapist may use several techniques to help a person adapt to his or her amputation and create a new sense of self. The therapeutic relationship and the therapeutic use of self can provide a safe environment and catalyst for the client to discuss feelings of loss, thoughts regarding body changes, and fears for the future. The therapist can teach the client coping skills for dealing with anxiety and depression, in addition to techniques for improving his or her postsurgical body image.[78] The consultation process can include recommendations for workplace adaptations and suggestions for how to make the home more accessible to a client with a new amputation. The therapeutic use of occupations that have been graded to the client's current abilities provides opportunities to master skills and experience success. The therapist's encouragement during such sessions not only fosters development and provides support, but also provides evidence to the client that recovery of function and return to participation in chosen occupations are indeed possible[78]; this knowledge fosters hope and a vision of the future.

It is important to recognize that an outside observer's rating of a person's adaptation to an LL amputation may not be the same as that person's self-rating. A surgeon may rate success on the basis of healing of the surgical wound, a prosthetist on the fit between residual limb and prosthesis, a physical therapist on the client's ability to ambulate, and an occupational therapist on the client's ability to participate in occupations. However, clients may place greater emphasis on other criteria in their determination of successful adaptation to an LL amputation. Some related variables that appear to be of primary concern to clients include feeling comfortable while being active in the presence of strangers, not feeling like a burden to one's family, being able to care for others, and being able to exercise recreationally.[64]

Context, Environment, and Activity Demands

An understanding of the client's contexts, environments, and demands of daily activities will help the therapist design a treatment program that will best help the client reengage in chosen occupations within his or her everyday environment. It will also help the therapist adapt the activity demands of the client's chosen occupations to facilitate greater independence and development of proficiency. Lena's occupational therapist took a detailed floor plan of Lena's bedroom and was able to move the furniture in her room into the skilled nursing facility, so it closely approximated her bedroom setup at home. When Lena performed her morning and evening ADLs in the room, she was then doing so in a more natural environment. Lena's therapist initially made significant adaptations to Lena's morning routine demands, wheeling Lena up to the sink in the bathroom for sponge bathing and bringing her clothes to her in the bathroom, where she would stand with the help of a grab bar, so the therapist could pull Lena's pants up. Over the course of time, as Lena improved her performance skills and her performance patterns and incorporated into her routine new ADL techniques taught during therapy, her occupational therapist was able to decrease the adaptation of activity demands, and Lena progressed to independence with routines that she would be able to sustain at home.

Additional Considerations With Elderly Clients

Although LL amputation may be performed to preserve function or to save the client's life, it does carry an increased mortality risk as the age of the client increases. One study of older persons who underwent a BKA found the survival probability after BKA to be 77% at 1 year, 57% at 3 years, and

28% at $7\frac{1}{2}$ years.[60] Because this increased mortality risk is related not only to the amputation surgery but also to preexisting health and environmental factors, attention to the overall health status of the client is of utmost importance.

Many body structures and functions are already compromised in elderly clients, making the rehabilitation process longer and more delicate. An elderly person may take more time to recover from the effects of anesthesia after surgery, including effects on cognition and the respiratory system. For unilateral amputees, leg balance on the unaffected limb is a significant predictor for prosthetic use.[91] Because balance may already be decreased and cognitive skills may have declined, elderly clients learning to use a prosthetic limb may experience greater challenges. Elderly clients have already experienced many losses, which may include family and friends, home, health, and function; the psychological sequelae of amputation can be all the more traumatic when layered over these previous losses.

Threaded Case Study

Lena, Part 2

Amputation of a lower limb has a significant functional impact on a person, but return to an active and fulfilling life is still possible. Lena required extensive assistance to take care of herself when she entered the skilled nursing facility, but her goal was to return home independently able to take care of herself and her home. During the course of occupational therapy, Lena realized that she had been slowly decreasing her participation in the very activities that helped her feel active and vital and helped her define who she was. She then decided to work with her therapist toward being able to reclaim these activities, particularly going back to her church and helping to bake pies for its upcoming autumn festival.

During the course of her occupational therapy, Lena's therapist presented her with activities that addressed the areas that Lena needed to improve to reach her goals. These goals, which Lena had identified as of interest to her, were adapted to provide an appropriate level of challenge. Because Lena liked to watch birds and had enjoyed decorative painting in the past, her occupational therapy sessions included building and painting birdhouses. This increased Lena's upper body strength and provided progressive challenges to her sitting and eventually standing balance, facilitating her return to independence with ambulatory tasks and providing an activity that Lena could perform at home and a product that she could donate to her church's fall festival.

As Lena's stay at the skilled nursing facility neared its end, she participated in community reentry sessions with her occupational therapist. Because Lena had mentioned her desire to help bake pies with the congregation for the fall festival, she and her occupational therapist visited the church together during a community reentry session; this gave Lena a chance to interact with some of the members of the baking committee so that they could see Lena's capable self, allaying their fears about interacting with a person with a disability and setting the expectation that Lena would be involved. Through supported engagement in this social community occupation, Lena gained confidence that she was still an accepted and desired member of her community. Together, Lena and her occupational therapist identified potential challenges presented by the layout of the kitchen. Lena engaged in trials and problem-solving strategies with her therapist to determine methods to allow safe participation in baking. In preparation for her return to the church as a member of the baking team, Lena then perfected these techniques in the occupational therapy kitchen back at the facility.

Lena's occupational therapist also worked with Lena to discuss the ways in which some of her prehospitalization habits and routines had contributed to high-risk situations and to identify strategies to help reduce her risks of rehospitalization. Lena learned how to perform her own lower body skin checks, and she was performing them regularly by the end of her stay. She went home with a daily routine that would help her stay active throughout the day, but also incorporated techniques that minimized periods of prolonged standing and reduced the amount of energy required to accomplish tasks. Lena's family then reorganized items in her kitchen, according to recommendations determined by Lena in collaboration with her occupational therapist, so that her environment placed less strain on her during daily activities. Lena went home independent in her daily activities, able to engage in individual and social occupations that made her feel happy and vital, and reclaimed a role that had long been abandoned.

Review Questions

1. List the common causes of acquired amputation.
2. Describe the role of the occupational therapist, as a team member, in the rehabilitation of an individual with an upper limb amputation.
3. What are the goals of amputation surgery?
4. Name three types of surgical techniques performed for amputations.
5. Name three ADLs that should be addressed immediately after amputation.
6. What is the purpose of a shrinker?
7. Name at least four postsurgical factors that can interfere with prosthetic training and rehabilitation. How is each factor managed?
8. What is the difference between phantom limb pain and phantom limb sensation?
9. Discuss the impact of the residual limb status on successful fitting and operation of an upper limb prosthesis.
10. Describe the goal of myosite testing for an electrically powered prosthesis.
11. Describe the typical psychological consequences of amputation surgery, and discuss how the occupational therapist facilitates adjustment to limb loss.
12. Define the “golden window” and identify its importance in upper extremity amputation rehabilitation.
13. What are the five most common types of upper limb prostheses?
14. List the motions used to operate the body-powered prosthesis.
15. Name at least two techniques for donning the body-powered prosthesis and describe them.
16. What is the importance of pre-positioning the terminal device?
17. Name three types of electric terminal devices. What are the advantages of each?
18. What components are specific to body-powered prostheses? To electrically powered prostheses?
19. List the five characteristics of advanced prosthetic training in the use of upper limb prostheses.
20. Discuss the primary function of a prosthesis in the functional performance of various ADL and IADL tasks.
21. What are the special considerations discussed in this chapter for treating persons with bilateral upper extremity amputations?
22. Identify and describe three outcome measures used with upper limb amputations.
23. How will advances in prosthetic technology and surgical techniques affect the outcomes for persons with upper limb loss?
24. Name two significant concerns for the residual limb immediately after surgery.
25. What is the purpose of a shrinker?
26. What should be done with the wheelchair to accommodate the residual limb? To accommodate a person with bilateral AKA?
27. Name the main components of an LL prosthesis.
28. What is the purpose of using a sock on the residual limb?
29. How will LL amputation affect other parts of the body?
30. How might LL amputation affect an individual's participation in occupations?
31. Which performance skills are most likely to be affected after LL amputation?
32. How can preexisting performance patterns affect a client's participation in occupations after an

amputation?

33. What are the potential psychosocial repercussions of LL amputation?
34. How can the demands of ADLs be adapted to foster greater independence after LL amputation?
35. What additional considerations does LL amputation present for elderly clients?

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Resources

Amputee Coalition

9303 Center Street, Suite 100

Manassas, VA 20110

Telephone: 888-267-5669

Website: http://www.amputee-coalition.org

Challenged Athletes Foundation

9591 Walpass Street

San Diego, CA 92121

Telephone: 858-866-0959

Website: http://www.challengedathletes.org

Disabled Sports USA

451 Hungerford Drive, Suite 100

Rockville, MD 20850

Telephone: 301-217-0960

Website: http://www.disabledsportsusa.org

National Amputation Foundation

40 Church Street

Malverne, NY 11565

Telephone: 516-887-3600

Website: http://www.nationalamputation.org

Sports and Recreation Technologies, LLC (formerly Therapeutic Recreation Systems, Inc.)

Sterling Circle, Studio A

Boulder, CO 80301-2338

Telephone: 800-279-1865 or 303-444-4720

Fax: 303-444-5372

Website: http://www.sportsandrectec.com

Email: bob.sportsnrectec@att.net

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[a]The author wishes to acknowledge the outstanding work of Denise D. Keenan in previous editions of this text. The present chapter sections are built on her foundational work.

Cardiac and Pulmonary Disease

Maureen Michele Matthews

CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Demonstrate a beginning understanding of the cardiovascular function and how heart rate and rhythm and blood pressure impact engagement in occupation.
2. Identify the significance of ischemic heart disease and valvular diseases of the heart and the potential impact on these conditions on occupational performance.
3. Differentiate between modifiable and nonmodifiable risk factors, and discuss how these risk factors might be impacted by context and environment.
4. Identify signs and symptoms of cardiac distress.
5. Describe the course of action that should be taken if signs and symptoms of cardiac distress are present.
6. Define sternal precautions, and identify three modifications of activities of daily living for these precautions.
7. Identify how performance patterns are impacted for persons with cardiovascular or pulmonary disease.
8. Describe methods for determining the heart rate and blood pressure, and calculate the rate-pressure product given the heart rate and blood pressure.
9. Give a brief overview of the respiratory system, and identify its primary function.
10. Define chronic obstructive pulmonary disease, and identify how occupational performance might be impacted by chronic obstructive pulmonary disease.
11. Identify pulmonary risk factors and psychosocial considerations within the context of social justice.
12. Describe dyspnea control postures, pursed-lip breathing, and diaphragmatic breathing.
13. Describe a relaxation technique, and explain the benefits of relaxation from an occupational perspective.
14. List interview questions that will help the clinician know what the patient understands about intervention.
15. List the principles of energy conservation, and identify how you might focus patient education based on the environment of a client in an assisted living facility.
16. Explain the significance of a metabolic equivalent chart in the progression of activities of daily living and instrumental activities of daily living, and describe how to use it.

KEY TERMS

Atrial fibrillation
Blood pressure
Cardiac ablation
Chronic obstructive pulmonary disease
Diaphragmatic breathing
Energy conservation

Heart rate

Ischemic heart disease

Metabolic equivalent

Myocardial infarction

Pack-year history

Pulmonary rehabilitation

Pursed-lip breathing

Rate-pressure product

Sternal precautions

In this chapter the term *patient* is used instead of *client* to reflect the practice setting and the acute nature of the diagnoses in the individuals described in the case studies.

Threaded Case Study

Rudy, Part 1

Rudy, a 64-year-old, married man with diabetes, was enjoying his daily exercise of running 3 miles when he suddenly noticed fatigue and difficulty breathing. In the emergency room his heart rate was 140, his blood pressure was 128/70, and his respiratory rate was 20 with oxygen saturation at 93%. He was diagnosed with atrial fibrillation, and his previously diagnosed defective heart valve was failing. He underwent an aortic valve replacement and cardiac ablation.

Rudy had a large sternal incision. His sternum was stabilized with wire, and his physician identified sternal precautions to maintain the integrity of the healing bone. During the evaluation, Rudy got out of bed, walked to the bathroom, and got up and down from the toilet. He then returned to bed. His pain was minimal with medication, but he moved impulsively, frequently violating his precautions. Because his wife worked outside the home, he was home alone part of the day.

Rudy has an executive desk job and plans to return to work in 3 weeks. He added that he wants to be able to do everything he did prior to his recent decline. Rudy and his wife were anxious and asked lots of questions. Rudy stated, "I need to go to the bathroom and dress by myself." Rudy's wife said she was afraid of potentially harming Rudy by expecting too much of him and was also afraid that he would potentially harm himself by not limiting his activity level. Rudy expressed concern that his wife was avoiding intimacy based on her fears of hurting him. A barrier to recovery that Rudy revealed was his regular alcohol consumption. This was not in evidence as a problem in the medical record.

Critical Thinking Questions

1. What probative questions might the occupational therapist ask to clarify what Rudy means by "everything he used to do"?

2. What skills must Rudy acquire in order to protect his healing sternum?

3. What areas of occupation might the therapist choose for the next intervention session, and based on Rudy's occupational profile, what goals might be included in his occupational therapy intervention plan?

Individuals with disorders of the cardiovascular or pulmonary system may be severely limited in endurance and performance in areas of occupation, including activities of daily living (ADLs) and instrumental activities of daily living (IADLs). Occupational therapy (OT) services may benefit these individuals and are available throughout the continuum of healthcare. An understanding of the normal function of the cardiopulmonary system, the pathology of cardiopulmonary disease, common risk factors, clinical terminology, medical interventions, precautions, and standard treatment techniques will guide the occupational therapist in providing effective care and promoting recovery of function in clients with compromised cardiovascular or pulmonary systems.

Anatomy and Circulation

The heart and blood vessels work together to maintain a constant flow of blood throughout the body. The heart, located between the lungs, is pear shaped and about the size of a fist. It functions as a two-sided pump. The right side pumps blood from the body to the lungs; the left side simultaneously pumps blood from the lungs to the body. Each side of the heart has two chambers: an upper atrium and a lower ventricle.

Blood flows to the heart from the venous system. Blood enters the right atrium, which contracts and squeezes the blood into the right ventricle. Next, the right ventricle contracts and ejects the blood into the lungs, where carbon dioxide is exchanged for oxygen. Oxygen-rich blood flows from the lungs to the left atrium. As the left atrium contracts, it forces blood into the left ventricle, which then contracts and ejects its contents into the aorta for systemic circulation (Fig. 44.1). Blood travels from the aorta to the arteries and through progressively smaller blood vessels to networks of tiny capillaries. In the capillaries, blood cells exchange their oxygen for carbon dioxide.

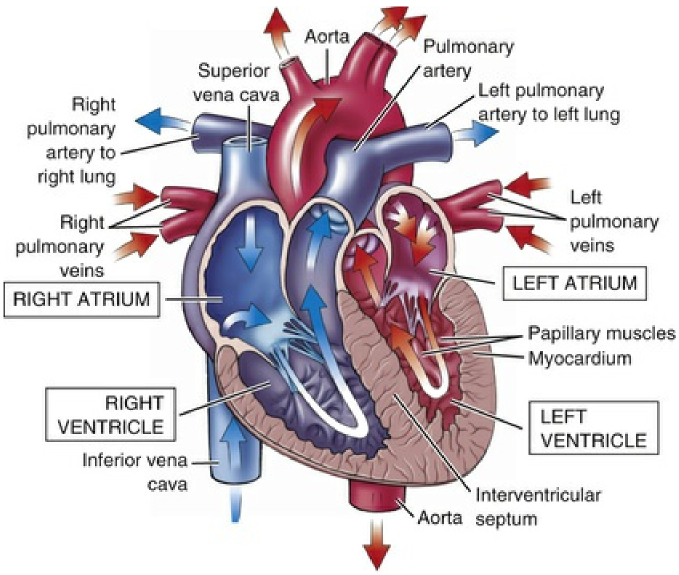

FIG 44.1 Coronary circulation. (From Herlihy B: *The human body in health and illness*, ed 5, St. Louis, 2014, Saunders.)

Each of the ventricles has two valves: an input valve and an output valve. The valves open and close as the heart muscle (myocardium) contracts and relaxes. These valves control the direction and flow of blood. The input valves are the mitral, or bicuspid, valve (between the left atrium and ventricle) and the tricuspid valve (between the right atrium and ventricle). The output valves make up the aortic and pulmonary valves.

The heart is living tissue and requires a blood supply (through an arterial and venous system of its own), or it will die. Coronary arteries cross over the myocardium to supply it with oxygen-rich blood. The coronary arteries are named for their location on the myocardium (Fig. 44.2). Cardiologists generally refer to these arteries by abbreviations, such as “LAD” for “left anterior descending” and “RCA” for “right coronary artery.” The LAD artery is on the left, anterior portion of the heart and runs in a downward direction; it supplies part of the left ventricle. Blockage of this coronary artery will interrupt the blood supply to the left ventricle. Because the left ventricle supplies the body and brain with blood, a heart attack caused by blockage of the LAD artery can have serious consequences.

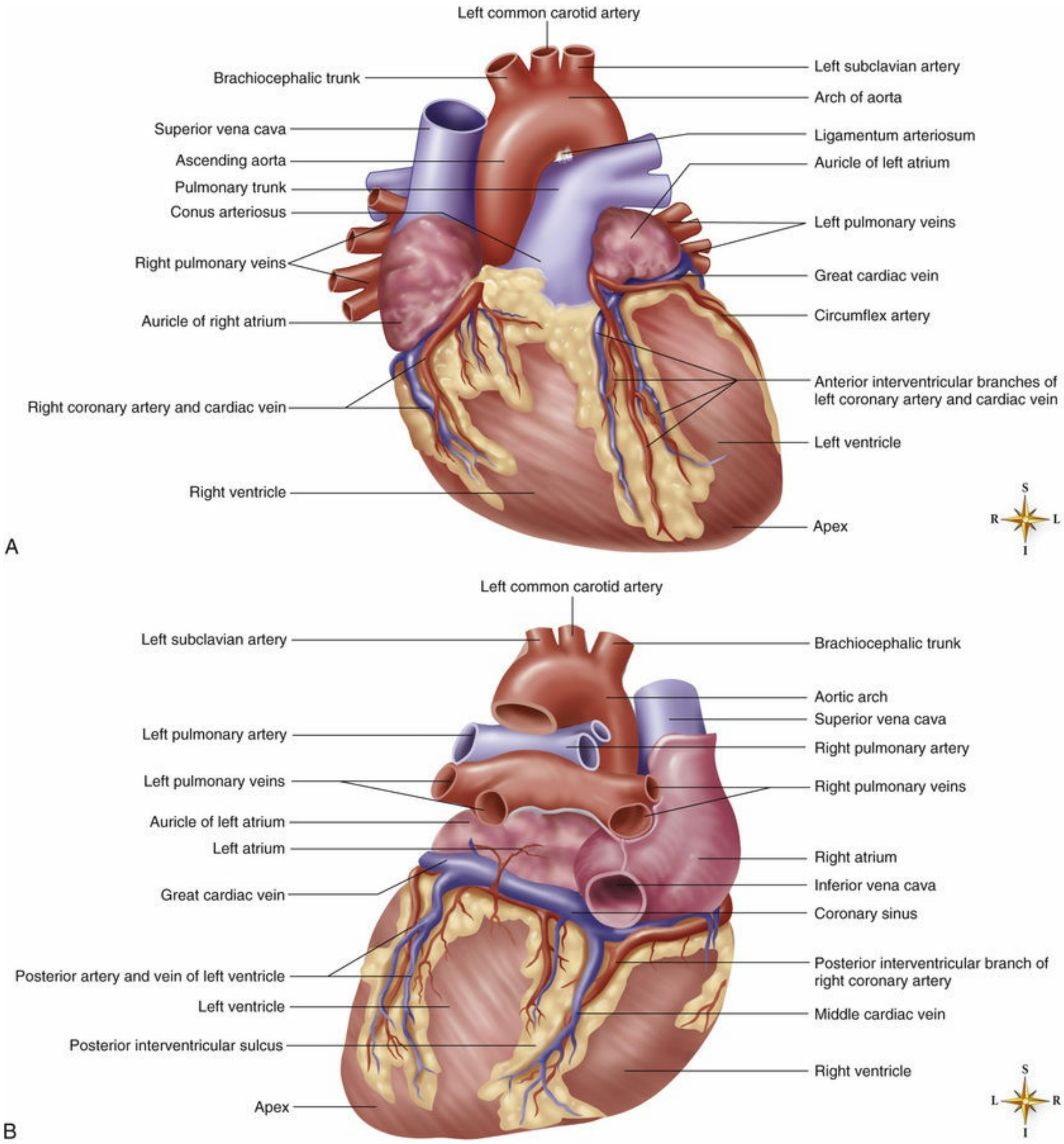

FIG 44.2 Anatomy of the heart. (From Patton K, Thibodeau G: *Anatomy & physiology,* ed 9, St. Louis, 2016, Elsevier.)

What Causes the Heart to Contract?

In addition to the ordinary muscle tissue of the heart, the myocardium is composed of two other types of tissue: nodal and Purkinje. These tissues are part of a specialized electrical conduction system that causes the heart to contract and relax (Fig. 44.3). An electrical impulse usually originates in the right atrium at a site called the sinoatrial node. The impulse travels along internodal pathways to the atrioventricular node, through the bundle of His, to the left and right bundle branches, and then to the Purkinje fibers. Nerve impulses normally travel this pathway 60 to 100 times every minute, first causing both atria to contract, pushing blood into the ventricles, and then provoking the ventricles to contract. The electrical impulse created by the heart's conduction system can easily be studied. Electrodes placed on a person's limbs and chest can pick up the heart's electrical impulse, which can be translated to paper as an electrocardiogram (ECG). The resulting ECG tracing is frequently used to help diagnose cardiac disease.

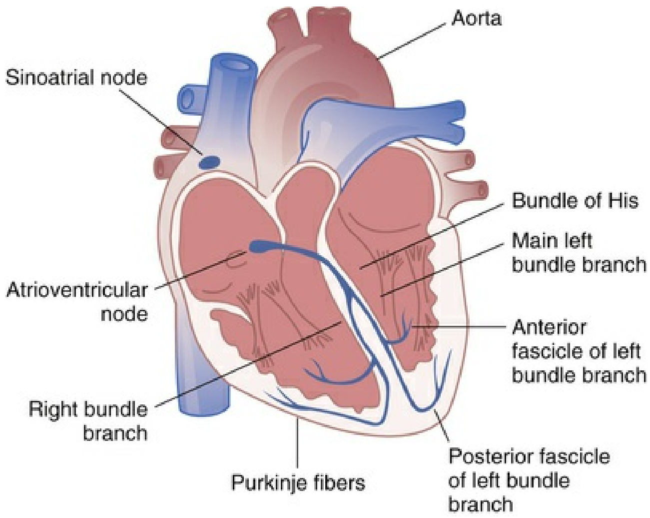

FIG 44.3 Cardiac conduction. (From Benjamin I, et al: *Andreoli and Carpenter's Cecil essentials for medicine,* ed 9, Philadelphia, 2016, Saunders.)

The sinoatrial node responds to vagal and sympathetic nervous system input.[20] This is why the **heart rate** (HR) increases in response to exercise and anxiety and decreases in response to relaxation techniques, such as deep breathing and meditation. Each cell within the electrical conduction system of the heart can respond to, conduct, resist for a brief period, and generate an electrical impulse. Because of this capacity, electrical impulses causing the heart muscle to contract can be generated from anywhere along the electrical conduction system. This is desirable when part of the conduction system has been damaged and is unable do its job, but it is undesirable when life-threatening conduction irregularities develop.

Cardiac Cycle

The cardiac cycle refers to a complete heartbeat from the generation of the heartbeat to the beginning of the next beat, and so includes the diastole, the systole, and the intervening pause. The cardiac cycle occurs in two phases: input (diastole) and output (systole). The frequency of the cardiac cycle is described by the HR (heart rate), which is typically expressed as beats per minute.

During the input phase, blood flows through the atria and into the ventricles. The atria contract and push more blood into the ventricles. Once the pressure inside the ventricles is equal to the pressure in the atria, the input valves (tricuspid in the right ventricle and mitral [or bicuspid] in the left ventricle) close. The ventricles then contract, which results in rapidly increasing ventricular pressure. When the pressure inside the ventricles exceeds the pressure in the blood vessels beyond, the output valves (pulmonary in the right and aortic in the left) open, and diastolic **blood pressure** (BP) is attained.

The ventricles continue to contract and squeeze blood under greater and greater pressure into the pulmonary and body circulation. Systolic BP is attained when pressure in the emptying ventricles falls below pressure in the blood vessels beyond, which causes the output valves to close.

Ischemic Heart Disease

Ischemic heart disease (ischemia) occurs when a part of the heart is temporarily deprived of sufficient oxygen to meet its demand. The most common cause of cardiac ischemia is coronary artery disease (CAD). CAD is the most common form of heart disease in the United States.[33]

CAD usually develops over a period of many years without causing symptoms. The internal wall of an artery can become injured. Once the wall is damaged, it becomes irregular in shape and more prone to collect plaque (fatty deposits such as cholesterol). Platelets also gather along the arterial wall and clog the artery, thereby creating a lesion in the same manner in which rust can clog a pipe. The artery gradually narrows and thus allows a smaller volume of blood to pass through it. This disease process is called atherosclerosis.

If a coronary artery is partially or completely blocked, the part of the heart supplied by that artery may not receive sufficient oxygen to meet its needs. Persons with partial blockage of a coronary artery may be free of symptoms at rest but have angina, a type of chest pain, with eating, exercise, exertion, or exposure to cold. Angina varies from individual to individual and has been described as squeezing, tightness, fullness, pressure, or a sharp pain in the chest. The pain may also radiate to other parts of the body, usually the arm, back, neck, or jaw. Angina has also been confused with indigestion. Rest or medication (or both) will frequently relieve angina. Usually, no permanent heart damage results. Angina is a warning sign that should not be ignored.

Chest pain that is not relieved by rest or nitroglycerin likely indicates a **myocardial infarction** (MI), or heart attack. A patient who has this type of pain should seek emergency medical help immediately. Individuals who attribute their symptoms to anxiety and stress are more likely to delay emergency care.[41] Substernal chest pain can be a warning sign that one or more of one's coronary arteries are blocked. If the blood flow to the heart muscle is interrupted and starved of the necessary oxygen, the heart will begin to die. This is an MI. If a substantial section of the heart is damaged, it will stop pumping (cardiac arrest).

Restrictions in activity are prescribed for the first 6 weeks after a heart attack because newly damaged heart muscle, like any injured body tissue, is easily reinjured.[14] During a heart attack, metabolic waste products accumulate in the damaged myocardium and make it irritable and prone to electrical irregularities such as premature ventricular contractions. A delicate balance of rest and activity must be maintained to allow the damaged area of myocardium to heal while also sustaining the strength of the healthy part of the heart. OT is frequently recommended to guide the patient toward a safe level of activity, or participation in occupation, during this acute period of recovery. Therapists teach persons with cardiac compromise: the signs of fatigue, when rest breaks are needed, and how to perform activities safely.

At approximately 6 weeks after an MI, scar tissue forms and the risk of extending the MI decreases. The scarred part of the heart muscle is not elastic and does not contract with each heartbeat. Therefore the heart does not pump as well. A graded exercise program will help strengthen the healthy part of the myocardium and improve cardiac output.[18] Cardiac rehabilitation is generally prescribed for persons recovering from heart attacks and for those recovering from cardiac surgery.

CAD can also lead to congestive heart failure (CHF). Similarly, infections can lead to CHF. This disease process develops over time with the heart becoming progressively weaker. CHF occurs when the heart is unable to pump effectively enough to meet the demand and fluid backs up into the lungs or the body. The fluid buildup in the lungs causes shortness of breath. Fluid overload is serious because it puts a greater workload on the heart as the heart strains while attempting to clear the excess fluid, which may result in further congestion. Heart size is often enlarged in persons with CHF because the heart muscle thickens (hypertrophy) from working so hard. Diuretics can be prescribed for persons with CHF to promote fluid loss through the urinary system. Low-sodium diets and fluid restrictions reduce the overall amount of fluid in the body. CHF cannot be cured, but with diet, medications, and rest, people with this condition can live longer and participate more fully in life.

Once an acute exacerbation of CHF is controlled, gradual resumption of activity will promote improved function. If activity is resumed too quickly, another acute episode may follow. Patients who have difficulty resuming their former level of activity may self-limit their recovery. OT can guide clients with acute CHF toward an optimal level of function via graded self-care tasks. “About

5.1 million people in the United States have heart failure,"[15] and "about half of the people diagnosed with heart failure die within 5 years of the diagnosis."[15] Table 44.1 delineates the four functional classifications of heart disease. OT can be of great benefit to persons with stages III and IV heart disease and can provide preventive programs for persons with stages I and II.

TABLE 44.1

Comparison of Three Methods of Assessing Cardiovascular Disability

Class	New York Heart Association Functional Classification[49]	Canadian Cardiovascular Society Functional Classification Severity of Unstable Angina[29]	Specific Activity Scale[16]
I	This category includes patients with cardiac disease but without resulting limitations in physical activity. Ordinary physical activity does not cause undue fatigue, palpitations, dyspnea, or anginal pain.	Ordinary physical activity, such as walking and climbing stairs, does not cause angina. Angina occurs with strenuous, rapid, or prolonged exertion during work or recreation.	Patients can perform to completion any activity requiring ≤7 METs (e.g., can carry objects that weigh 80 lb, do outdoor work [shovel snow, spade soil], and do recreational activities [skiing, basketball, squash, handball, jog/walk 5 mph]).
II	This category includes patients with cardiac disease resulting in slight limitations in physical activity. They are comfortable at rest. Less than ordinary physical activity causes fatigue, palpitations, dyspnea, or anginal pain.	Ordinary activity is somewhat limited. This includes walking or climbing stairs rapidly; walking uphill; and walking or climbing stairs after meals, in cold, in wind, when under emotional stress, or only during the few hours after waking. This also includes walking more than two blocks on a level surface and climbing more than one flight of stairs at a normal pace and in normal conditions.	Patients can perform to completion any activity requiring ≤5 METs (e.g., have sexual intercourse without stopping, garden, rake, weed, roller skate, dance the fox-trot, walk at 4 mph on level ground) but cannot and do not perform to completion activities requiring ≥7 METs.
III	This category includes patients with cardiac disease resulting in marked limitation in physical activity. They are comfortable at rest. Less than ordinary physical activity causes fatigue, palpitations, dyspnea, or anginal pain.	Ordinary physical activity is significantly limited. This includes walking one to two blocks on a level surface and climbing more than one flight of stairs in normal conditions.	Patients can perform to completion any activity requiring ≤2 METs (e.g., shower without stopping, strip and make the bed, clean windows, walk 2.5 miles, bowl, play golf, dress without stopping) but cannot and do not perform to completion activities requiring ≥5 METs.
IV	This category includes patients with cardiac disease resulting in an inability to carry out any physical activity without discomfort. Symptoms of cardiac insufficiency or angina syndrome may be present even at rest. If any physical activity is undertaken, discomfort is increased.	Patients are unable to carry out any physical activity without discomfort; angina syndrome may be present at rest.	Patients cannot perform to completion any activity requiring ≥2 METs and cannot carry out activities listed above (Specific Activity Scale, class III).

METs, metabolic equivalents.

From Goldman L, et al: Comparative reproducibility and validity of systems for assessing cardiovascular functional class: advantages of a new specific activity scale, *Circulation* 64:1227, 1981.

Valvular Disease

The heart valves, which are responsible for controlling the direction and flow of blood through the heart, may become damaged by disease or infection. Two complications result from valvular disease: volume overload and pressure overload. A fibrous mitral valve will fail to close properly, and blood will be regurgitated back to the atria when the left ventricle contracts. Volume overload results when fluid accumulates in the lungs, thereby causing shortness of breath. Volume overload increases the potential for **atrial fibrillation**, which results in irregular and ineffective contractions in both atria. Blood flow through the heart slows, and blood clots (emboli) may develop in the ventricles. Many cerebrovascular accidents are caused when emboli ejected from the left ventricle enter the circulatory system of the brain. Volume overload caused Rudy's shortness of breath and rapid heart rate.

If the aortic valve fails to close properly (aortic insufficiency), CHF or ischemia may result. Another disorder of the aortic valve is aortic stenosis (narrowing), which results in pressure overload. The left ventricle, which must work harder to open the sticky valve, becomes enlarged, and cardiac output decreases. Ventricular arrhythmia (irregular rhythm of heartbeats), cerebral insufficiency, confusion, syncope (fainting), and even sudden death may result from aortic stenosis. Surgery to repair or replace the damaged valves is frequently recommended.

Cardiac Risk Factors

Many scientific studies have been conducted to determine the causes of heart disease. The most famous of these, the Framingham study,[11] helped identify many factors that put an individual at risk for atherosclerosis. Risk factors are divided into three major categories: those that cannot be changed (heredity, male gender, and age), those that can be changed (high blood pressure, cigarette smoking, cholesterol levels, and an inactive lifestyle), and contributing factors (diabetes, stress, and obesity). The Framingham Heart Study continues with research milestones in identifying specific genetic and social factors associated with heart disease, dementia, and stroke.[13] Other factors that contribute to CAD include sleep apnea, alcohol, and preeclampsia.[38] There is a bidirectional link between CAD and depression. Persons with CAD are more likely to develop depression and persons with depression are more likely to develop CAD than others.[17]

The more risk factors that an individual has, the greater the individual's risk for CAD. All team members—the physician, nurse, physical therapist, case manager, social worker, nutritionist, and occupational therapist—should support the patient's attempts to reduce risk factors. In reviewing Rudy's case study, several risk factors are clearly present, whereas others appear to be absent.

Medical Management

A heart attack is a medical emergency, and treatment with aspirin and oxygen is usually initiated before diagnosis. Early treatment is usually started prior to confirmation of the diagnosis and includes aspirin, nitroglycerin, oxygen, and treatment of chest pain.[34] After emergency treatment, heart attack survivors are typically managed in a coronary care unit, where they are closely observed for complications. Approximately 90% of persons who have suffered an MI will have arrhythmia.[3] Heart failure, the development of blood clots (thrombosis and embolism), aneurysms, rupture of part of the heart muscle, inflammation of the sac around the heart (pericarditis), and even death are potential outcomes of MI. Close medical management is imperative.

Generally, patients are managed for 1 to 3 days after MI in an intensive care unit. Once their condition is stabilized, they graduate to a monitored hospital bed. Patients typically stay 5 to 10 days in the hospital after an acute MI. Vital signs are monitored closely while activity is gradually increased. OT personnel may be called on to monitor the patient's response to activity and educate the patient about the disease process, risk factors, and lifestyle modification.

Various surgical procedures can correct the circulatory problems associated with CAD. Balloon angioplasty, also called percutaneous transluminal coronary angioplasty (PTCA), and coronary artery bypass grafting (CABG) are most common.[10]

In PTCA, a catheter is inserted into the femoral artery and guided through the circulatory system into the coronary arteries. Radioactive dye is injected into the arteries, and the site of the lesion is pinpointed. A balloon is then inflated at the site of the lesion to push the plaque against the arterial wall. When the balloon is deflated and the catheter removed, circulation to the myocardium usually improves. During PTCA, a wire mesh tube, called a stent, may be implanted into the coronary artery to keep the artery open.[27]

If a lesion is too diffuse or if an artery reoccludes after PTCA, CABG may be performed. The diseased section of the coronary arteries is bypassed with healthy blood vessels (taken from other parts of the body), thus improving the coronary circulation. In performing CABG, the surgeon usually opens the chest wall by cracking the sternum (sternotomy) and spreading the ribs to gain access to the heart. Sternal precautions to prevent trauma to the compromised chest are generally in place for 6 to 8 weeks after a sternotomy. Ten-year survival rates after a CABG vary between 70% and 93% depending on the number of grafts, the sex of the patient, and the vein or artery recruited for the bypass.[6]

When heart rhythms are abnormal—too fast, too slow, or too irregular to support normal activity—medical intervention is indicated. Arrhythmias that cannot be controlled with medication may be managed by the insertion of a pacemaker in the chest. Wires are run from the pacemaker to specific spots on the heart. The pacemaker delivers a small electrical impulse to the heart muscle and sets the pace of the heart's electrical conduction. The impulse may be set to deliver a regular impulse or to send an impulse only if the heart rate drops below a certain number of beats per minute (demand). Modern pacemakers can monitor physiological responses such as BP and temperature. Implantable cardioverter-defibrillators (ICDs) may also be used to treat cardiac arrhythmias. An ICD can both pace the heart muscle and deliver a high-energy impulse to reset the heart muscle if certain dangerous arrhythmias develop.

Cardiac ablation is a medical procedure used to destroy small areas of the heart that are emitting dangerous signals that cause the heart to contract abnormally. Small catheters are threaded through a vein to the heart. The dysfunctional cardiac tissue is reached and an electrical impulse is sent to the site, destroying the abnormal tissue.[36]

When the heart's pumping ability has become too compromised by CHF or cardiomyopathy, a heart transplant or heart-lung transplant may be considered. After the healthy tissue of a recently deceased person is harvested, the patient's diseased organ (or organs) is removed, and the harvested tissue is transplanted into the patient's body. Transplant patients are typically maintained on special medication to decrease the risk for organ rejection. Nearly 50% of all heart transplant recipients survive for 10 years. Most recipients resume normal lifestyles, but only about 40% return to work.[39]

Ventricular assistive devices (VADs) and total artificial hearts are some of the newer options for individuals with end-stage heart failure or for extremely sick persons awaiting heart transplant. These mechanical circulatory support devices support the damaged heart by pumping blood mechanically. Surgically implanted, with a battery pack worn externally, these devices can allow patients to return home to a more active occupational level while they await a transplant. Nearly 80% of persons using these devices in clinical trials have survived the wait for a new heart.[19]

Valvular stenosis may be managed surgically with a valvuloplasty, in which a balloon is inflated in the damaged valve, stretching and breaking up scar tissue, thus opening and restoring blood flow within the heart. Damaged valves may need to be replaced in order to restore optimal blood flow. A valve replacement may require a sternotomy (opening of the breast bone) or only a small incision, in the case of a transcatheter valve replacement.[1] A sternotomy was performed to replace Rudy's valve.

Cardiac Medications

Knowledge of the purpose and side effects of cardiac medication promotes an understanding of the patient's response to activity. Table 44.2 lists common cardiac medications.

TABLE 44.2

Common Cardiac Medications

Category	Common Names	Purpose and Uses	Reason Prescribed
Anticoagulants (blood thinners)	Warfarin (Coumadin) Heparin	Decrease the blood's ability to clot	Prevent clot formation or enlargement; prevent stroke
Antiplatelet agents	Aspirin Clopidogrel (Plavix)	Prevent clots by preventing platelets from sticking together	Prevent clots after MI; with unstable angina, ischemic stroke, plaque
Angiotensin-converting enzymes—ACE inhibitors	Fosinopril (Monopril) Captopril (Capoten) Quinapril (Accupril)	Expand blood vessels, lower levels of angiotensin II; make the heart work more easily	Treatment of — Hypertension — Heart failure
Angiotensin II receptor blockers (or inhibitors)	Losartan (Cozaar) Irbesartan (Avapro)	Keep blood pressure from rising by preventing angiotensin II from having an effect on the heart	Treatment of — Hypertension — Heart failure
Angiotensin-receptor Neprilysin inhibitors (ARNIs)	Sacubitril/valsartan (Entresto)	Open narrow arteries, improve artery opening, improve blood flow, reduce sodium retention, decrease the work of the heart	Treatment of heart failure
β-Blockers	Atenolol (Tenormin) Propranolol (Inderal)	Decrease heart rate and cardiac output, lower blood pressure, and make the heart beat more slowly and with less force	Treatment of — Abnormal cardiac rhythms — Chest pain Prevent recurrent heart attacks; lower blood pressure
Calcium channel blockers	Amlodipine (Norvasc, Lotrel) Diltiazem (Cardizem, Tiazac)	Interrupt movement of calcium into cells of the heart and blood vessels	Used to treat high blood pressure, angina, and some arrhythmias
Cholesterol lowering medications	Statins (Lipitor, Crestor) Nicotinic acids: (Advicor) Cholesterol absorption inhibitors: (Vytorin)	Lower blood cholesterol levels	Lower LDL
Digitalis preparations	Digoxin (Lanoxin)	Increase the force of cardiac contractions	Treatment of — Heart failure — Arrhythmias — Atrial fibrillation
Diuretics (water pills)	Furosemide (Lasix) Hydrochlorothiazide (Esidrix, HydroDIURIL)	Cause loss of excess water and sodium by urination, thus relieving heart workload and buildup of fluid in lungs and body tissues	Lower blood pressure; reduce edema in lungs, stomach, and extremities
Vasodilators	Nitroglycerin Minoxidil	Relax blood vessels; increase supply of blood and oxygen to the heart while reducing its workload	Ease chest pain

HDL, high-density lipoprotein; LDL, low-density lipoprotein; MI, myocardial infarction.

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Psychosocial Considerations

Depression, anger, anxiety disorders, and social isolation are common in individuals receiving cardiac rehabilitation. Improvement in event-free survival for persons receiving treatment for these problems was not found to have improved survival versus an untreated control group. However, the treated individual in a large randomized multicenter trial improved in socialization and mood compared with the control group.[2] "Nevertheless, even if psychosocial interventions ultimately are shown not to alter the prognosis of CHD patients, they remain an integral part of cardiac rehabilitation services to improve the psychological well-being and quality of life of cardiac patients."[23]

As patients begin to resume more normal activities, such as self-care and walking around the ward, feelings of helplessness may begin to subside. Patients feel more secure when familiar coping mechanisms allow them to respond to the stress, but some former coping mechanisms (e.g., smoking, drinking, consuming fatty foods) are harmful and should be discouraged and replaced by newly learned coping strategies, often those taught by the occupational therapist and other members of the intervention team. Typically, the nutritionist directs the patient toward healthy food choices, the physical therapist provides guidance toward exercise, and the nurse oversees management of medications.

Denial is common in patients with cardiac disease. Patients in denial must be closely monitored during the acute phase of recovery. Persons in denial may ignore all precautions and could stress and further damage their cardiovascular systems. Clinical evidence supports psychosocial counseling after MI that focuses on improving self-health appraisal, improving social support, and establishing an effective means of coping to improve quality of life.[48] The patient's family must be included in the education so that their misconceptions and anxieties do not compound the patient's fears. In Rudy's case, his wife's anxiety that she might accidentally harm him or that he might harm himself and Rudy's concern that his wife is avoiding intimacy and the self-identified barrier of alcohol consumption must be addressed in his intervention plan.

Depression and lack of social support adversely impact persons with CHF and need to be addressed.[43] Quality of life is impacted by one's sense of control and perception of symptoms at hospital discharge in persons with heart disease as much as 3 years after a cardiac event.[22] Patients' perceptions of their illness can have an impact on their ability to make the changes in lifestyle necessary for healthy living after an acute coronary event. The occupational therapist's understanding of client factors, specifically values, beliefs, and spirituality, can help the healthcare team better understand the uniqueness of each individual and positively impact recovery.

Cardiac Rehabilitation

During the first 1 to 3 days after an MI, the patient's medical condition is usually stabilized. This acute phase is followed by a period of early mobilization. Phase 1 of treatment, inpatient cardiac rehabilitation, includes monitored low-level physical activity, including self-care, reinforcement of cardiac and postsurgical precautions, instruction in energy conservation and graded activity, and establishment of guidelines for appropriate activity levels at discharge. Through monitored activity, the ill effects of prolonged inactivity can be averted while medical problems, poor responses to medications, and atypical chest pain can be addressed. See Table 44.3 for signs and symptoms of cardiac distress.

TABLE 44.3

Signs and Symptoms of Cardiac Distress

Sign/Symptom	What to Look for
Angina	Look for chest pain that may be described as squeezing, tightness, aching, burning, or choking. Pain is generally substernal and may radiate to the arms, jaw, neck, or back. More intense or longer-lasting pain forewarns of greater ischemia.
Dyspnea	Look for shortness of breath with activity or at rest. Note the activity that brought on the dyspnea and the amount of time that it takes to resolve. Dyspnea at rest with a resting respiratory rate of greater than 30 breaths per minute is a sign of acute congestive heart failure. The patient may require emergency medical help.
Orthopnea	Look for dyspnea brought on by lying supine. Count the number of pillows that the patient needs to breathe comfortably during sleep (one, two, three, or four pillows needed to relieve orthopnea).
Nausea/emesis	Look for vomiting or signs that the patient feels sick to the stomach.
Diaphoresis	Look for cold, clammy sweat.
Fatigue	Look for a generalized feeling of exhaustion. The Borg Rate of Perceived Exertion Scale is a tool used to grade fatigue (see Box 44.1). Cerebral signs—ataxia, dizziness, confusion, and fainting (syncope)—are all indications that the brain is not getting enough oxygen.
Orthostatic	Look for a drop in systolic blood pressure and hypotension of greater than 10 mm Hg with a change in position from supine to sitting or sitting to standing.

Phase 2 of treatment, outpatient cardiac rehabilitation, usually begins at discharge. During this phase, exercise can be advanced while the patient is closely monitored on an outpatient basis. Community-based exercise programs follow in phase 3. Some individuals require treatment in their place of residence because they are not strong enough to tolerate outpatient therapy.

There is a strong base of clinical evidence that cardiac rehabilitation improves survival and quality of life and reduces the cost of medical care in the long run. This has led the Center for Medicare and Medicaid Services to expand the indications for cardiac rehabilitation programs.[52] These physician-directed, exercise-based programs include regular monitored exercise, lifestyle modification, and medical therapy. Individuals are taught how to monitor their response to activity and what to do in the event of an adverse response.

The Borg Rate of Perceived Exertion Scale (Box 44.1) is a tool used to measure perceived exertion. The patient is shown the scale before an activity and instructed that a rating of “6” means no exertion at all and a rating of “19” indicates extremely strenuous activity, equal to the most strenuous activity that the patient has ever performed. After the activity has been completed, the patient is asked to appraise his or her feelings of exertion as accurately as possible and give the activity a rating.

Box 44.1

Instructions for Using the Borg Rate of Perceived Exertion Scale

During the work, we want you to rate your perception of exertion (i.e., how heavy and strenuous the exercise feels to you and how tired you are). The perception of exertion is felt mainly as strain and fatigue in your muscles and as breathlessness or aches in the chest. All work requires some effort, even if only minimal. This is also true if you move only a little (e.g., walking slowly).

Use this scale from 6 to 20, with 6 meaning “no exertion at all” and 20 meaning “maximal exertion”:

6—“No exertion at all” means that you don't feel any exertion whatsoever (e.g., no muscle fatigue, breathlessness, or difficulty breathing).

9—“Very light” exertion, such as taking a shorter walk at your own pace.

13—A “somewhat hard” work, but it still feels okay to continue.

15—It is “hard” and tiring, but continuing isn't terribly difficult.

17—”Very hard.” This is very strenuous work. You can still go on, but you really have to push yourself and you are very tired.

19—An “extremely” strenuous level. For most people this is the most strenuous work that they have ever experienced.

Try to appraise your feeling of exertion and fatigue as spontaneously and as honestly as possible without thinking about what the actual physical load is. Try to not underestimate and to not overestimate your exertion. It's your own feeling of effort and exertion that is important, not how this compares with that of others. Look at the scale and the expressions, and then give a number. Use any number you like on the scale, not just one of those with an explanation behind it.

Sternal Precautions

Precautions to prevent trauma to the new graft sites, incisions, and sternum generally last about 8 weeks after surgery and generally include the following: do not lift more than 8 pounds, do not push or pull with arms when getting into and out of bed or up from a chair, do not bring elbows above shoulders, avoid twisting and deep bending, hug a pillow when coughing or sneezing, do not drive until cleared by surgeon, and report clicking or popping noises to your surgeon. **Sternal precautions** vary widely among hospitals, surgeons, and therapy departments. This is likely because they were developed on anecdotal and indirect evidence. Concern has been expressed in the literature that sternal precautions that are too restrictive might interfere with long-term functional outcomes and that individualized precautions based on surgical closure techniques and individual patient profiles would yield an improved functional outcome.[4]

Occupational therapists play a key role in assessing and educating individuals on sternal precautions. Engagement of patients in functional activity frequently will challenge individuals to maintain precautions while engaged in an ADL. Therapists need to assess what factors interfere with the individual's ability to comply with precautions and subsequently make suggestions for modification to education and recommendations for discharge. Cognitive impairments can limit one's ability to comply and may be temporary in nature if influenced by medication or, of more long-term concern, if underlying conditions such a dementia are present. Given the potential for neurologic events such as a cerebrovascular accident (CVA) or a transient ischemic attack (TIA) after surgery, the therapist may be the first to observe deficits from such events, which may appear as a lack of ability to comply with precautions.

Monitoring Response to Activity

When the patient's response to an activity is being assessed, symptoms provide one indication that the patient is or is not tolerating the activity. HR, BP, **rate-pressure product** (RPP), and ECG readings are other measures that may be used to evaluate the cardiovascular system's response to work.

Heart Rate

Heart rate (HR), or the number of beats per minute, can be monitored by feeling the patient's pulse at the radial, brachial, or carotid sites. The radial pulse is located on the volar surface of the wrist, just lateral to the head of the radius. The brachial pulse is found in the antecubital fossa, slightly medial to the midline of the forearm. The carotid pulse, located on the neck lateral to the Adam's apple, should be palpated gently; if overstimulated, it can cause the HR to drop below 60 beats per minute (bradycardia). To determine HR, the clinician applies the second and third fingers (flat, not with the tips) to the pulse site. If the pulse is even (regular), the clinician counts the number of beats in 10 seconds and multiplies the finding by 6. The thumb should never be used to take a pulse because it has its own pulse.

All clinicians who assess HR, as well as the patient him or herself, should be able to note the evenness (regularity) of the heartbeat. HR can be regular or irregular. An irregular heartbeat may be described as regularly irregular, which means that there is a consistent irregular pattern (e.g., every third beat is premature), or it may be described as irregularly irregular, which means that there is no pattern to the premature or skipped beats. HR irregularities include skipped beats, delayed beats, premature beats, and beats originating from outside the normal conduction pathway in the heart. Although an irregular HR is not normal, many individuals function quite well with an irregular rate. Clinicians should note the client's normal rate pattern, as well as any variations. The therapist evaluating a client for the first time should compare his or her observations about heart rate and regularity with the patient's record. A sudden change in HR from regular to irregular should be reported to the physician. An ECG or other diagnostic test may be ordered on the basis of such findings. When the HR is irregular, the number of beats should be counted for a full minute. Patients can be taught to take their own pulse and monitor the response of HR to activity. As a general rule, HR should rise in response to activity.

Blood Pressure

BP is the pressure that the blood exerts against the walls of any vessel as the heart beats. It is highest in the left ventricle during systole and decreases in the arterial system with distance from the heart.[51] A stethoscope and BP cuff (sphygmomanometer) are used to indirectly determine BP. The BP cuff is placed snugly (but not tightly) around the upper part of the patient's arm just above the elbow, with the bladder of the cuff centered above the brachial artery. The examiner inflates the cuff while palpating the brachial artery to 20 mm Hg above the point at which the brachial pulse is last felt. With the earpieces of the stethoscope angled forward in the examiner's ears, the dome of the stethoscope is placed over the patient's brachial artery. Supporting the patient's arm in extension with the pulse point of the brachial artery and the gauge of the stethoscope at the patient's heart level, the examiner deflates the cuff at a rate of approximately 2 mm Hg per second. Listening is imperative when recording BP. The first two sounds heard correspond to systolic BP. The examiner continues to listen until the last pulse is heard and diastolic BP is attained.

Physicians usually indicate treatment parameters for the HR and BP of patients in medical facilities. Parameters are frequently written in abbreviations, such as "Call HO if SBP > 150 < 90; DBP > 90 < 60; HR > 120 < 60." (In other words, "Call the house officer or physician on call if systolic BP is greater than 150 or less than 90, if diastolic BP is greater than 90 or less than 60, and if HR is greater than 120 or less than 60.")

HR and BP will fluctuate in response to activity, and cardiac output is affected by both HR and BP. Measurement of the rate pressure product, or RPP (measurement of the workload or oxygen demand), can give a more accurate indication of how well the heart is pumping. The RPP is the product of HR and systolic BP (RPP = HR × SBP). It is usually a five-digit number but is reported in three digits by dropping the last two (for example, HR 100 × SBP 120 = 12,000 = RPP 120). During any activity, the RPP should rise at peak and return to baseline in recovery (after 5 to 10 minutes of rest).

Correctly reading and interpreting an electrocardiogram (ECG) is a skill that requires hours of learning and practice for proficiency. Electrocardiography is not available in most nonacute settings. The reader is referred to Dubin's *Rapid Interpretation of EKGs*,[12] which is an excellent resource for persons unfamiliar with the subject.

There are many similarities in the evaluation and treatment of persons with cardiac disease and those with pulmonary dysfunction. A review of the pulmonary system and its disease processes follows.

Threaded Case Study

Harriet, Part 1

Harriet is a 64-year-old widow and mother of an adult daughter. She retired 3 years ago from her housekeeping job because of fatigue and shortness of breath. Chronic obstructive pulmonary disease was diagnosed at that time. She has been smoking cigarettes since the age of 20 and currently smokes one pack per day. She shares a small one-bedroom apartment with her terrier, Sir Filo. There is a first-floor laundry room in her building. Harriet's daughter lives three blocks away and checks on her mother daily. Harriet's baseline level of function 4 weeks ago consisted of walking the dog around the block slowly, fixing meals, doing laundry, and performing activities of daily living independently. She also enjoys playing bingo on Tuesday nights at her local church and cards with her widowers-and-widows group. Her daughter assists her in grocery shopping and cleaning.

Harriet was released from the acute care hospital 3 days ago, her condition having been stabilized after an acute exacerbation of her chronic obstructive pulmonary disease. Since her recent discharge, her daughter empties Harriet's bedside commode, shops for groceries, and fixes dinner for Harriet and Sir Filo. Results of the occupational therapy evaluation indicated that Harriet became short of breath when combing her hair. She was unable to pace her activity, to coordinate pursed-lip breathing with activity, or to assume dyspnea control postures when needed. She was receiving 2 L of oxygen by nasal cannula at all times. Harriet wants to be able to feed Sir Filo herself, stating that dogs become attached to people who feed them. She does not want her daughter to empty her commode and wants to be able to prepare dinner for herself. She does not want to be a burden to her daughter but rather to enjoy visiting with her.

Critical Thinking Questions

1. What goals may Harriet find relevant in her therapy?

2. What safety concerns might arise?

3. Do Harriet's goals appear realistic given her baseline level of function?

Anatomy and Physiology of Respiration[3,30,32]

Whereas the heart provides oxygen-rich blood to the body and transports carbon dioxide and other waste products to the lungs, the respiratory system exchanges oxygen for carbon dioxide. The cardiac and pulmonary systems are interdependent. If no oxygen were delivered to the bloodstream, the heart would soon stop functioning for lack of oxygen; conversely, if the heart were to stop pumping, the lungs would cease functioning for lack of a blood supply. All body tissues depend on the cardiopulmonary system for their nutrients.

The respiratory system supplies oxygen to the blood and removes waste products, primarily carbon dioxide, from the blood. Air enters the body via the nose and mouth and travels through the nasopharynx to the larynx or voice box. From there, the air continues downward into the lungs by way of the trachea or windpipe. The trachea consists of ribbed cartilage approximately 10 cm long. When the trachea or pharynx becomes blocked, a small incision may be made in the trachea to allow air to pass freely into the lungs. This procedure is called a tracheotomy.

The trachea divides into two main bronchi that carry air into the left and right lungs. The bronchi continue to branch off into smaller tubes, called bronchioles. Bronchioles are segmented into smaller passages called the alveolar ducts. Each alveolar duct is divided and leads into three or more alveolar sacs. The entire respiratory passageway from bronchi to alveolar sacs is often referred to as “the pulmonary tree” because its structure is much like that of an upside-down tree, with the alveolar sacs representing the leaves.

Each alveolar sac contains more than 10 alveoli. A fine, semipermeable membrane separates the alveolus from the capillary network. Across this membrane, oxygen is transported and exchanged for carbon dioxide. Carbon dioxide is exhaled into the air after traveling upward through the pulmonary tree (Fig. 44.4).

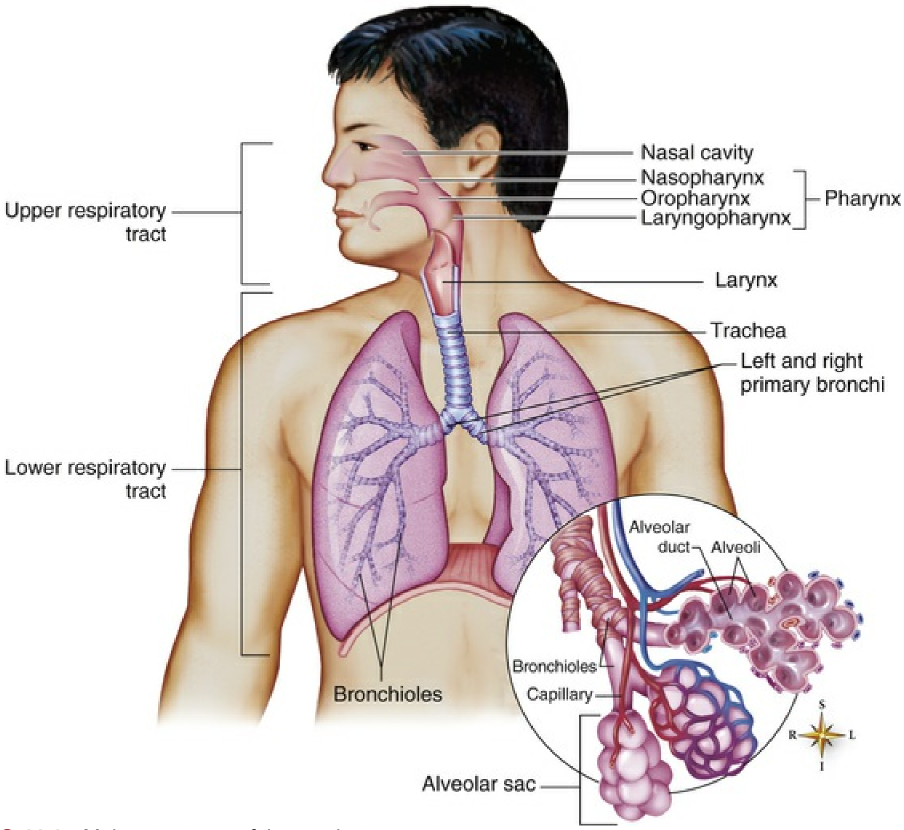

FIG 44.4 Major structures of the respiratory system. (From Patton K, Thibodeau G: *Anatomy & Physiology*, ed 9, St. Louis, 2016, Elsevier.)

With the exception of the nose and mouth, all the airways are lined with cilia and coated with mucus. Mucus and cilia provide a filtering shield that protects the fragile airway respiratory structures from dust and germs.

The musculature of the thorax helps in inspiration and expiration. During inspiration, the muscle power for breathing air into the lungs is provided primarily by the diaphragm. Originating from the sternum, ribs, lumbar vertebrae, and lumbocostal arches, the diaphragm forms the inferior border of the thorax. The muscle fibers of the diaphragm insert into a central tendon. Innervated by the left and right phrenic nerves, the diaphragm contracts and domes downward when stimulated. This downward doming of the diaphragm enlarges the volume of the thorax and causes a drop in pressure in the lungs relative to the air in the environment. Air then enters the lungs to equalize inside and outside pressure. Accessory muscles, the intercostals and scalenes, are also active during inspiration. The intercostals maintain alignment of the ribs, and the scalene helps elevate the rib cage.

At rest, expiration is primarily a passive relaxation of the inspiratory musculature. The lungs help draw the thorax inward as the inspiratory muscles relax. Forced expiration requires active contraction of the abdominal muscles to compress the viscera and squeeze the diaphragm upward in the thorax. Expiration can be further forced by flexing the torso forward and pressing with the arms on the chest or abdomen. As the volume of the thorax decreases, air is forced out of the lungs.

Accessory muscles in the neck and collarbone region can be recruited to assist in respiration when lung disease is active or other respiratory musculature is impaired.

Innervation of the Respiratory System

Breathing is mostly involuntary. A person does not have to think to take a breath. The autonomic nervous system has control over breathing. With anxiety and increased activity, the sympathetic nervous system will automatically increase the depth and rate of inspiration.

Inspiration and expiration have a volitional component. Volitional control allows us to control our breathing as we swim and to play the harmonica. Additionally, receptors within and outside the lungs can, when stimulated, cause changes in the depth and rate of breathing. Although the pons, medulla, and other parts of the brain provide the central control for breathing, they adjust their response to input from receptors in the lungs, the aorta, and the carotid artery.

Chronic Lung Disease[26]

Occupational therapy is frequently prescribed for individuals with chronic lung conditions that functionally impact their ability to participate in their usual occupations. Persons with **chronic obstructive pulmonary disease** (COPD), sarcoidosis, asthma, idiopathic pulmonary fibrosis, or cystic fibrosis may benefit from learning better ways to breathe and to conserve their energy. COPD includes two primary medical conditions: emphysema and chronic bronchitis. The air sacs of the lungs (alveoli) are damaged, lose their elasticity, and may become clogged with mucus.[37] It becomes harder to breathe, and as the disease progresses individuals experience a decrease in their IADL and ADL abilities. COPD is not curable, and the damage caused by the disease is irreversible. With medical management and lifestyle changes, the disease progression can be slowed and the individual's ability to participate in occupations can improve.

Emphysema is a medical condition in which the alveoli are gradually damaged. Although cigarette smoking is the leading cause of emphysema,[28] airborne irritants such as air pollution, marijuana smoke, and particles produced in manufacturing are contributing causes. Persons with chronic bronchitis experience shortness of breath (dyspnea) on exertion, and as the disease progresses, dyspnea occurs at rest.

In bronchitis the bronchial airway becomes inflamed, leading to increased mucus production, cough, and airway obstructions. When the airway is constantly irritated, a chronic cough with mucus results. Smoking is the major contributing cause of chronic bronchitis. Persons with chronic bronchitis are prone to upper respiratory infections, which worsens their disease process. Persons with severe chronic bronchitis are unlikely to recover fully.

Inflammation, fibrosis (thickening of the connective tissue), and narrowing of the terminal airways of the lungs are physiological changes that occur with peripheral airway disease. Smoking and other environmental pollutants irritate the airways, which leads to the development of abnormal terminal airways. Coughing and spitting up mucus from the lungs are common clinical manifestations of this disorder. The disease process may never progress beyond this initial phase, or it may evolve into emphysema and full-fledged COPD.

Asthma is characterized by irritability of the bronchotracheal tree and is typically episodic in onset.[35] Persons suffering from asthma experience wheezing and shortness of breath that may resolve spontaneously or necessitate the use of medication to calm the airway. Persons with asthma may be free of symptoms for periods between the episodes of wheezing and dyspnea. Some individuals appear to have a genetic predisposition to asthma. Allergenic causes of asthma may include pollen and respiratory irritants such as perfume, dust, and cleaning agents. Bronchospasm occurring with exposure to cold air or induced by exercise is sometimes the first clinical manifestations of asthma. Irritation of the airway leads to narrowing of the air passages and interferes with ventilation of the alveolar sacs. If left untreated, a severe asthmatic episode may result in death. Persons with severe asthma may be referred to occupational therapy to address declining ADL function.

Pulmonary Risk Factors

Smokers are 12 times more likely to die from COPD than nonsmokers.[50] Cigarette smoking also causes emphysema and chronic bronchitis. Clinical manifestations of the respiratory disease increase as the **pack-year history** increases. Pack-year history is calculated by multiplying the number of packs of cigarettes consumed per day by the number of years of smoking. A person who started smoking at the age of 20 and is now 64 has a pack-year history of 44 ($64 - 20 = 44 \times 1$ pack/year = 44 pack-years). Because cigarette smoke is a pulmonary irritant, it can also be a causative agent in asthmatic episodes. Other environmental irritants, such as air pollution, chemical exposure, and dust, are contributory risk factors in the development of COPD and asthma.[28]

Medical Management

COPD is a progressive, chronic disease. The onset of the disease is insidious. When patients initially seek medical attention, they are frequently seen in a physician's clinic rather than at a medical center. Besides evaluating the patient's medical history and symptoms and performing a physical examination, the physician will assess the patient's history of smoking and occupational exposure to respiratory irritants. Blood work and an x-ray examination will be performed to further assess the patient's clinical status. Most people with COPD take medication every day. Medications prescribed include anti-inflammatory agents (e.g., steroids and cromolyn sodium), bronchodilators (e.g., albuterol and theophylline) to help open the airway, and expectorants (e.g., iodides and guaifenesin) to help loosen and clear mucus. Flu shots and pneumococcal vaccines are recommended. Oxygen therapy may also be prescribed at a specific flow rate. Occasionally, persons receiving oxygen therapy may be tempted to increase the liter-per-minute flow in the erroneous thinking that more is better. This can result in retention of carbon dioxide and lead to failure of the right side of the heart.

Persons in acute respiratory distress may initially be managed with a ventilator before being weaned to oxygen. Ventilators provide mechanical assistance to the process of inspiration and do not increase the number of healthy alveolar sacs. Ventilators will not slow the end-stage disease process of COPD. Mechanical ventilation is frequently prescribed for persons with an acute exacerbation of the disease process caused by pneumonia, influenza, or CHF.

Pulmonary rehabilitation (PR) is a multidisciplinary, comprehensive program, tailored to the individual needs of each recipient. Psychological, emotional, physical, and emotional problems are addressed. The physician-directed team may include nurses; respiratory, physical, and occupational therapists; psychologists; and others with relevant skill sets. Pulmonary rehabilitation improves dyspnea symptoms in person with COPD, reduces the number of hospital days, and efficaciously utilizes medical services.[44]

OT Practice Notes

Frequently, the occupational therapist's role in treating clients with COPD involves salvage rather than prevention of the disease process. Earlier intervention by an occupational therapist is critical to prevent the disease.

Signs and Symptoms of Respiratory Distress

Dyspnea is probably the most obvious sign of a breathing difficulty. In the most severe form of dyspnea, the patient is short of breath even at rest. Clients with this level of dyspnea are unable to utter a short phrase without gasping for air. When reporting that a client has dyspnea, the practitioner should note the precipitating factors and associated circumstances—for example, “Harriet becomes short of breath when washing her face while seated in front of the sink.”

Other signs that the body is not getting enough oxygen include extreme fatigue, a nonproductive cough, confusion, impaired judgment, and cyanosis (bluish skin color caused by insufficient oxygen in the blood).

Psychosocial Considerations

Because COPD is a progressive, debilitating physical illness, it is not surprising that the psychosocial effects of the disease are considerable. Chan identified five themes related to barriers preventing engagement in occupation for people with COPD: uncertainty about progression of the disease, attributing the cause of the disease to external factors, progressing restriction in activity and isolation, anxiety and depression, and passive acceptance.[5] For persons with COPD, anxiety and depression are most strongly linked to decreased exercise capacity and shortness of breath.[9,45] Training in progressive muscle relaxation can be a successful tool for controlling the dyspnea and anxiety and for lowering the HR.[42]

Most cardiac and respiratory disease processes are preventable. Individuals with these diseases may lack basic skills in coping and setting limits with themselves or with others. The therapist's role includes encouraging the patient to engage in activities that will develop his or her skills and promoting the resumption of occupations that bring value, meaning, and participation back into the patient's life. With these skills, the patient begins to see himself or herself as a person actively making choices to get better. By working with Harriet on ways to engage with her dog when she does not have the endurance to take a walk, the occupational therapist not only teaches energy conservation but also conveys this information in a meaningful manner to the patient.

Pulmonary Rehabilitation

The goal of pulmonary rehabilitation is to stabilize or reverse the disease process and return the patient's function and participation in activity/occupation to the highest capacity. A multidisciplinary rehabilitation team working with the patient can design an individualized intervention program to meet this end. Accurate diagnosis, medical management, therapy, education, and emotional support are components of a pulmonary rehabilitation program. OT personnel are frequently part of the patient's team, which is headed by the patient and also includes the physician, nurse, and the patient's family and social supports. Respiratory therapists, dietitians, physical therapists, social workers, and psychologists may also be team members. Roles of team members vary slightly among facilities. Knowledge of specialized pulmonary treatment techniques is imperative for each team member when treating persons with pulmonary disease.

There are a number of recognized pulmonary rehabilitation guidelines. Both low- and high-intensity exercises are beneficial (higher intensity is better); arm exercises should be unsupported (active motion with no outside assistance), against gravity and with and without resistance; leg exercise should be included; and supplemental oxygen is helpful during rehab exercise.[44] The occupational therapist should apply these guidelines during ADL training. By continuing to maintain the higher level of activity gained in a pulmonary rehabilitation program, individuals can have sustained benefit from the program for years.

Intervention Techniques

Dyspnea control postures.

Adopting certain postures can reduce breathlessness. In a seated position, the patient bends forward slightly at the waist while supporting the upper part of the body by leaning the forearms on a table or the thighs. In a standing position, relief may be obtained by leaning forward and propping oneself on a counter or shopping cart.

Pursed-lip breathing.

Pursed-lip breathing (PLB) is thought to prevent tightness in the airway by providing resistance to expiration. PLB improves air movement, releasing trapped air in the lungs and helps to keep the airways open. Persons with COPD sometimes instinctively adopt this technique, whereas others may need to be taught it. Instructions for PLB are as follows:

1. Relax your neck and shoulder muscles.

2. Inhale slowly through the nose for a count of two.

3. Purse the lips as if to whistle.

4. Exhale—slowly, to a count of 4—through pursed lips as if trying to make a candle flicker without blowing it out.

Pursed lip breathing should be used when bending, lifting, or stair climbing.[7]

Diaphragmatic breathing.

Another breathing pattern, which calls for increased use of the diaphragm to improve chest volume, is **diaphragmatic breathing**. Many persons learn this technique by placing a small paperback novel on the abdomen just below the xiphoid process (base of the sternum or breastbone). The novel provides a visual cue for diaphragmatic movement. The patient lies supine and is instructed to inhale slowly and make the book rise. Exhalation through pursed lips should cause the book to fall.

Relaxation.

Progressive muscle relaxation in conjunction with breathing exercises can be effective in decreasing anxiety and controlling shortness of breath. One technique involves tensing muscle groups while slowly inhaling and then relaxing the muscle groups while exhaling twice as slowly through pursed lips. It is helpful to teach the patient a sequence of muscle groups to tense and relax. One common sequence involves tensing and relaxing first the face; followed by the face and the neck; then the face, neck, and shoulders; and so on, down the body to the toes. A calm, quiet, and comfortable environment is important for the novice in learning any relaxation technique.

Other treatments and considerations.

Physical therapists are generally called on to instruct patients in chest expansion exercises, a series of exercises intended to increase the flexibility of the chest. Percussion and postural drainage use gravity and gentle drumming on the patient's back to loosen secretions and help drain the secretions from the lungs. By isometrically contracting the arms and hands while they are placed on the patient's thorax, the therapist may transmit vibration to the patient. Vibration is performed during the expiratory phase of breathing and helps loosen secretions. Percussion and postural drainage may, however, be contraindicated in acutely ill patients and those who are medically unstable.

Humidity, pollution, extremes of temperature, and stagnant air have deleterious effects on persons with respiratory ailments. The therapist and patient should take these factors into consideration when planning activity.

Migliore's guidelines for the management of dyspnea provide a clinical progression and direction for the integration of dyspnea control techniques with the progression of activity.[31]

Individuals with chronic respiratory or cardiovascular limitations are frequently restricted in their ability to perform ADLs. OT intervention can promote improvements in the client's life management skills and quality of life.

Evaluation

Review of the Medical Record

A review of the medical record will identify the patient's medical history (diagnosis, severity, associated conditions, and secondary diagnoses), social history, test results, medications, and precautions.

Patient Interview

It is common courtesy and good medical practice to begin every encounter with a patient by introducing oneself and explaining the purpose of the evaluation or intervention. Good interviewing skills, including asking the right questions, listening to the patient's response, and observing the patient while responding, are considered integral aspects of the therapeutic use of self. Thoughtful, probing questions will help the patient and therapist identify areas of concern and lay the groundwork for establishing mutually agreeable goals. The therapist should observe the patient for signs of anxiety, shortness of breath, confusion, difficulty comprehending, fatigue, abnormal posture, reduced endurance, reduced ability to move, and stressful family dynamics. Interview questions should not only seek clarification of information that was unclear in the medical record but also clarify the patient's understanding of his or her condition and treatment.

A patient with a history of angina should be asked to describe what the angina feels like. If the patient has also had an MI, the patient should be asked whether he or she can differentiate between the angina and the MI chest pain. Clarification of symptoms before treatment can prove invaluable should symptoms arise. What clarifying questions might the therapist ask in evaluating Rudy or Harriet?

Asking patients to describe a typical day, to identify activities that bring on shortness of breath or angina, and to tell how their physical limitations interfere with the activities or occupations that they need to do or most enjoy doing will reveal problems that are meaningful and relevant to the patient.

Clinical Evaluation

The purpose of clinical assessment is to establish the patient's present functional ability and limitations. The content of an occupational therapist's clinical evaluation will vary from patient to patient and from setting to setting. Clients with impairments in the cardiovascular system will require monitoring of HR, BP, signs and symptoms of cardiac distress, and possibly ECG readings during an assessment of tolerance to postural changes and during a functional task. Table 44.4 provides a summary of appropriate versus inappropriate responses to activity. Individuals with disorders involving the respiratory system should be monitored closely for signs and symptoms of respiratory distress. If an oxygen saturation monitor is available, the patient's range of motion, strength, and sensation may be grossly assessed within the context of the ADL assessment. The patient's cognitive and psychosocial status will become apparent to a skilled clinician via interview and observation.

TABLE 44.4

Cardiovascular Response to Activity

	Appropriate	Inappropriate
Heart rate (HR)	Increases with activity to no more than 20 beats/min above the resting heart rate	HR more than 20 beats/min above the resting heart rate (RHR) with activity, RHR ≥120, HR drops or does not rise with activity
Blood pressure (BP)	Systolic blood pressure (SBP) rises with activity	SBP ≥220 mm Hg postural hypotension (≥10–20 mm Hg drop in SBP, decrease in SBP with activity)
Signs and symptoms	Absence of adverse symptoms	Excessive shortness of breath, angina, nausea, and vomiting; excessive sweating; extreme fatigue (rate of perceived exertion [RPE] ≥15); cerebral symptoms

After completing the evaluation, the clinician has sufficient information to formulate an intervention plan. In establishing the intervention goals and objectives, the clinician verifies that the patient agrees with the intervention plans and projected outcome. At this point it is helpful to assess the patient's perspective on barriers to attaining the goals identified. Asking “what might prevent you from being successful in…?” can yield unexpected information and identify other areas of concern. The occupational therapist discovered Rudy's possible alcohol dependence by using this type of probative question.

Intervention

Client goals, present clinical status, recent occupational performance history, response to current activities and occupations, and prognosis all help guide the progression of intervention for persons with cardiovascular or respiratory impairment. Clients with significant cardiac or pulmonary impairment, limited recent ability to participate in occupation, inappropriate responses to activities and occupations or orthostatic change, and a poor prognosis will progress very slowly. Individuals with little impairment of the heart or lungs, a recent history of normal occupational performance, appropriate responses to orthostatic change and activities and occupations, and a good prognosis will progress rapidly by comparison.

Progression and Energy Costs

The energy costs of an activity or occupation and the factors that influence energy costs can further guide the clinician in the safe progression of activity or participation in occupation. Oxygen consumption suggests how hard the heart and lungs are working and is indicative of the amount of energy needed to complete a task. Resting quietly in bed requires the lowest amount of oxygen per kilogram of body weight, roughly 3.5 mL O_2/kg body weight. This can also be expressed as 1 basal **metabolic equivalent** (MET). As activity increases, more oxygen is needed to meet the demands of the task. For instance, dressing requires 2.5 METs, or roughly twice the amount of energy that lying in bed requires (Table 44.5). Guided by a MET table, the patient's response to activity or occupation, the prognosis, and the patient's goals, the occupational therapist will be able to determine a logical intervention progression. As a general rule, once a patient tolerates an activity (e.g., seated sponge bathing) with appropriate responses, the patient may progress to the next higher MET-level activity (e.g., standing sponge bath).

TABLE 44.5

Basal Metabolic Equivalent Table of Self-Care and Homemaking Tasks

MET Level	Activities of Daily Living	Instrumental Activities of Daily Living, Work, Play, and Leisure
1–2	Eating, seated[25]; transfers, bed to chair; washing face and hands; brushing hair[25]; walking 1 mph	Hand sewing[8]; machine sewing; sweeping floors[5]; driving automatic car, drawing, knitting[46]
2–3	Seated sponge bath,[46] standing sponge bath,[46] dressing and undressing,[21] seated warm shower,[46] walking 2–3 mph, wheelchair propulsion 1.2 mph	Dusting,[25] kneading dough,[7] hand-washing small items,[8] using electric vacuum,[25] preparing a meal,[21] washing dishes,[46] golfing[46]
3–4	Standing shower, warm[21]; bowel movement on toilet[8]; climbing stairs at 24 ft/min[46]	Making a bed[21]; sweeping, mopping, gardening[46]
4–5	Hot shower,[21] bowel movement on bedpan,[21] sexual intercourse[46]	Changing bed linen[25]; gardening, raking, weeding; rollerskating,[16] swimming 20 yards/min[46]
5–6	Sexual intercourse,[46] walking up stairs at 30 feet/min[46]	Biking 10 mph on level ground[46]
6–7	Walking with braces and crutches	Swimming breaststroke,[46] skiing, playing basketball, walking 5 mph, shoveling snow, spading soil[46]

The duration of sustained physical activity must be taken into account when activity guidelines are being determined. Obviously, persons who have difficulty performing a 2-MET activity must still use a commode (3.6 METs) or bedpan (4.7 METs) for their bowel management. This is possible because a person can perform at a higher than usual MET level for brief periods without adverse effects.

At 5 METs, sexual activity is frequently a grave concern to persons with impaired cardiovascular function and their partners. Sexual intercourse is intermittent in its peak demands for energy. Few patients recall receiving counseling about sexual activity after a heart attack.[24] Bringing up the topic of sexual intimacy with both partners present is one technique that can put both the patient and therapist in an open frame of mind. Patients are frequently able to return to sexual intercourse once they can climb up and down two flights of steps in 1 minute with appropriate cardiovascular responses.[47] Providing the patient with information about when it is safe to resume sexual activity can reduce anxiety surrounding the resumption of sexual intercourse. Anxiety may be further decreased by discussing sexual activity guidelines with the patient and partner and identifying various forms of romantic intimacy, such as hand holding and kissing, when intercourse is not feasible. Besides instructing the patient to monitor HR and symptoms of cardiac distress before and after intercourse, the therapist should inform the patient and partner that cardiac medications might affect the patient's libido. The patient should be encouraged to inform the physician of problems related to sexual activity. In many cases the physician can adjust the patient's medications to control symptoms.

Energy Conservation

When patients are taught methods to conserve their energy resources, they will be able to perform at a higher functional level without expending more energy. The principles of **energy conservation** and work simplification are based on knowledge of the ways in which specific factors cause various cardiovascular responses. Ogden identified six variables that increase oxygen demand: increased rate, increased resistance, increased use of large muscles, increased involvement of the trunk musculature, raising one's arms, and isometric work (straining).[40] Upper extremity activity has also been shown to require greater cardiovascular output than lower extremity activity, and standing activity requires more energy than seated activity. Extremes of temperature, high humidity, and pollution make the heart work harder. By applying this information, a skilled clinician can suggest modifications in activity that will decrease the amount of energy needed for the task.

Energy conservation training should be individualized for each patient. Time management is an invaluable tool for energy conservation. Time management involves learning to plan one's activity or participation in occupation so that tasks requiring high energy expenditure are interspersed with lighter tasks, and rest breaks are scheduled throughout the day, especially after meals. The most important part of educating the client is incorporating his or her active involvement in planning the day. Client involvement increases the likelihood of realistic goal attainment. Rather than prescribing how Harriet might sequence her ADLs, IADLs, and rest breaks throughout her typical day, the therapist might engage her in a conversation about what works or does not work well for her in her current performance patterns. The therapist would then ask probing questions, such as "Have you tried taking your shower at a different time of day?" and "Would laying your clothes out the night before help your morning go more smoothly?" Such a client-centered approach engages the patient in the process of designing realistic performance patterns that incorporate principles of energy conservation according to his or her own circumstances and values. Through such collaboration, the therapist demonstrates respect for the patient's needs and increases the likelihood that changes will be implemented successfully.

Written material may augment energy conservation instruction. However, until the patient has successfully applied energy conservation principles to activity, the therapist should expect little follow-through with energy conservation recommendations. Practice and practical application of skills are critical to changing behavior.

The specific pulmonary rehabilitation intervention techniques of PLB, diaphragmatic breathing, dyspnea control postures, and relaxation techniques were discussed earlier in this chapter. Exhaling with exertion is another breathing principle for persons with compromised cardiac or pulmonary function. Franklin might be taught to exhale when having a bowel movement rather than holding his breath and straining. Harriet might be taught to exhale when lifting or lowering her pet's water bowl. This technique is more energy efficient and helps control systolic BP responses to activity. It is important for the patient to practice these skills during treatment. Therapeutic support is often critical in learning.

Lifestyle Modification

Modification of lifestyle is a key component in improving cardiovascular health. Exercise education should include the benefits of exercise; a graded program of increased activity and participation in occupation; stretching, strengthening, and aerobic activity; guidelines for monitoring HR, BP, and rate of perceived exertion; cool-down; safety issues related to clothing, environmental factors, and warning signs; a plan for resuming exercise if it is skipped for a period; and emergency guidelines. Although the physical therapist typically designs and oversees the exercise program, the occupational therapist can provide valuable insight into forms of exercise that might be meaningful to the patient. Modification of diet may be addressed by the dietitian but can readily be reinforced during meal preparation activities. To stop smoking, refrain from excessive alcohol consumption, and stop abusing drugs are challenging goals for clients who have developed these habits. Support groups, counseling, and medical management play key roles in successful cessation or modification of these risk factors. Occupational therapists believe that enabling the client's participation in rounds of personally meaningful and healthy occupations can also play a key role in supporting health and controlling such risk factors. The therapist worked with Rudy's treatment team to address his alcohol use concerns and helped him identify healthy occupational patterns (regular yoga) he had previously abandoned that would support sobriety.

Patient and Family Education

As members of the healthcare team, occupational therapists share the responsibility for patient and family education. The team must instruct the patient and family members in cardiac or pulmonary anatomy, the disease process, management of symptoms, risk factors, diet, exercise, and energy conservation and must reinforce the teaching. Inclusion of family members in an education program provides support indirectly to the client through the family unit. Such support is critical when the client depends on the assistance of a family member to accomplish everyday tasks.

Summary

Healthy persons are able to meet the varying demands of their bodies for oxygen because their heart and respiratory rates adjust to meet oxygen demand. When either the cardiovascular or the pulmonary system (or both) is compromised, the ability to perform normal activities or occupations declines. This chapter is intended to guide the occupational therapist in the treatment of clients with impairment of the heart or lungs and in designing programs to maximize clients' independent performance in areas of occupation to support participation in context. The two case studies presented in this chapter and related information portray the range of problems involving client factors, contextual issues, performance skills, and performance patterns that typically interfere with the client's ability to perform customary activities and occupations.

Threaded Case Study

Rudy, Part 2

Reflecting on the case of Rudy (who had undergone a valve replacement following a cardiac episode), the reader should consider the importance of really listening to the patient and following up with probative questions to develop more client-centered and thus more relevant goals. The first question the reader was asked to consider while reading the chapter was "What probative questions might the occupational therapist ask to clarify what Rudy means by 'everything he used to do'?" Rudy provided some clues in his occupational profile that yield themselves to further exploration. Besides returning to work, being able to dress himself, and managing his toileting, a therapist might further inquire as to (1) the role Rudy normally has in management of the home, how he previously showered, and in what other avocational activities he participates; (2) whether he and his wife would like to discuss safe resumption of sexual activities; and (3) the job-specific tasks that are most relevant for him to return to work.

With regard to the second question involving resumption of sexual activity, the therapist must first assess Rudy's understanding of his precautions and any factors that are interfering with his ability to apply those precautions. Besides asking Rudy to list his precautions and providing a written list of precautions, the therapist can better support Rudy's compliance by reviewing the at-risk postures prior to an activity as well as pacing the activity according to Rudy's ability to comply. The occupational therapist should consider if Rudy's memory and ability to apply precautions might be impacted by his pain medications, his premorbid personality, any neurologic condition associated with alcohol abuse, or perhaps even portend an impending CVA.

Finally, the reader was asked to consider what areas of occupation might the therapist choose for the next intervention session and, depending on Rudy's occupational profile, what goals might be included in his OT intervention plan. Performing the seated sponge bathing task and repeating bed mobility training while reinforcing sternal precautions would be a good choice of activities for the next therapy session. Rudy required frequent cuing and therapeutic intervention to keep him safe. By incorporating practice in safely pacing the activity and self-monitoring his HR and application of sternal precautions, his therapist will begin practical application of the skills essential to safe management of his cardiac condition. OT intervention will most likely end before Rudy returns to work. It is critical for him to understand how he might apply his sternal precautions at home and at work. The occupational therapist intervenes by using education to engage Rudy in a conversation about ways that he might adapt these principles to his work. Thus the therapist sets the groundwork for carryover of principles into that setting.

Threaded Case Study

Harriet, Part 2

When considering the case of Harriet, the reader was asked what goals she might find relevant in therapy. Harriet identified several meaningful goals during the initial occupational therapy evaluation, including feeding her dog Sir Filo, preparing her own dinner, and being able to empty her bedside commode herself. Another question involved the safety concerns that might arise in treating Harriet. Additional goals relevant to her safety include learning to pace her activity, coordinating her breathing with function, increasing her ability to assume dyspnea control postures when needed, and increasing her safety with oxygen. The oxygen line not only poses a potential trip hazard but also presents a fire hazard given her meal preparation goals and smoking habit. Smoking cessation is a goal that can be explored but will be meaningful only if Harriet wants to quit. Finally, the reader was asked to determine what goals appear realistic given Harriet's baseline level of function. Given her baseline level of function, all the goals she identified appear to be realistic.

Review Questions

1. Describe the heart, including its size, anatomy, and functional parts.
2. Name the heart valves, and give their locations and functions.
3. Discuss the relationship between the coronary arteries and health of the heart.
4. List and describe the symptoms of cardiac distress.
5. What are the typical psychosocial responses to a diagnosis of heart disease?
6. How is cardiac response to activity monitored? How does the therapist know that a change in level of activity is warranted?
7. Describe the functional parts of the pulmonary system.
8. What is COPD, and what is its significance for occupational performance?
9. What can the OT practitioner do to help prevent or reduce the incidence of COPD?
10. Demonstrate the recommended dyspnea control postures.
11. Compare pursed-lip breathing with diaphragmatic breathing. When should one be used rather than the other?
12. Describe the appropriate evaluation content and approach for patients with cardiac and pulmonary problems.
13. What is a MET, and what is the clinical value of a MET table for occupational therapists?
14. How would you teach energy conservation techniques to the following individuals, all of whom have cardiac or pulmonary disease?
    - A 40-year-old female marathon runner
    - A 50-year-old homemaker and adoptive mother of eight (including three children younger than 6 years)
    - A 60-year-old air conditioner repairman
    - A 72-year-old man who says his main pleasures are riding thoroughbreds, drinking good Kentucky bourbon, smoking cigars, and enjoying the company of lovely women

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Cancer and Oncology Rehabilitation

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CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Identify and describe the range of effects that cancer can have on occupational performance.
2. Understand the various types of cancer, which are most common in men and women, and the most common medical and therapeutic interventions.
3. Identify the types of occupational therapy interventions used to promote occupational performance in adults with cancer.
4. Explain the side effects of surgery, radiation therapy, and chemotherapy and their impact on occupational performance.
5. State the distinct value that occupational therapy adds to rehabilitation of the person with cancer.

KEY TERMS

Cancer
Cancer-related cognitive impairment

Cancer-related fatigue

Chemotherapy

Hospice

Lymphedema

Metastasis

Palliative care

Radiation therapy

Case Study

Kay

Kay is a 36-year-old mother of two children who lives with her spouse and works full time. She was diagnosed with invasive ductile breast cancer and underwent surgery followed by radiation and chemotherapy. She received occupational therapy as an inpatient and is now receiving follow-up services as an outpatient after expressing concerns to both her treating physician and nurse practitioner about her performance of daily occupations.

Kay was evaluated by the outpatient occupational therapist to identify challenges to occupational performance in any of her roles (eg, parent, spouse, worker, homemaker, volunteer, sports enthusiast, and religious participant). Kay is functioning independently in her self-care but is feeling stretched to her limits due to fatigue and mild cognitive issues caused by the radiation and chemotherapy.

Kay is also experiencing psychosocial distress related to her body image and impending reconstructive surgery. Kay told her occupational therapist, "I am barely making it through the day and am trying to hold it together while I care for my kids, take care of the home, and try to do some work. I am exhausted all the time and continually make stupid mistakes and feel confused over things that used to be so simple. I can't even imagine getting back to running or my volunteer work at my church. I am at the end of my rope!"

Critical Thinking Questions

- If Kay is able to bathe and dress herself and get support from her spouse over the short term, why does she need occupational therapy?
- Kay has identified fatigue and cognitive issues as primary concerns but is struggling with performance of all of her daily roles, so where should the occupational therapist begin?
- In addition to the physical symptoms that Kay is experiencing, what are the psychosocial issues that should be addressed by the occupational therapy practitioners working with Kay?

Introduction to Cancer and Oncology Rehabilitation

In 2015, an estimated 1,658,370 new cases of cancer were diagnosed in the United States, and 589,430 people died from the disease. Approximately 39.6% of men and women will be diagnosed with cancer at some point during their lifetime.[23] The most common cancers in men are prostate, lung and bronchus, colon and rectum, urinary and bladder, and melanoma of the skin. The most common cancers in women are breast, lung and bronchus, colon and rectum, uterine corpus, and thyroid.[3] Overall men have a 50% chance of developing some form of cancer in their lifetime, and women have a 33% risk of incidence. The number of cancer survivors in the United States is expected to reach 22 million by 2024.[24] **Cancer** is typically described according to where the cancer originates with the most common forms being melanoma (skin), carcinoma (skin or tissue lining organs), sarcoma (connective tissue), leukemia (bone marrow or blood-forming organs), lymphoma (immune system), multiple myeloma (plasma cells and bone marrow), and central nervous system (brain and spine).

Oncology rehabilitation including occupational therapy, physical therapy, speech-language pathology, and rehabilitation medicine has grown rapidly. Oncology rehabilitation services are provided at large National Cancer Institutes such as the University of Texas MD Anderson Cancer Center in Houston, Texas, at smaller cancer centers and community-based hospitals, and in the home. Rehabilitative services are provided at all stages of cancer or what is referred to as the *cancer care continuum*. The stages of the cancer care continuum include (1) pretreatment (newly diagnosed but no treatment initiated), (2) active treatment (treatment with a curative goal), (3) maintenance (long-term therapy with a goal of remission), (4) posttreatment or survivorship (medical treatment complete with no sign of disease), and (5) palliative care (treatment when cancer is incurable with a focus on comfort and function). Occupational therapy practitioners also have roles in cancer prevention through lifestyle redesign and occupational performance to support health.

Treatment Options

The range of cancer treatments is driven by the type of cancer, how early the disease is discovered, and how advanced the cancer has become. The length of time that treatment lasts and the impact of treatment on an individual can be wide ranging. The most common forms of treatment include the following[23]:

- Surgical removal of cancer cells/tumors from the body
- **Radiation therapy** focused on killing cancer cells and shrinking tumors
- **Chemotherapy** using drugs to kill cancer cells
- Immunotherapy focused on strengthening and using a person's immune system to fight cancer
- Hormone therapy, which uses hormones to slow or stop cancer cell growth
- Stem cell transplants, which restore blood-forming cells destroyed by high-dose chemotherapy or radiation

Precautions, Contraindications, and Medical Complexity

Providing safe occupational therapy intervention for people with cancer can be complex and requires specialty and sometimes advanced knowledge and understanding of how medications, treatments, and the status of body systems affect the course of evaluation and treatment. Medications and the disease process can influence the body that is attempting to maintain homeostasis. Some body functions that could be affected include changes in heart rate and rhythm, dizziness, blood pressure problems, changes in vision, and changes in cognitive status, appetite, or metabolism. Two key measures of body functions when the person is undergoing cancer treatments are vital signs and laboratory ("lab") values. Vital signs (i.e., blood pressure, arterial blood pressure, intracranial pressure, respiration rate, heart rate, and oxygen saturation) and laboratory ("lab") values are two important measures of body functions to monitor during intervention with cancer survivors. Lab values provide the practitioner with information regarding a client's biochemistry that could affect performance.[30]

Common lab values that should be reviewed prior to each occupational therapy intervention session include the following:

- Blood cell counts such as red blood cell count, white blood cell count, hemoglobin, and hematocrit.
- Coagulation panels such as prothrombin time, international normalized ratio, and partial thromboplastin time.
- Basic metabolic panels including blood sugar, calcium, creatinine, potassium, and blood urea nitrogen.

These lab values each have a range within which functional activity and participation in rehabilitation activities is safe and appropriate. Functional activity is contraindicated for lab values that are critically outside the normal range. Tests such as a complete blood count can help practitioners determine safe functional activity guidelines, particularly for patients who are undergoing or have just completed chemotherapy, radiation therapy, or bone marrow transplants. Criteria for exercise vary depending on the type of cancer, the treatment that a patient is receiving, and the patient's reaction medically and physiologically. Patients who may be able to safely exercise at one point in their course of treatment may be under activity restrictions at other times. Table 45.1 includes examples of three common lab values seen in the oncology setting which are (1) platelets, (2) hematocrit, and (3) white blood cells. The precautions associated with abnormal values for each are also noted. The ranges provided are reflective of commonly used values. Medical and rehabilitative practice in regard to lab values may vary, so practitioners should become familiar with the specific ranges considered normal in their setting and consult with the medical team to determine when participation in rehabilitation is contraindicated.

TABLE 45.1

Examples of Common Lab Values in the Oncology Rehabilitation Setting and Their Indication for Participation in Rehabilitation Activity

Lab Name	Normal Range	Accepted Values for Participation	Rehabilitation Implications	Other Findings
Platelets	150 k/uL–450 k/uL	140–440 k/uL	<5 K only active assistive movements/no Valsalva maneuvers <20 K active movements >50 K resistive movements Fall risk assessments are paramount when platelets are low	Check for petechiae: a reddish purple rash Check for any active signs of bleeding: nosebleeds, excessive bleeding from cuts, blood tinged sputum, swollen joints, etc. Below 20 K (+) increase risk for intracranial bleed
White blood cells (WBCs)	3.5 k/uL–10.5 k/uL	4–11 k/uL	(+) Risk for infection Neutropenia: absolute neutrophil count less than 0.5 cell/mm^3	Adhere to hand hygiene and infection control policies Patient may present with a fever when neutropenic
Hematocrit	Normal Male: 37%–49% Female: 36%–46%	Male: 40%–54% Female: 37%–47%	<20%: can result in cardiac failure/death <25%: defer therapy 25%–30%: ADL and exercise, as tolerated 30%: can add resistive exercise	Consult with medical team

Radiology and Imaging

Occupational therapy practitioners should consult and review imaging reports such as computed tomography scans (CT or CAT scans), magnetic resonance images (MRIs), ultrasound, or x-rays in the event of acute fractures, **metastasis** (the spread of cancer to another part of the body), or any changes in status that could affect precautions or treatment. These test results may influence the type of testing that the occupational therapy practitioner performs or alter the intervention plan. For example, evidence on an MRI may show new metastatic disease to the brain that would result in more intense cognitive testing. An MRI exhibiting new pathologic fractures could alter activities of daily living (ADLs) that require weight bearing or lifting.

In general, the occupational therapy practitioner should verify blood counts, vital signs, and images before evaluation and treatment. The practitioner should also verify any specific precautions that are associated with the type of cancer before attempting interventions including mobilization, weight bearing, manual muscle testing, or any activities that may have a resistive component.

Occupational Therapy and Cancer: Domain and Process

Because of the variations in types of cancers and the broad-ranging impact of the disease and its treatments, understanding the occupational therapy process and cancer requires consideration of the full domain of occupational therapy and the full scope of the occupational therapy process as represented in the Occupational Therapy Practice Framework.[7] Table 45.2 provides examples applied to Kay, who was introduced at the start of the chapter.

TABLE 45.2

Occupational Therapy Domain and Process in Oncology Rehabilitation

Occupational Therapy Domain	Examples Related to Kay
Occupations	Occupations related to Kay's identified roles of parent, spouse, worker, homemaker, volunteer, sports enthusiast, and religious participant. Physical, cognitive, emotional, and psychosocial factors can affect all areas of occupation including ADL, IADL, rest/sleep, education, work, play, leisure, and social participation.
Patient factors	All areas of patient factors must be considered including values and beliefs about health and illness as Kay confronts the impact of cancer on body functions such as respiration, sensation, cognition, and organ function and body structures such as bone, joints, and muscles.
Performance skills	Depending on the location of the cancer and the effects of treatment performance skills including cognitive abilities, motor skills, process skills, and social interaction skills.
Performance patterns	Kay's habits, routines, roles, and rituals used in the process of engaging in occupations can be disrupted by surgery or the effects of chemotherapy or radiation on level of energy, endurance, interest in continuing in roles, and interacting with others.
Contexts and environments	Cultural, personal, temporal, and virtual contexts can support or inhibit the occupational performance of persons with cancer. The physical and social environment including natural and built environments, objects, and relationships with family members, friends, coworkers, and others must be considered.
Occupational Therapy Process	
Evaluation	Identification of information about the Kay's needs, problems, and concerns.
Occupational profile	Summary of Kay's occupational history, patterns of daily life, interests, values and needs.
Analysis of occupational performance	Using assessment tools to identify the Kay's assets and problems.
Intervention	The skilled services provided by occupational therapy practitioners to facilitate Kay's engagement in occupational performance.
Intervention plan	Guides the actions of the practitioner and the approaches used to achieve the Kay's goals. Putting the intervention plan into action.
Intervention implementation Intervention review	Continuous process of reevaluating the intervention plan to improve outcomes.
Targeting of outcomes	Selecting the results to be achieved through occupational therapy interventions.

Common Assessments Used in Oncology Rehabilitation by Occupational Therapists

In addition to routine assessment of ADLs, instrumental activities of daily living (IADLs), and other areas of occupation through observation of performance, there are specific assessments or categories of assessments commonly used by the occupational therapist in treating the person with cancer. A few examples include the following:

- *Activities of daily living assessment* scales such as the Katz ADL Scale.
- *A-One* is a cognitive assessment that directly links functional performance (basic activities of daily living and mobility) to neurobehavioral deficits including cognitive-perceptual and motor impairments. The A-One is appropriate to use for patients over the age of 16 who present with damage to the central nervous system.
- *Brief Fatigue Inventory (BFI)* is a short assessment of the severity of fatigue experienced over the previous 24 hours and its impact on function.
- *Executive Function Performance Test* is a performance-based standardized assessment of cognitive function available for free in the public domain.
- *Functional Assessment of Cancer Therapy (FACT)* is a general assessment of quality of life.
- *Kettle Test* is a performance-based assessment of cognitive functional performance.
- *Multiple Errands Test (MET)* evaluates the effect of executive function deficits on everyday functioning through a number of real-world tasks.
- *Pain scales* such as rating pain from 0 to 10 where 0 is no pain and 10 is the worst pain imaginable or the Wong-Baker face scale that uses pictures to express “no hurt” to “worst hurt.”

Significant Secondary Conditions Related to Cancer and Cancer Treatment

In addition to problems caused directly by cancer, there are several significant secondary conditions that can be caused by the cancer or cancer treatment (eg, surgery, radiation, chemotherapy). The following are examples of such secondary conditions and brief explanations of the significance for occupational performance.

Cancer-Related Fatigue

The National Comprehensive Cancer Network (NCCN) has defined **cancer-related fatigue** (CRF) as "a distressing, persistent subjective sense of physical, emotional or cognitive tiredness or exhaustion related to cancer or cancer treatment that is not proportional to recent activity and interferes with usual functioning" (p. FT-1).[25] Occupational therapy practitioners can empower clients by helping them distinguish between other types of normal fatigue experienced in the past from CRF, as rest and sleep will only worsen the symptoms, which seems counterintuitive to most people. Clients further need to comprehend that CRF comprise much more than the physical realm. Hann and colleagues described CRF as having four subcomponents that are (1) general fatigue, (2) emotional fatigue, (3) physical fatigue, and (4) mental fatigue.[16] Occupational therapy practitioners play a vital role in helping each patient identify how each dimension directly contributes to CRF as well as strategies for addressing each aspect interfering with daily activity. The incidence of cancer-related fatigue experienced by patients with cancer is difficult to determine as published studies are restricted to prevalence data.[12] However, some studies reveal that CRF is experienced by a majority of patients during the course of treatment and one-third will experience persistent fatigue after treatment is completed.[12] In practice, almost 80% of patients report CRF as the most distressing symptom experienced as it can drastically decrease participation and performance of all occupations, roles, and routines.

CRF profoundly affects the quality of life (QOL) of both patients and their families, including mental, physical, psychosocial, and economic aspects.[12] CRF can result in an altered lifestyle, decreased participation, a decline in performance capacity due to inefficient use of energy, loss of control and identity, impaired volition and motivation, reduced ability to work, reduced self-efficacy, poor QOL, lack of social interaction, and loss of important roles.

All clients should be screened for CRF throughout the continuum of care recognizing that the experience of CRF is unique to each individual. There is no accurate objective report, and the most common measure is patient self-report (ie, using the BFI). It is also important to recognize that symptom severity is not equivalent to the degree to which symptoms interfere with the performance and participation in meaningful activities, therefore what matters is how CRF directly affects occupational performance and participation.[9,20]

Table 45.3 provides examples of each of the types of occupational therapy interventions identified in the Occupational Therapy Practice Framework: Domain and Process that are appropriate to CRF.[7]

TABLE 45.3

Examples of Occupational Therapy Interventions Associated With Cancer-Related Fatigue

Occupational Therapy Intervention Approach	Example
Create and promote	Create educational materials to guide patients in management of cancer-related fatigue or cognitive impairment.
Prevent	Screen for early signs of CRF and educate patients and family members on the potential for the onset of CRF with new treatments.
Establish and restore	Examine daily routines and establish habits and patterns that incorporate rest and exercise to minimize cancer-related fatigue.
Modify	Simplify ADLs and IADLs and add cuing strategies to compensate for cancer-related cognitive impairments such as impaired short-term memory and lowered attention span.
Maintain	Identify occupations and roles important to the patient and prioritize involvement in meaningful occupations that will allow the patient to continue role fulfillment. Use lifestyle redesign approaches to maintain strength, endurance, and mobility during and after treatment.

ADLs, activities of daily living; CRF, cancer-related fatigue; IADLs, instrumental activities of daily living.

Occupational therapy intervention for CRF varies depending on its severity and can include participation in the full range of human occupation. The following are some basic guidelines to follow in interventions for CRF:

- Remain client-centered, use active listening, and use a holistic approach focusing on therapeutic use of self.
- Assess the patient's motivation and volition for performance of occupations and roles.
- Assess all areas of function (physical, cognitive, psychosocial/emotional, etc.).
- Ensure that intervention will include an application of skills and use of occupation rather than remain solely didactic.
- Provide demonstrations and give homework to facilitate carryover of skills and learning.
- Assess response to treatment and indications that treatment or homework is too intense or counterproductive.

Cancer-Related Cognitive Dysfunction

Up to 75% of patients with cancer experience **cancer-related cognitive impairment** during or after cancer treatment with impairments in memory, executive functioning, and attention span. It is estimated that nearly 4 million cancer survivors have some form of cognitive difficulty.[17] Cognitive impairments resulting from cancer-related treatment can vary from subtle to dramatic and can be temporary or permanent. Table 45.4 correlates different treatments used in treating cancer with predicted cognitive impairments.[1]

TABLE 45.4

Common Cancer Treatment Methods and Their Predicted Cognitive Impairments

Chemotherapy	Inattention Lack of concentration Decreased working memory Impaired executive functioning
Radiation therapy	Inattention Decreased memory Impaired executive functioning Impaired visual perceptual skills
Steroids	Behavioral changes Decreased verbal memory Inattention
Sedatives	Decreased level of arousal Delirium Confusion/disorientation

In approaching intervention for cancer-related cognitive dysfunction, the occupational therapy practitioner has several options. These options are presented in Table 45.5. Which approach is used depends on the treatment context and the severity of the impairments experienced by the patient. It is important to note that the approaches are not exclusive and several maybe used throughout the episode of care.

TABLE 45.5

Intervention Approaches for Cancer-Related Cognitive Dysfunction

Cognitive behavioral strategies	Coping skills/relaxation Sleep hygiene and education Self/goal management
Remediation/restoration	Repeated practice of drills, exercises, or activities Relevant real-life tasks Computer-based training
Compensatory skills training	Environment or task modifications Adjustment of task features/sensory cues Involvement of the individual's mental operations; use of imagery
Meaningful functional activity	Promotes and maintains focus; concentration Decreases anxiety Improves psychological well-being

Chemotherapy-Induced Peripheral Neuropathy

Chemotherapy-induced peripheral neuropathy (CIPN) is experienced by patients undergoing treatment with certain neurotoxic chemotherapy agents such as the platinum drugs that cause dysfunction or damage to peripheral nerves, and functional recovery can take months to years depending on many factors.[18] CIPN can present as motor, sensory, autonomic, or mixed impairments and typically follows a symmetric stocking-glove distribution of impairment with the earliest symptoms developing at the fingertips and toes. Common symptoms that impair occupations include tingling, numbness, paresthesia, temperature sensitivity, pain, feeling of wearing gloves and stockings, weakness, and impaired balance.[31] Many patients report the effects of CIPN as painful, disabling, creating significant loss of function, and decreasing quality of life. Overall survival might be effected with dose reductions or discontinuation of treatment when severe symptoms arise.[21]

Standard sensory testing, balance tests, outcome measurements, and functional timed tests to better determine underlying problems related to performance skill deficits are appropriate for the patient with CIPN. Standard sensory tests will help establish a baseline and determine change over time as well as identify which type of sensation is potentially affecting occupational outcomes. It is also beneficial to assess balance and the patient's confidence with activities requiring balance.[10]

Intervention for patients with CIPN include compensation strategies for safety, foot care and proper shoes, strategies to reduce ischemic and thermal injuries and management of symptoms of autonomic dysfunction, falls prevention, and use of assistive devices to compensate for loss of sensation or weakness to promote independence and remain active in daily activities.[31] Activity pacing and gradation of activity is also beneficial as are use of energy conservation techniques to manage muscle fatigue. Exposure to different surfaces during functional tasks (ie, desensitization) can reduce anxiety associated with CIPN.

Cancer-Related Pain

Pain due to cancer is a complex symptom that affects a person's life, including physical functioning, the performance of activities of daily living, psychological, and emotional status and social interactions.[29] It is estimated that 33% to 50% of patients with cancer will experience some level of pain and estimates are considerably higher (over 70%) in patients with advanced disease.[15] Occupational therapy practitioners evaluate the impact of pain on a client's desired activities and quality of life and equip the patient with the skills and strategies to manage the pain. Practitioners must use their skills to validate the patient's pain and work to establish trust.[5,22]

Cancer-related pain and the fear of pain can have a significant negative affect on occupational performance. Strategies to facilitate occupational performance include collaborative activity analysis with patients, graded activities, identifying pain triggers, posture assessment, and visualization or mental strategies to overcome the pain cycle.

Deconditioning in Oncology

Occupational therapy practitioners working with clients in the oncology setting must emphasize the relationship between deconditioning and occupational performance. Deconditioning is best understood as a loss of functional capacity due to lack of activity, which is multifactorial in nature. Deconditioning, as associated with disease process and cancer-related treatments, can have a dramatic impact on quality of life. Additionally, deconditioning is often associated with poor responses to cancer-related treatments and, subsequently, poor survival. The literature also suggests that the mechanism for fatigue may be related to a "vicious circle between fatigue, physical inactivity, and deconditioning."[33] Occupational therapy practitioners can help individuals combat this cycle through mobilizing activities such as eating meals sitting up instead of lying in bed, walking to the bathroom instead of using a bedside commode, and performing simple ADLs while standing and walking short and safe distances.

Cardiovascular and Pulmonary Considerations

In the oncological setting, the occupational therapy practitioner must consider cardiovascular and pulmonary status as it relates directly to the client's occupational performance. The clinical picture becomes complex in oncology as the relationship between cardiovascular and pulmonary performance and activity tolerance are so tightly linked. Exercise tolerance is affected by a number of factors, including tumor burden, anticancer therapies, salvage surgical resection, and pleural effusion, to name a few. Baseline pulmonary and cardiovascular impairments must also be considered, as patients with cancer are typically older. Inactivity, as is commonly seen in these patients, can cause profound muscle atrophy, as well as a decline in cardiac performance. Physical activity, including occupational engagement and exercise, has been shown to increase cardiovascular and pulmonary measures as well as reduce fatigue, resulting in strong implications for the efficacy of skilled occupational therapy intervention in this patient population.

Psychosocial Issues (Body Image, Depression, Anxiety)

The individual diagnosed with cancer is faced with many psychosocial challenges such as distress starting at initial diagnosis and often lasting throughout survivorship. The word *cancer* is often associated with a "life-threatening" disease, although it is more recently referred to a chronic illness in the field of medicine. Beyond thoughts of death, clients begin to worry about how the diagnosis and treatment will affect not only their own occupational performance but also that of family and friends. Lyons suggested, "The awareness of mortality and resultant uncertainty can create tension in the lives of those with cancer." There are many effects of psychosocial challenges on everyday occupations including but not limited to altered or disrupted roles, routines, and habits; changes to social contexts; negative emotions, loss of control and identity; impaired motivation; and decline in quality of life.[19]

Body image and self-efficacy is a common psychosocial issue experienced by patients with cancer secondary to unavoidable changes to appearance and decline in function. Body image is a complex concept that goes far beyond one's experience of physical appearance. Body image is further defined as a multidimensional construct that involves perceptions, thoughts, feelings, and behaviors related to the entire body and its functioning.[13]

Moreover, Zabora and colleagues stated that 60% of cancer patients suffer psychological distress.[34] Distress can be defined as a multifactorial, unpleasant emotional experience of a psychological, social, or spiritual nature that interferes with effective coping.[26] Some literature, however, estimates that the proportion exceeds 60%, which is often what is seen in practice. Many individuals who are referred for occupational therapy services experience a higher incidence of psychosocial challenges, most likely secondary to a decline in function and occupation-based activities, than clients who are never referred to occupational therapy.[10] Occupational therapy practitioners are well suited to meet these psychosocial issues and trained to assess the needs of the whole person in different environments and contexts, which includes any psychosocial issues interfering with occupational performance and participation.[5]

Occupational therapy intervention for psychosocial issues can include adaptations to the physical and social environment to promote occupations.[5] The focus of intervention can include the following:

- Stress management and coping strategies to increase one's sense of control
- Relaxation techniques, guided imagery, and breathing techniques as part of a personal plan to manage anxiety
- Lifestyle management and redesign
- Cognitive behavioral techniques and adaptive solutions to practical problems
- Positive lifestyle change and adoption of healthy behaviors
- Interventions related to disturbance in body image
- Psychosexual therapy focusing on communication training, sensate focus, and body image exposure
- Expressive-supportive therapy focusing on expression of thoughts and emotions, receiving and offering support, coping skills
- Educational interventions including information disseminated in lecture formats to increase knowledge on disease and treatment with the aim of increasing self-efficacy

Although it is easy to direct the clinical eye to physical changes and manifestations of cancer, the occupational therapy practitioner working in oncology must have a keen awareness of a number of detrimental effects on occupational performance and participation that are not observable, namely anxiety and depression. People with cancer and their families experience a substantial amount of psychological morbidity. Depression and anxiety can impact functioning, quality of life, and survival. Tang and colleagues noted that cancer patients, especially in terminal cases, are predisposed to depressive symptoms as a result of progressive functional decline, accelerating symptom severity, deteriorating social support, and a self-perceived burden to others.[32] Pain associated with treatments is also correlated to depression and anxiety. Typical assessments found and utilized in the oncology setting to measure these issues include the Hospital Anxiety and Depression Scale, the Beck Depression Inventory (BDI), and the Beck Anxiety Inventory (BAI).

Lymphedema

Lymphedema, a condition caused by inadequate drainage of lymphatic fluid, is a common secondary condition associated with some forms of cancer treatment. Lymphedema is most commonly associated with breast cancer but can be seen with other forms of cancer, including lymphoma. There are multiple causes of inadequate lymphatic drainage, including blockage of lymphatic flow by a tumor, scarring and inflammation of the lymph nodes and vessels following radiation therapy, and surgical resection of a lymph node or multiple lymph nodes. Lymphedema can occur in the head and neck region but most commonly occurs in the arms or the legs. Scrotal edema also can occur post-surgery.

According to the American Cancer Society, lymphedema can begin soon after surgery or radiation but can also appear many years after treatment, and cancer survivors should be educated to the fact that they will remain at risk for lymphedema throughout their lives.[2] Eighty percent of individuals experience an onset of lymphedema within 3 years of surgery; the remainder develop edema at a rate of 1% per year.[28] O'Toole and colleagues[27] note that lymphedema can have significant functional implications, and increased attention has been given to lymphedema with increased survivorship. Treatment approaches for lymphedema include gentle exercise paired with diaphragmatic breathing, compression garments and lymphedema wrapping techniques, manual lymphatic drainage, pneumatic compression, and complete decongestive therapy (CDT). Certification in the management of lymphedema is available to both occupational therapy practitioners and physical therapy practitioners.

Palliative Care and Hospice

Palliative care and **hospice** are closely related. In both situations practitioners intervene with persons facing life-threatening illnesses. The official American Occupational Therapy Association document, "The Role of Occupational Therapy in End of Life Care," states the following:

Palliative care differs from hospice care in that it can be initiated at any point in the course of the patient's illness. Curative care interventions also may be used within the context of palliative approach, whereas curative services are not provided when a patient is receiving hospice care. A patient receiving palliative and curative services simultaneously may transition to a hospice service when curative therapies are no longer appropriate or desired and the end of life is more imminent.[6] (p. S67)

A key element of occupational therapy practice in palliative care and in hospice is remaining client centered and providing occupation-based intervention. The occupational therapy practitioner in hospice collaborates with the patient and the patient's family to identify goals and to assist the patient to remain self-determinant. Because persons with cancer may be under hospice care for a short time before death or for many months, and because hospice care is provided on an inpatient basis and at home, patients may wish to continue to perform occupations across the spectrum of occupational roles including worker, home manager, parent, spouse, religious participant, and others. The occupational therapy process is the same with the patient who is dying as it is with any other occupational therapy patient. Even those who are faced with imminent death typically have goals and wish to remain in control and self-determinant.

Summary

The number of cancer survivors is growing significantly and persons with cancer have rehabilitation needs including needs for occupational therapy intervention during and following active treatment. Cancer can result in a range of problems that affect occupational performance including cancer-related fatigue, cancer-related cognitive dysfunction, pain, cancer-induced neuropathy, lymphedema, depression, and a range of psychosocial issues related to body image, reproduction, and identity.

Although many persons with cancer may be able to physically perform basic ADLs and IADLs, the effects of cancer and its treatment such as surgery, radiation, and chemotherapy can be devastating. Occupational therapy assessment and intervention should be comprehensive and identify the full range of factors that are influencing occupational performance. Strategies including but not limited to energy conservation, work simplification, compensatory strategies for decreased attention or memory, prevention of edema and lymphedema, and to address psychosocial issues including body image and sexuality are appropriate.

Comprehensive oncology rehabilitation by the occupational therapy practitioner begins with an evaluation of occupational performance and the development of the occupational therapy profile. Remaining patient focused, theory driven, and evidence based during the intervention planning and implementation phases will help to ensure positive outcomes.

Review Questions

1. What are the most common forms of cancer in men and women, and what is the likelihood of experiencing cancer during one's life?
2. What are common treatment approaches for cancer, and how can they impact the occupational performance of persons with cancer?
3. Why is occupational therapy intervention for persons with cancer medically complex?
4. What areas of specialty and advanced knowledge must the occupational therapy practitioner have when working with persons with cancer?
5. What are common approaches to assessment of occupational performance in the person with cancer?

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Suggested Readings

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American Cancer Society. www.cancer.org.
Cancer Hope Network. www.cancerhopenetwork.org.
Coping with Cancer Magazine. www.copingmag.com.

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Special Needs of the Older Adult*

Samia Husam Rafeedie

CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Describe the importance of wellness and productive aging for the baby boomer generation.
2. Describe what an occupational therapist can do to help an older adult to age in place.
3. Identify the policies established for older adults in the United States and how they impact service delivery.
4. Describe the therapeutic benefits of utilizing occupations as a primary modality with older adults.
5. Describe how the learning needs and styles of older adults may differ from those of younger persons.
6. Describe the accepted theories of how aging occurs.
7. Describe how mental functions may change as a person ages.
8. Identify basic age-related changes in sensory functions and body structures.
9. Identify basic age-related changes in neuromusculoskeletal functions.
10. Identify basic age-related changes in cardiovascular, hematologic, immunologic, and respiratory functions.
11. Identify basic age-related changes in voice and speech functions; digestive, metabolic, and endocrine functions; and genitourinary and reproductive functions.
12. Identify basic age-related changes in skin and related structure functions.
13. Describe the concept of "flipping a nursing facility" and facilitating a paradigm shift with clients and colleagues alike.

KEY TERMS

Aging in place
Allostatic load
Andropause
Mild cognitive impairment
Old-old
Productive aging
Senescence
Shared governance

Threaded Case Study

Doris, Part 1

Doris has been an assistant to a local certified public accountant (CPA) for decades and is responsible for the bookkeeping and bills in her home. She enjoys sending e-mails on her personal computer and playing the piano. In fact, Doris was a piano instructor for many years and enjoyed teaching the young people in her neighborhood as a side job. Her husband, Don, says that this was the only thing that kept her going prior to her most recent fall. Doris is a 79-year-old mother of two, grandmother of four, and great grandmother of two who lives in Indiana with her husband of 55 years.

Doris and Don have recently moved into a senior living community right behind the skilled nursing and rehabilitation facility where she was admitted for 1 month following an incident at home where she fell and could not be assisted by her husband, who also has medical complications with his heart. Doris' family became concerned after recent falls at the new apartment, and Doris showing signs of increased forgetfulness and bouts of confusion. She was recently diagnosed with senile dementia–Alzheimer's type and has a past medical history of hypertension, spinal stenosis, diverticulitis, osteoarthritis, laser eye surgery, and a colonoscopy. Her admitting diagnosis is right hip fracture.

Doris' occupational therapy evaluation took place at bedside with her husband present. She required supervision for feeding and maximum assistance with grooming and bathing activities; she also required maximum verbal cues for thoroughness and attention to detail. Doris required supervision for upper body dressing and minimal assistance for lower body dressing and toileting. She required stand-by assistance for bed mobility and minimal assistance for all other activity of daily living transfers with the use of a front-wheeled walker. She was oriented ×2 (to her name and situation) and could follow simple directions. Her long-term memory and short-term memory were impaired. Upon observation, her oculomotor skills and visual fields appeared intact. However, she had two pairs of glasses; one pair was for reading and one was for distance, but she was uncomfortable with both pairs and said she was waiting for a new pair from her doctor. Range of motion was within normal limits in the bilateral upper extremities. She demonstrated good (4/5) manual muscle grades throughout both upper extremities and is right-hand dominant. No apparent tone impairments were noted, and she had no complaints of pain at the time of evaluation. Fine motor and gross motor coordination appeared within functional limits for both upper extremities. Minimal edema was present in both lower extremities.

Critical Thinking Questions

1. What intervention activities might be used to support engagement in meaningful occupation while Doris is at the rehabilitation facility?

2. What are the areas of concern with Doris' caregiver and home situation?

3. How will Doris' current and past medical history complicate the rehabilitation process?

Introduction

Occupational therapy practitioners have a unique opportunity to be at the forefront of healthcare delivery to our society's older adults. Occupational therapy's holistic and client-centered approach highlights strengths and resources as well as supports the complex and challenging physical, social, cognitive, and emotional changes experienced by this population. These changes may impact occupational independence, as well as participation in meaningful activity; therefore a careful and thorough approach to assessment and intervention is required to meet the needs of our aging population.

Americans born between 1946 and 1964 are members of the baby boom generation, and this cohort turned 65 years of age in 2011.[32] Chop estimates that from this time on, “approximately one American will turn 65 years of age every 8 seconds for the next 18 years” (p. 2).[32] In 2010, the U.S. Census Bureau reported that nearly 40.3 million people, representing 13% of the total population, belonged to the baby boom generation. Werner reported that more people were 65 years of age and over in 2010 than in any other census reporting period,[159] and this population increased at a faster rate (15.1%) than the total United States population (9.7%). By the year 2030, it is estimated that 22% of Americans (70.2 million) will be 65 years of age and older.[32]

Another fast-growing population of interest for occupational therapy is the group older than 85 years of age. This cohort is referred to as the **old-old** and is expected to increase from 5.5 million in 2010 to 6.6 million in 2020 (19% increase) according to Chop.[32] Opportunities for occupational therapy are also presenting themselves on the global scale with an estimated 1.3 billion people in the 65 years and older bracket worldwide. For the first time in history, people over 65 years of age will outnumber children under the age of 5, and according to Chop,[32] this will likely happen between 2015 and 2020.

These population trends demand special attention as occupational therapy practitioners work with older adults in a variety of settings including, but not limited to, home healthcare, assisted living, skilled nursing, inpatient rehabilitation, outpatient clinics, community health programs, adult day programs, and extended care facilities, as well as in palliative care. Not only will the role of occupational therapy in healthcare support the aging population with physical disabilities, but occupational therapy is also positioned to address aging in place, wellness, and prevention.

This chapter highlights the unique contributions occupational therapy practitioners can make when working with older adults who may have physical limitations but who are also getting older and experiencing the many developmental and biopsychosocial (biologic, psychological, and sociologic) changes that naturally occur from the moment a person is born. The third edition of the Occupational Therapy Practice Framework (OTPF)[5] is utilized as a foundation to paint a comprehensive picture from a top-down approach, starting with wellness and productive aging, then moving to occupation and participation in meaningful activity and, finally, highlighting body functions and structures that have the potential to physiologically decline as a person ages.

Wellness and Productive Aging

Improvements in healthcare technology and lifestyle have positively impacted the lifespan with people now living longer and healthier lives as a result of **productive aging**.[22] According to the National Institute on Aging,[108] people are living longer. In 1970, people were expected to live approximately 71 years, but this number has been on the rise. In 2008, the average life expectancy was 78 years of age, and moving into 2020, the U.S. Census Bureau[147] projects that this number will rise to almost 80 years, on average. Given this increase in life expectancy, the myths of aging would have society believe that with age comes disability and limitations, but this is not necessarily true.

Important information regarding nutrition, exercise, and health management can be accessed instantly by way of smart phones, computers, and other personal electronic devices. Older adults do experience problems with health if the body is not taken care of over time. The National Institute on Aging[108] reports that problems with health can arise if the body has been subjected to overeating, poor nutrition, and lack of adequate exercise and activity, as well as exposure to toxins (such as drugs and alcohol); therefore preventive measures are critical for the older adult population.

Healthy People 2020 includes a goal for improving the health of all Americans and strives to encourage collaborations across communities, empower individuals to make informed health decisions, and measure the impact of activities associated with prevention.[59] A gerontological approach is reflected in the work this organization has developed for older adults, including socioeconomic and lifestyle-related influences on health. Healthy People 2020 highlights the importance of independence and vitality with aging and uses a health-oriented approach rather than a disease-oriented approach. According to Healthy People 2020, common complaints experienced frequently by older adults include joint stiffness, weight gain, fatigue, loss of bone density, and loneliness. The research presented by this organization also indicates that these conditions can be prevented, or even eliminated, with activities such as exercise, stress management, nutrition counseling, and substance control.[22]

Occupational therapy practitioners work with older adults on all aspects of their lives so that they are ready to face the challenges ahead as they work to age in place and participate fully in life. With the holistic perspective occupational therapy brings to the table, it is essential that the field addresses promotion of health at both the individual and the community level. The basic tenets of occupational therapy have always helped with identification, realization, and change in the person, the occupation, or the environment in an effort to enhance participation and quality of life.[160] Community-based practice will be critical as more and more baby boomers require services. Occupational therapy practitioners have opportunities for employment in senior centers, community centers, and skilled nursing facilities where innovative programs can be designed and implemented.

An example of an innovative program developed by occupational therapists includes Farewell to Falls. Farewell to Falls is part of a fall prevention program developed at the Trauma Service of Stanford University Medical Center. According to Corman,[37] best practice in fall prevention should include a multifactorial risk assessment and intervention, with a focus on home safety and modifications,[96] medication management, and regular exercise. The development of this program also included best opportunities for patient compliance with suggestions related to behavior change by way of individualized assessment and home-based intervention.

The Home Safety Council and National Council on Aging named this program as one of the ten best programs nationally with respect to providing "creative programs and practices in home assessment and modifications" (p. 206)[37] in March of 2007. The program is designed to send an occupational therapist to a patient's home for two visits in order to complete a health and daily living skills interview, as well as a safety checklist and sensory-motor assessment. A basic fall prevention screening is completed, and simple home modifications are recommended. The program will even cover the cost of some modifications, such as grab bars. A pharmacy resident participates in the initial home visit to review medications and provide information on drug interactions and side effects. During the second home visit, the occupational therapist reviews the pharmacy-prepared medication report and prescribes an individualized exercise program for the patient. Patients receive a follow-up phone call once per month to encourage compliance, and after the first year of the implementation an occupational therapist reevaluates the patient during a home visit.[37]

Another example of an innovative program designed by occupational therapists and occupational scientists is the Lifestyle Redesign intervention,[68] which enables participants to, "infuse sustainable, personally satisfying, health-promoting activities into daily life" (p. xiii).[33] In a groundbreaking study, the USC Well Elderly Study[34] demonstrated in a dramatic way that occupational therapy intervention, based on sound occupational science principles, was more effective than other types of group activities and beneficial overall to older adults. During the 9-month study period, participants were randomly assigned to the Lifestyle Redesign intervention, a social activity control group, or a no-treatment control group. Participants who were assigned to the Lifestyle Redesign intervention group maintained or improved their health-related quality of life and life satisfaction.[68] These changes were a direct cause of involvement in the specific occupational therapy intervention, not merely involvement in busy work, or social activity.[33] In the profession's earliest days, occupation was seen as health promoting and necessary for a productive and satisfying life.[112]

Aging in Place

Aging in place is a phrase utilized in healthcare, among policy makers and advocacy groups, meaning to continue to live in the community, with some level of independence, rather than moving into an institution or care facility.[39] With the rise of healthcare costs and the increase in the number of older adults, the cost of healthcare programs has risen to staggering levels.[22] According to the Centers for Disease Control and Prevention (CDC), the national health expenditures as a percentage of the gross domestic product for national health programs (ie, Medicare, Medicaid, veterans' medical care) increased from 0.4% in 1962 to approximately17.4% in 2013.[27] Older adults with declining health spend more money on long-term institutionalization care than on any other kind of healthcare.[22]

The cost for long-term care varies by state, but on average, it costs $87,000 per year for a semiprivate room. It is estimated that by 2030, the cost for institutionalized care will grow to $190,600 per year.[22] This is a cost that few older adults will be likely to afford and is therefore not a realistic option when extensive medical care is needed. A person's health and well-being is strongly connected to the environment in which that person lives. Older adults who are physically and cognitively able to stay at home prefer to do so; however, those with physical or cognitive limitations, as well as other complex medical conditions, may need assistance or a more supportive environment.[124] The National Conference of State Legislatures and the American Association of Retired Persons (AARP) reported that 90% of seniors wish to stay at home as they age, and even if these older adults require some sort of assistance or ongoing healthcare during retirement, 83% would prefer to stay in their homes.[104] A small number of seniors prefer to move to a care facility (9%), and an even smaller percentage (4%) prefer to move in with a family member (2011). The AARP published an executive report highlighting policies that integrate land use, housing and transportation, efficient delivery of in-home services, provision of transportation options, and improvement of affordable and accessible housing to prevent social isolation.

Wanting to age in place is based on the accumulation of memories, habits, roles, and routines, or what may be described as the context or the environment. A number of helpful web-based resources focus on older adults and aging in place, as well as a number of services that can be utilized by older adults and occupational therapy practitioners working in the community. A growing number of developers and contractors use universal design principles in new construction and have an overall goal of creating aging-friendly communities—places where all areas of community are accessible and user-friendly for older adults and people with a variety of abilities and disabilities. Many housing alternatives are available for older adults to age in place, with the idea being that aging in place relates to the preferred place of residence. When there is a good person-environment fit, a person is more likely to increase or maintain occupational performance. This environment can be a single-family home, an apartment, an assisted living senior complex, or with family.

Until residences are more accessible, evaluations for home modification will continue to be an important part of occupational therapy intervention. Whether it is an actual onsite evaluation or a review of the home and community by report, evaluation of context is important when looking at the whole person. When performing a home evaluation, it is important to look at the fit between the person and the environment and then consider what modifications or services can help a person age in place. It is also critical to look beyond the physical and cognitive to the psychosocial, financial, and support-related change.

There are empowering movements in the community that support older adults who wish to maintain their independence and stay actively engaged in meaningful activity. One such movement is known as the Village to Village Network[153] and was developed to promote aging in place to foster a person's ability to continue to live in his or her home as safely, comfortably, and independently as possible, regardless of age, income, or ability level. The promoters of this network believe that older adults who are empowered can take control over their own lives, and as a cohesive and collective group, they can design and implement the future they desire for themselves.

A similar movement is the Green House Project, which has been growing since the early 2000s. Organizations are running successful Green House homes in a variety of settings, including skilled nursing facilities, assisted living centers, short-term rehabilitation centers, veterans' homes, and memory care facilities. On the Robert Wood Johnson Foundation (RWJF) website, this project is described as “a revolution in long-term care, creating small homes that return control, dignity, and a sense of well-being to elders, while providing high-quality, personalized care.”[121] Older adults are living happier and healthier lives, according to the research conducted by the RWJF. This is an alternative to traditional nursing homes and provides opportunities for older adults to contribute to the everyday operational tasks of the home, to engage in purposeful activity, and, most important, to age in place.

Occupational therapy practitioners have an important opportunity when working with older adults in community-based settings or healthcare facilities. The field thrives on empowering clients through meaningful occupations and “engagement in enjoyable and productive activity is paramount to productive aging” (p. 263).[124] Teaching our clients, caregivers, and colleagues about advocacy and empowerment changes perspectives and shifts attitudes in traditional medical settings, like skilled nursing facilities. There is an organizational structure known as **shared governance**, which is a nursing-derived concept that can lend a great deal to occupational therapy practitioners who are in leadership positions or seeking leadership opportunities in interprofessional settings. The emphasis is on a nonhierarchical matrix that disseminates accountability and decision making to front-line staff[36] working directly with residents, patients, clients, or elders in the various healthcare settings. Transforming the leadership style in health facilities with one of shared governance has many benefits, according to Myers and colleagues.[100] Some of these benefits include overall patient satisfaction, improved patient outcomes, improved patient care, increased staff morale, increased job satisfaction (leading to staff retention), personal and professional growth and development, increased staff autonomy and decision making, and improved communication among interdisciplinary team members. All of these benefits support a culture for aging in place and “flip” the very traditional (and at times, stigmatized) perception of a nursing home into a client-centered and occupation-based program where clients and clinicians equally thrive.

Clinicians are expected to be good stewards of limited resources, promote a positive work culture, and use best evidence when working with patients, caregivers, and colleagues through a lens of shared governance.[100] Occupational therapy practitioners are the experts of occupational analysis, occupational balance, and wellness. Therefore incorporating meaningful activity into an intervention should remain at the forefront of what occupational therapy practitioners do—provide therapeutic intervention based on everyday activities or occupations.

Occupations

Activities of Daily Living

Completion of activities of daily living (ADLs) is a significant component of independent living for older adults. Continued participation in the basic self-care tasks and routines followed by older adults is also viewed as critical in avoiding disability.[116] According to Robnett and O'Sullivan, 88% of people age 75 and older are independent with basic ADLs.[124] In a study by Jacobs and colleagues,[69] functional status declined progressively according to age with a trend from independence at age 70 to difficulty in performing ADLs at age 78, to dependence in performance by age 85. The study consisted of following a longitudinal cohort with a representative sample of 1861 people born between 1920 and 1921.[69]

According to Keeler and colleagues,[76] functional status has a dramatic impact on life expectancy, with declines in both ADLs and mobility resulting in decreased life expectancy and the remaining years of survival categorized as living with a disability. In fact, an association was identified between unmet needs for assistance in one to two ADLs and 1-year mortality, revealing a greater risk for mortality among older adults with mild disability.[58]

Of particular interest for the older adult population are the ADLs of feeding and swallowing and the connection between nutrition and chronic conditions. According to Thompson, approximately 15% of the older adult population living in the community and 50% of hospitalized older adults are malnourished, and the incidence of chronic disease in this population is high, “with 80% of older adults having at least one chronic disease and 50% having at least two” (p. 192).[144] An occupational therapy practitioner may consider several factors when weight loss or malnourishment has been identified as an issue. An individual who has been losing weight could have difficulty chewing because of poor dentition or ill-fitting dentures.[2] The death of a spouse or friend could impact appetite or a feeling of isolation during mealtime, limiting caloric intake.[62,144] An older adult may also have difficulty sitting comfortably at the table or maintaining safe posture required for feeding and swallowing. Older adults may also be losing weight because of difficulty preparing meals, transporting food within the kitchen, grocery shopping, or getting to the store or restaurant.

An older adult's ability to engage in functional mobility will impact other ADLs, including toileting and issues of continence. The likelihood of incontinence increases with age; Kuchel and DeBeau[82] reported that 23% of people who are 60 to 79 years of age and 32% of people 80 years of age and older are diagnosed with incontinence. Both men and women experience incontinence and may not feel comfortable initiating a discussion upon evaluation; however, the clinician can broach the topic in a sensitive manner. Quality of life, self-esteem, and self-concept may be affected by incontinence.[82] Treatment sessions can address management within the scope of ADLs, in collaboration with nursing and the physician. A referral to a specialist may also be warranted. It should be noted that side effects to medications impacting balance or cognition, access to toilets, and functional impairments (including the ability to transfer independently) are of concern for older adults living with this condition.

Incontinence and functional mobility impairments are also essential when addressing sexuality with the older adult population. Not only are physical abilities and limitations taken into consideration, but a number of chronic mental and psychological disorders, chronic illnesses and medication side effects, gender-specific health concerns, and lifestyle changes experienced over the lifespan should be taken into account.[63] According to Hillman,[63] only recently has society viewed aging and sexuality as an important topic that deserves attention from a clinical perspective. In her work, Hillman highlighted what clinicians can expect when working with baby boomers regarding sexuality and aging. Older adults may seek support for sexual dissatisfaction through medical and psychological treatment. Sexual disturbances may be a result of underlying interpersonal problems, which reflect changes in family structure over the course of time, such as divorce, stepfamily members, and multiple marriages. Eating disorders, institutionalization, openness to diversity, less traditional gender roles, and the influence of the Internet and related technologies will also impact the aging population seeking professional services.[63] This is an important area of human interaction and life satisfaction, and also a sensitive discussion to have with an older client. Should the client wish to engage in discussion, open-ended questions and a comprehensive occupational therapy intervention are encouraged. The extended PLISSIT model (Permission, Limited Information, Specific Suggestions, Intensive Therapy), or Ex-PLISSIT, extends the original model developed by

Annon,[9] which was a conceptual scheme for the behavioral treatment of sexual problems. By emphasizing the importance of explicitly obtaining permission during every phase of an intervention geared toward sexuality and rehabilitation, the Ex-PLISSIT model is a more contemporary approach available to practitioners.[142] The reader is referred to Chapter 12 on sexuality and physical dysfunction as well as the work of Kontula and Haavio-Mannila,[81] Bauer and colleagues,[16] and Hinchliff and Gott[64] for more research, clinical relevance, and adaptive approaches related to this topic.

Adaptive approaches with functional mobility should always be assessed carefully because many older adults experience changes in this area. An older adult may use an assistive device for mobility, although it may not be used all of the time. Sometimes individuals are self-conscious in public and may use a cane or walker only at home.[119] Others feel comfortable walking in their home environment or using the furniture to help maintain their balance but will use a device when walking long distances. It is important to ask each client about a variety of situations to ensure an understanding of how the client maneuvers in different settings, as prevention of falls is critical for this population. See Chapter 11 for information on individual and community mobility.

For older adults, falls are a major cause of "premature death, physical injury, immobility, psychosocial dysfunction, and nursing home placement" (p. 194).[145] Falls are more prevalent in the adult population who are 65 years and older, with one out of every three adults falling at least once per year.[124] Having one fall will increase the risk for an older adult to fall again, and alarmingly, among older adults, falls were considered the leading cause of fatal and nonfatal injuries in 2013, according to the CDC, with about 25,500 older adults dying from unintentional fall injuries.[28] In 2013, the CDC also reported 20% to 30% of older adults who experienced a fall also acquired injuries such as head trauma, lacerations, and hip fractures, costing the United States healthcare system approximately $34 billion when adjusted for inflation. As Leland and colleagues stated, "Falls are a serious public health concern among older adults in the United States" (p. 149)[85]; therefore occupational therapy practitioners should assess and intervene accordingly based on current evidence and practice guidelines. More information can be found through publications by the American Occupational Therapy Association (AOTA),[4] American Geriatrics Society (AGS), and the British Geriatrics Society (BGS) for specific algorithms and intervention approaches for older adults in the community, those living in long-term care facilities, and those with cognitive impairments.[3]

Instrumental Activities of Daily Living

Contrary to common belief, over 80% of people 75 years of age (and older) are free of functional limitations requiring assistance for instrumental activities of daily living (IADLs), according to Robnett and O'Sullivan.[124] Performance of IADLs is a factor in determining whether a person can continue living at home independently and should therefore be addressed when working with an older adult client. Difficulty in performing IADLs is associated with poor self-efficacy and decreased quality of life.[111,133] A change in performance of home management skills is sometimes the first sign that a person needs assistance in the home, and this may trigger considerations for moving into a family member's home or another community-based setting like assisted living.[52]

Living in the community requires a means of transportation, whether it is driving or utilizing public transportation. Maintaining the ability to drive is critical for older adults in that it allows the freedom they desire, and it promotes healthy aging and access to community resources, including shopping centers, medical appointments, and visiting friends and family.[53] According to the CDC, there were nearly 36 million licensed drivers in the United States who were 65 years of age or older in 2012,[30] and it is estimated that there will be more than 40 million older adult drivers by 2020.[106] The risk for accidents and injuries while driving increases with age, making the need for occupational therapy practitioners greater with this population. Occupational therapy practitioners can intervene at many levels, including in the areas of vision, cognition, functional mobility, and upper extremity strength, among others (Fig. 46.1).

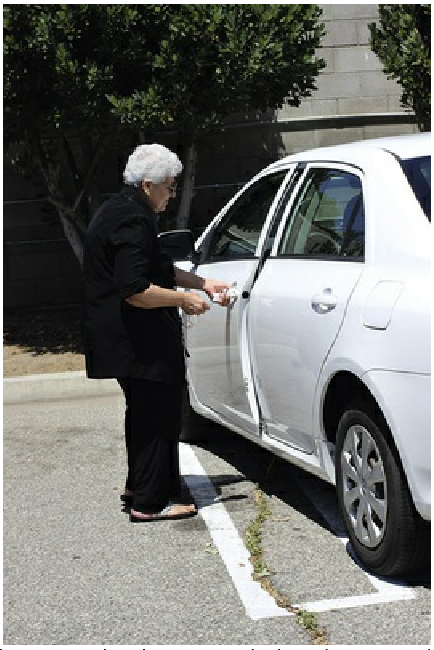

FIG 46.1 An older adult driver accessing the community in order to complete daily tasks. (Photo courtesy Ramez Ethnasios.)

According to Rosenbloom,[125] older adults are not likely to use public transportation when they turn 65 years of age; they prefer to continue to drive or use private cars. Public transportation has traditionally been utilized by those who are commuting to work and underutilized by this population for many reasons, including cost, accessibility, and a fear of being stigmatized.[125] In fact, the National Council on Disability (NCD) stated that some people with disabilities cannot work, even though they would like to, and completing basic IADLs such as shopping or visiting friends becomes a challenge due to a lack of safe and reliable transportation options.[105] Safety is paramount in the area of transportation and driving, as well as in the home.

Safety when functioning in the home is a primary concern and should be addressed on multiple levels. Common factors to assess include vision (particularly in the areas of visual acuity, contrast sensitivity, glare sensitivity, adaptation to the dark, and visual field cuts), whether sufficient lighting and contrast are available for the older adult to be able to see, whether the home is in good repair, whether the person can move around the environment successfully, whether the neighborhood is safe, and whether the older adult is cognitively intact to understand whether risks are present. Doris and Don recently moved into a new home and while they continue to unpack and organize personal items, the living space is cluttered with boxes and stacks of books, magazines, and clothing. This is creating a fall risk for Doris and limits the space in the hallways and rooms for safely using her walker. Doris has been diagnosed with Alzheimer's disease, so she is disoriented at baseline and the new living space further confuses her when she tries to use the bathroom in the middle of the night. Clearing a pathway in the hallway and removing items from the floors will decrease Doris' fall risk and promote functional mobility. The possibility of utilizing a bedside commode should also be discussed with both Don and Doris.

Other factors affecting a person's ability to safely remain in the home is pain. Pain can decrease mental flexibility, which includes immediate and delayed memory, as well as language; and it can also decrease physical functioning.[74,157] Depression can influence cognitive processing and has been associated with cognitive decline,[162] and older adults should be screened upon evaluation when assessing safety in the home. Once the physical portion of the home evaluation is completed with the particular client in mind—including abilities and inabilities—it is time to address components that are important to aging in place that can be considered part of the extended context or the environment. What services are available in the community? How can the person access these services? Is the person willing and able to access them? Is the person socially isolated? Does the person drive despite not being able to see well enough or not being cognitively intact? Can modifications be made to the routine that will keep the client safe and socially connected? What are the client's social supports? These are just a few of the many questions that a clinician needs to start asking when evaluating a client with regard to aging in place and safety in the home.

An occupational therapy practitioner may consider any of a number of home evaluations. Some of the home evaluations are based on performance and some are based on the physical characteristics of a home only. Psychometrically sound evaluations include the Safety Assessment of Function and the Environment for Rehabilitation,[86] the In-Home Occupational Performance Evaluation,[135] and the Home and Community Environment Assessment.[77] See Chapter 10 for an example of a home evaluation. A home evaluation was completed at Don's and Doris' home using the facility's home assessment form to capture information and make recommendations. It was decided that Doris would benefit greatly from a bedside commode for use during the middle of the night, to avoid walking to the bathroom. A shower chair was also recommended, as well as a long-handled bath sponge. Doris did not like using the long-handled reacher and decided she did not need that "gadget." Don was tasked with asking their oldest daughter for help unpacking and clearing the hallways and floors, and Doris agreed to allow their oldest daughter to help with finances until Doris and Don were "back on their feet."

Community-based occupations, such as taking a grandchild to school, going to the pharmacy, or shopping at a department store, can be intimidating to an older adult who has experienced a change in health status. Health management and maintenance is a critical area to explore, as is participating in religious and spiritual activities and expressions as a part of an intervention plan in the area of IADLs.

Illness, chronic disease, or injury can lead to limitations to IADLs, making it difficult for older adults to remain at home.[59] Older adults have the same responsibilities younger adults have, such as caring for pets, caring for a spouse or loved one, or child rearing. According to Brossoie and Chop,[22] there is a recent trend in grandparents raising their grandchildren. In 2010, the United States Census Bureau reported approximately 2.5 million grandparents claiming responsibility and providing basic needs for their grandchildren. This can become an enjoyable, rewarding, yet challenging responsibility, with financial restrictions, taking on new social roles, and coping with any social stigmas attached to the grandchild's parents, who are unable to care for their children.[22] Financial management is an area for occupational therapy assessment if an older adult client is a caregiver for a grandchild, particularly if the person is retired and has a limited income. Safety and emergency maintenance and preparedness should also be considered, such as having a list of emergency contacts and knowing what to do in case of a natural disaster.

Becoming a caregiver for an adult family member or friend is also a reality with the older adult population. The responsibilities often occur in a slow and progressive manner, and the full extent of functional decline is not realized by the caregiver or the person receiving the care.[102] For many caregivers, the initiation of services is subtle and not many other family members will recognize how much support the caregiver is providing to a spouse until it becomes a full-time job. Care recipients wish to stay as independent as possible and try to decline this care from loved ones and family members, until they reach a point where they simply cannot function without the support. In the United States, the trend is for the oldest daughter (or daughter-in-law) to provide assistance with basic ADLs and IADLs, whereas the son typically manages the finances and estate affairs. Other family members are also called upon for help, and certainly many offer to help.[22]

In many families, a child is not aware of the habits, roles, and routines of an aging parent until a health issue arises and a parent needs physical assistance in the home. Aging parents do not wish to move in with a child, as maintaining independence and control over their lives is important; however, approximately 86% of caregiving support is provided by family.[102] It is important to keep in mind the health and well-being of the caregiver, as you evaluate the needs of an older adult client. Caregiver burnout and stress are real indicators that the caregiver may need respite care to provide a break, or counseling to learn how to handle a new familial role as a caregiver. Older caregivers may also have their own medical conditions and limitations, which take a backseat to the needs and priorities of the care recipient. This was the case with Don, who also had a medical condition that impacted his ability to care for Doris. Not wanting to draw attention onto himself and away from his spouse, Don simply stated, "I have a heart condition; but I am just fine." Don was adamant about not "worrying the girls" with their problems and not wanting to rely on their daughters for support, as "they were busy with their own children and families." It was important to assess Don's ability to care for Doris by asking questions related to his role in Doris' everyday activities, but then to also question if his needs were being met and if he was able to take breaks during the day as he needed. According to a report published by the National Alliance for Caregiving[102], 57% of the caregivers in the survey reported good to excellent health; however, 17% reported fair to poor health, and the longer the caregiving occurs, the more likely the health of the caregiver declines.

In the United States, when adults are in a position of caring for their own children and their parents, they become members of the sandwich generation because they are "caught between two caregiving roles—caring for a child and caring for a parent" (p. 30).[22] The average woman in the United States can expect to spend more time caring for her aging parent than she did caring for her own children.[41] Caregivers also need support and attention from the occupational therapy practitioner. It is vital for the clinician to be aware of the context or environment, the requisite occupations the caregiver is responsible for, and to provide resources that address the emerging needs of the caregiver during an intervention. These resources may include referral for counseling, respite services, or assessment of coping skills and treatment to address prioritizing to better meet the needs of the caregiver and person receiving the care. During an intervention session, the occupational therapy practitioner discussed respite care with Don and encouraged him to call about a local support group for spouses who are caring for a loved one with Alzheimer's disease. He said that it sounded interesting but was not sure where Doris would go during the meeting. The occupational therapy practitioner and Don researched the support group and found that there was a respite program in the same building as the support group and he and Doris could go together. Doris would be safe and engaged in activity while he attended the meeting. Don also asked the clinician for resources on Alzheimer's disease and how to help a loved one in the home through compensatory strategies and "tricks" to keep them going. Don worried that Doris would stop doing what she loved—playing the piano—and then "things would snowball into bigger problems."

Unfortunately, there is a link between caregiving and elder abuse. Some studies suggest that "family members who provide care for persons with dementia are up to three times more likely to physically abuse the care recipient as those who care for relatives without dementia" (p. 620).[8] Elder abuse is defined as any knowing, intended, or careless act that causes harm or serious risk of harm to an older person, physically, mentally, emotionally, or financially,[103] and includes many different kinds of abuse. Elder abuse can be physical, emotional, or sexual in nature; other forms include exploitation, neglect, abandonment, and self-neglect. Elder abuse can take place in a private home, a healthcare institution, or a senior center and can be inflicted by a family member or a healthcare provider.

There are signs and symptoms to be aware of, as occupational therapy practitioners are considered mandated reporters and must contact the appropriate authorities (either directly or by way of a social worker or case manager, depending on the facility, employer, or policy in place). Once adult protective services is contacted, an investigation begins. The various signs or symptoms depend on the type of abuse and can be anything from shouting at an older adult or unexplained bruises, burns, and injuries with the outline of an object or hand, to torn clothing, poor skin condition, and indications that the older adult is withdrawn or frightened. Other signs to be aware of include poor hygiene, pressure ulcers, malnourishment or dehydration, or bruising around the breasts or genitals.[23]

Rest and Sleep

Sleep is an important occupation because of its restorative qualities, as well as its ability to support healthy aging and participation in meaningful activity.[4] According to the OTPF (third edition), the occupation of sleep and rest also includes sleep preparation. This can be described as undressing and grooming prior to going to sleep, listening to music as a form of unwinding, saying goodnight to loved ones, setting an alarm clock, or even locking the house door before retiring to the bedroom.[4]

The National Sleep Foundation (NSF) reports that 65% of people who are 55 years of age or older complain of sleep problems at least three times per week.[110] The NSF also recommends between 7 and 9 hours of sleep per night for an adult who is 65 years of age or older[110]; when this amount of sleep is not achieved, it can have significant effects on how one feels and responds to events during the day. This is particularly important when older adults are hospitalized, because it is challenging to achieve undisturbed sleep in a hospital setting. According to a pilot study with 48 older adults completed by Missledine and colleagues,[98] noise levels, light, and disturbances prevented a restful night's sleep with an average of 13 awakenings per night. This resulted in an average of 3.5 hours of sleep per night, which falls short of the recommended 7 to 9 hours. Occupational therapy practitioners can support hospitalized older adults by collaborating with the nursing team to reduce light and sound disturbances and post a "do not disturb" sign on the door to facilitate sleep hygiene and sleep preparation in the hospital setting. See Chapter 13 for additional information on sleep and rest.

Education

In 2013, approximately 25% of adults 65 years of age and older had at least a bachelor's degree and 83% of those who are 85 years of age and older had a high school degree.[146] Educational attainment is on the rise and is associated with longer work lives, with men achieving higher levels of education as compared to women.[43]

There is a program titled “Road Scholar,” previously known as Elderhostel, which offers thousands of courses appealing to older adults who are already well educated and focus on college-level studies and cultural enrichment. The courses most commonly taken are those related to financial planning, health and wellness, and contemporary civic responsibilities. Older adults choose to return to school for a variety of reasons, including transitions in life, to learn a subject area of interest, to meet new people, and to remain occupied and have “something to do.”[43] An occupational therapy practitioner should inquire about an older adult's educational level and complete an onsite assessment of the campus/classroom, if possible, for any environmental modifications, accommodations, or functional mobility concerns.

Work

The health of an older adult is associated with the ability to work. According to Adams and colleagues,[1] adults who are 45 to 69 years of age are approximately three times more likely than their younger counterparts (adults who are 18–44 years of age) to report an inability to work because of health reasons. In workers 50 years of age or older, researchers found that approximately 22% reduced their employment hours, 20% have tried to eliminate demanding physical aspects of the job, and 5% reported trying to accept fewer mentally challenging tasks while in the workplace.[19]

Studies have also pointed to planned or unplanned retirement, with health issues playing a larger role in nonprofessional jobs.[19] According to Goyer, over 50% of retired adults made the transition to retirement before truly wanting to retire, with 32% of these adults blaming a decline in health as the reason.[55] Ewald stated, “The ability to retire was determined primarily on the basis of finances and health, factors working as incentives or disincentives depending on individual circumstances” (p. 345).[43] Many older adults continue to work for the enjoyment and desire to do so; others continue to work because of financial necessity, including repayment of second or third mortgages that were taken out to support children or grandchildren who experienced financial distress in the market crash of 2008.

Work also positively impacts health and well-being. Older adults who are highly engaged in their work have been identified as being less stressed, less dependent on healthcare, and less likely to call in sick or utilize sick days. These adults also stay on the job longer than their less engaged counterparts.[49] According to Pitt-Catsouphes and colleagues, workplace-based health and wellness programs (HWPs) may be beneficial “for promoting positive health-related behaviors among older workers and for increasing their ability to continue to work” (p. 262).[115] This is an area in which an occupational therapy practitioner could thrive while supporting older adults in their quest to maintain health, wellness, and employment.

Volunteer work is also often part of an older adult's repertoire of occupations and is just as important as paid employment. About 25% of adults 65 years of age or older engage in some type of volunteering in the community for many reasons including achievement of higher levels of mastery, life satisfaction, and energy.[126] Others participate in volunteering for other reasons, such as making a contribution to society, meeting others, gaining career-related opportunities, enhancing self-esteem, reducing negative feelings, and strengthening social relationships.[35,154] Paid and volunteer work may present the need to do an onsite community evaluation so that the client can prepare for reengaging in these occupations (Fig. 46.2).

FIG 46.2 Volunteers preparing food to sell at a Coptic Orthodox church for fundraising efforts in their community. (Photo courtesy Ramez Ethnasios.)

Leisure

"Although the aging process is one factor that influences occupational engagement, the older adult's individual perspective affects not only what the older adult is able and may need to do but also what the older adult chooses and wants to do" (p. 302).[136] According to a systematic review completed by Stav et al.,[136] leisure activities have positive health benefits and when incorporated into everyday activities, behaviors such as gardening, visiting friends, participating in clubs, or reading result in a variety of health outcomes. Some activities such as playing board games, taking a trip to a museum, and completing cognitive puzzles play a role in decreasing the risk of dementia and result in higher cognitive levels.[51,128,152] There are also global health benefits that have been identified in the literature, such as increased survival rates and increased coping and well-being strategies for widows.[70,71]

It is common for occupational therapy practitioners to work in adult physical rehabilitation settings that do not allow for direct billing and reimbursements of leisure activities as part of an intervention due to many third-party payer restrictions regarding treatment goals. However, in implementing occupations as ends and occupations as means, as described by Gray,[56] leisure activities can be utilized as a complement to ADL and functional mobility goals established for clients, as well as a therapeutic tool to address performance skills and client factors in the areas of vision, cognition, and motor control. Meaningful activities and creativity in intervention planning are important for success when working with this population. In the skilled nursing environment, it may be possible to design a functional maintenance program for a client that involves recreation activities to address particular functional or treatment goals as well (see Chapter 16 for more information).

Social Participation

Just as leisure activities have been proved to impact health positively, so has social participation. In their systematic review of the literature, Stav et al.[136] synthesized 33 different research articles and concluded that there is strong evidence linking participation in social activities with preventing decreased cognition and physical decline. Social activities identified in the review included attendance in groups outside of the home, regular visits and contact with friends, and participation in social networks. These types of activities also improved physical health and functioning in terms of ADL performance, as well as showed lower mortality rates and improved quality of life.[136]

The occupational therapy practitioner can be of particular support in assessing a community environment and making recommendations for adaptation to promote the participation and independence of older adults. Incorporation of family and friends into intervention, although directed by the client, can also ease concerns about what a client can safely do and can often support increased client participation in social activities.

The Wellness Program for Older Adults[94] demonstrated that occupational therapy intervention that addresses prevention efforts for older adults living in the community enhances ADLs, IADLs, physical and mental health, occupational functioning, and life satisfaction. Occupational therapy practitioners play a role in personal aspects of an older adult's life; therefore they can address modification of components of occupations that are important to an older adult either in a group setting or in individual treatment before it becomes problematic for the older adult. This can be done through a community model and results in an overall increase in participation by older adults and an increase in quality of life.

Policy Affecting Older Adults

To provide the best healthcare, occupational therapy practitioners should be aware of the policies affecting older adults in the United States. Policies not only impact the way clinicians document services, but they also impact reimbursement and payment systems in several settings including inpatient hospital settings, acute rehabilitation settings, skilled nursing facilities, home healthcare, outpatient, or even palliative care.

An overview of important financial and healthcare policies is presented here as a framework for working with this population. Practitioners and students are encouraged to research the specific policies related to their state of employment and, generally speaking, in the facilities of employment. Learning how policies impact practice is also learned on the job. A plethora of resources can be found online, and trusted online resources, such as www.cms.gov (Centers for Medicare and Medicaid Services), should be utilized for more detail and to stay abreast of changes that occur frequently.

A significant change in healthcare policy was the passing of the Patient Protection and Affordable Care Act (ACA) in 2010. This was part of President Barack Obama's healthcare reform legislation, which requires most individuals living in the United States to have health insurance through employer-based insurance, health insurance exchanges, or the optional expansion of state programs (including Medicaid).[61] There are specific provisions of this policy that impact older adults, including Medicare Part D's prescription drug plan (closing the coverage gap in prescription drug coverage through Medicare [also known as “the doughnut hole”]), the creation of a center in each state to provide funds to individuals who are Medicare or Medicaid eligible, as well as expanded services in the home and community for those who receive Medicaid.[148]

With the passage of the Social Security Act in 1935, the national government highlighted a realization that older adults required support and assistance, and since that time, Social Security has helped millions of older adults financially. In 1961 the first White House Conference on Aging was held; these conferences continue to be held once every decade (with the most recent conference in 2015) in Washington, D.C. In 1962 the Commission on Aging was established, and in 1965, the Older Americans Act was created, which was a catalyst for the creation of the Federal Administration on Aging. In 1965 Medicare was established as a federal healthcare insurance for older adults and Medicaid was also enacted, providing healthcare assistance programs for individuals with low income, including those with disabilities. In 1990, the Americans with Disabilities Act (ADA) was established, facilitating the integration of people with disabilities into employment, services, and healthcare.[23] Of course, all of these policies are implemented in a unique way, as the current situations in the United States change by way of politics and demographics.

Social Security is the Old-Age, Survivors, and Disability Insurance (OASDI) program. Current taxpayers pay for this program and the longer one works, the longer one pays into the system. This program is for older adults, retired workers, workers with disabilities, and dependents and survivors of workers who have participated in Social Security. Benefits can be received as young as 62 years of age; however, the benefit is greater for workers who wait until full retirement (which is based on their birth year).[131]

Supplemental Security Income (SSI) provides a monthly monetary payment for eligible individuals who have low income or resources. Criteria for eligibility include being 65 years of age or older, being legally blind, or being disabled. SSI is funded through the U.S. Treasury's general fund and is not recognized as an entitlement, like Social Security. The payment amount varies and depends on each individual's income, resources, and living arrangement.[23]

Medicare is a social insurance that is government-sponsored and covers people 65 years of age and older, certain people under 65 years of age with long-term disabilities, and adults with end-stage renal disease requiring dialysis or kidney transplant. Medicare is divided into four parts: Parts A, B, C, and D. Part A is known as hospital insurance and covers inpatient hospitalizations, limited skilled nursing care (100 days, renewable over the lifespan), hospice, and home healthcare. Part B is also known as Medical Insurance and covers doctors' services, outpatient care, home healthcare, durable medical equipment, and some types of preventive services. Part C is also known as Medicare Advantage plans (and includes Parts A and B) but is run by private insurance companies. Part D is also known as the Medicare Prescription Drug Coverage plan and is also run by private insurance companies.[132] Occupational therapy services (among other rehabilitation services) are covered under Parts A, B, and C, and coverage is specific to the setting in which services are being delivered. Documentation requirements and expectations vary from setting to setting; practitioners are encouraged to learn the details and keep abreast of the Medicare policies specific to the place of employment (see Chapter 8 for additional information on documentation).

Medicaid is a public assistance program that provides healthcare to people of all ages with low income, including those with disabilities. Medicaid is a federal and state partnership, not the responsibility of the federal government (as is Medicare). Eligibility differs by state, and each state has specific income levels and resource amounts for qualification. Medicaid is the largest payer of long-term services and supports in the United States, including nursing facility care and home- and community-based services. Nursing facility care is one of the mandatory services covered by Medicaid in all states; however, Medicaid does not currently mandate home- and community-based services. For all Medicaid services, individuals must meet the eligibility requirements for the state in order to qualify for long-term services and supports. There are financial requirements that must be met, and if an individual has more financial resources and supports than is considered the minimum requirement, a "spend down" occurs where the assets and income are depleted to the point where the individual does qualify for Medicaid services. In-home services, such as personal care services and community-based services, are also provided.[90]

The Aging Network and Older Americans Act defines an older adult as being 60 years of age or older. Caregivers of older Americans are also covered, according to this act. Funds are provided to the states and tribal organizations to offer specific services as mandated by the Older Americans Act. These services include nutrition services, congregate services and home-delivered meals (Meals on Wheels), supportive services including transportation, in-home care, adult day care, and preventive health services. One important service is the Long-Term Ombudsman program and the National Family Caregiver Support Program, which offers counseling, training, and respite care to caregivers.[23]

Finally, some older adults do carry long-term care insurance. These policies are sold by private companies and only fund about 7% of long-term services and supports in the United States.[23] Depending on the policy and coverage, home- and community-based services may be provided, as well as nursing facility care. Policies can be expensive and premiums typically rise as a person ages. When working with older adult clients, it will be necessary to understand the medical insurance the client carries and what services are covered by the insurance. Collaboration with the client, family members, case manager, and social worker is essential for best practice. Healthcare policy and insurance impact occupational therapy services, including evaluation, assessments, and intervention.

Threaded Case Study

Doris, Part 2

Several assessment tools were utilized with Doris as part of her occupational therapy evaluation and intervention plan. The Brief Cognitive Rating Scale (BCRS),[117] which is utilized with the Global Deterioration Scale (GDS),[118] was used initially to acquire a baseline for cognitive function. Doris scored 4.6 on the GDS, which indicates a moderate cognitive decline/late confusional state. At this level, definite concentration deficits are present, with marked deficit on serial 7s and frequent deficits in subtraction of serial 4s from 40. Doris was unsure of the weather and did not know her current address. There was a clear-cut deficit in long-term memory, and most of Doris' past history was obtained from Don. She could not recall childhood friends or teachers but could state the name of her high school. Confusion in chronology of personal history is also found at this stage.

The Cognitive Performance Test[24] was also administered, resulting in findings that were consistent with a moderate stage of Alzheimer's disease and difficulties completing detailed tasks. This score was consistent with Don's report of Doris' need for assistance with most IADLs and ADLs, and the outcomes of this assessment complemented those of the GDS.

The Geriatric Depression Scale[163] was also administered, and the outcome indicated that Doris should meet with her physician for diagnostic testing for possible major depressive disorder. The occupational therapy practitioner notified the charge nurse at the facility and asked her to relay this information to the admitting physician so that Doris could be evaluated by the proper healthcare provider. Lastly, the Canadian Occupational Performance Measure (COPM)[84] was utilized with Doris and Don. This assessment tool was an excellent way to find out what Doris wanted to do, needed to do, or was expected to do through a semistructured interview with Don and Doris. This tool is utilized not to assess performance but to assess self-perception of importance, as well as performance and satisfaction with performance in three general areas: self-care, work, and leisure.

Assessment and Intervention

Customary assessment and intervention strategies for adults with physical disabilities are recommended for older adults, as presented throughout this textbook. There are, however, many assessments and intervention approaches recommended for older adults specifically. Leland and coworkers[85] published occupational therapy guidelines for productive aging for community-dwelling older adults, which include evidence-based guidelines for this population. For a thorough and detailed table highlighting examples of standardized screening tools and assessments, please refer to these guidelines, published by the AOTA.

These recommendations are also published in the National Guideline Clearinghouse to clarify the role of occupational therapy in treating community-living older adults and to support productive aging efforts. Areas of intervention specifically named in the guidelines include those that improve IADLs, fall prevention, home modification, health management, and health maintenance. It is recommended that occupational therapy practitioners use standardized assessment tools and outcome measures for evaluating occupational performance consistently and whenever possible. Client-centered and occupation-based intervention plans that are meaningful and individualized show positive benefits to older adult clients. Performing functional and occupation-based activities within the older adults' actual environment will facilitate carryover and generalizing of information learned during intervention. Research shows that gains observed in physical performance (client factors and performance skills) do not always translate to an improvement in IADL performance.[111]

Intervention activities should always be meaningful and age appropriate. Many older adults enjoy occupations that are fun and playful, including games and crafts. These activities should be considered carefully, however, to be sure that they are meeting the needs of each individual client. A thoughtful interview should be completed, and a thorough occupational profile will support the use of occupation-based and client-centered practice. While searching for activities that present the "just right" challenge for the client, it may be tempting to use tasks that meet most specifications for intervention, but may also be demeaning. During the occupational therapy evaluation, Don mentioned, "I know you therapists mean well when you set up those cones and have Doris walk around them, but they really don't do her a bit of good. She needs to do real things so she can get back to our real home and take care of herself, because I can't do it all anymore."

If an older adult comments that an activity seems childish or questions why an activity is being used as part of therapy, participating will probably not prove to be a significant benefit. Remnants of the reductionist paradigm of the field exist in all practice settings, where clients are given a restorator bike for the upper extremities or asked to raise the weighted bar 15 times and repeat. At times, clinicians can function on autopilot and execute more of a cookie cutter approach to therapy, which is not meaningful or even therapeutic for the older adult client, or any client for that matter. It can lead to frustration, dissatisfaction, and confusion of the role occupational therapy plays in a variety of settings, such as skilled nursing facilities, inpatient rehabilitation facilities, and outpatient settings. The match between the client and the intervention task is especially important for members of this age group. Working with the client to problem-solve strategies for therapy and the best approach to meeting established goals will further engage the client in the intervention process, while increasing self-esteem and effectiveness. After completing the occupational therapy evaluation, the clinician reviewed the results with Don and Doris and asked about the goal for occupational therapy. Without hesitation Doris said, "Play the piano again"; and without hesitation Don said, "Be able to get around and do some of the things she needs to do to take care of herself." These goals were meaningful to Doris and would be utilized as a means to an end during her rehabilitation.

It is recommended that occupational therapy practitioners incorporate involvement or participation of physical, social, leisure, religious, work, or volunteer activities into intervention approaches and utilize an evidence-based approach to develop healthy routines and habits in this population. Health management approaches, self-management programs, and health education programs are also recommended.[11] The recommendations also encourage clinicians to consult with organizations that focus on aging to develop preventive educational and intervention programs for this population, including the area of driving to support productive aging.[111,136]

Educational programs and teaching aimed at older adult clients and their families or caregivers must also be considered carefully with respect to health literacy. To an older adult, this could mean anything from reading and writing to speaking and listening. In a literacy survey processed by the United States Department of Education, adults 65 years of age and older had the lowest average prose, document, and quantitative literacy.[83] Oftentimes, health professionals communicate at higher levels than older adults understand. According to Stableford,[134] "Many, if not most, older adults have trouble understanding both verbal and written health communication" (p. 324). The cause does not need to be linked to English as a second language, although at times this is a reason.

There are common assumptions that have been made about the learning needs of older adults. In 1984, Knowles identified specific concepts that he believed should be a foundation of adult education and included understanding why something needs to be learned (prior to learning it), motivating oneself to learn through internal forces (versus external forces), being solution driven and problem based, associating learning with social roles, tapping into the rich experiences of life to enhance learning, and lastly becoming more self-directed with respect to learning. All of this should occur as one's personality matures. These general assumptions do not always fit the needs and desires of older adult clients in occupational therapy for several reasons. However, older adult learners must have their developmental needs and interests met; therefore Knowles recommended an environment of mutual trust, respect, and acceptance of differences.[80]

Many obstacles can get in the way of an older adult understanding instructions during patient education, including family members, the healthcare provider's style, or the language being utilized. The experience of learning will be impacted by the assumptions being made about older adults; therefore it is critical to analyze learning assumptions being made about older adults by clinicians and educators.[31] In a review and critique of the portrayal of older adult learners, it was reported that society views older adult learners as a homogeneous group of people, not affected by age-related changes to the mind and body. Clinicians must pay attention to the diversity that exists among the older adult population with respect to age, race, ethnicity, educational levels, and income, as well as physical and cognitive abilities. Not all older adults are capable and motivated learners, as much of the literature would convey in this review.[31] Many older adults do have age-related changes associated with cognition, which impact their learning abilities. Others have decreased motivation to participate in learning opportunities secondary to lower socioeconomic status or residing in an isolated rural community.

Stress, anxiety, decreased vision, and decreased hearing can contribute to misunderstandings or lack of comprehension with written and verbal instructions provided by health professionals. Older adults take a longer amount of time to process information, and hearing information repeatedly helps older adults to make associations and connections to existing knowledge, so hearing information once prior to discharge will likely not be recalled upon reaching home.[87,88] Medical interpreters and translated brochures are helpful and recommended, as are "teach-back" strategies, where clients are asked to demonstrate what the healthcare provider just reviewed or taught to prove learning occurred.[134] Levy recommended other strategies,[87,88] such as chunking information in an organized way to promote effective storage of new information, being mindful of internal and external contextual factors during the learning process to facilitate recall in a new environment, and providing cues that offer opportunities for recognition or matching information with previously learned information.

The American Medical Association also recommends that clinicians apply the following verbal communication tips, which contribute to improved patient understanding: slow down, use plain/nonmedical language, show or draw pictures, limit the amount of information and repeat that information, use the teach-back technique, and create a shame-free environment where clients are encouraged to ask questions.[158] When using plain/nonmedical language, it is important to write down what the patient should do, how to do it, and why the patient should do it; these reminders facilitate communication with loved ones or caregivers who may not be present at the time of teaching. Additional suggestions made by Stableford[134] include framing the conversation first, before diving into the discussion, as well as encouraging the older adult to bring a friend or family member to appointments.

During initial contacts with an older adult, the occupational therapy clinician must take the time to listen to and get to know the client. By the time that intervention begins, the clinician will have an understanding of the client's learning style, deficits that may require specific types of teaching, and any cognitive or perceptual deficits that should be considered. The pace and style of the intervention will be individualized to meet the client's learning needs. If increased recovery time is needed for limitations in cardiovascular function, the clinician should plan for this and allow time to assess vital signs and monitoring. The clinician should also incorporate energy conservation or work simplifications into the intervention plan, if the patient needs these strategies. The client is the best judge of what fits within his or her life and goals, and this should ultimately be respected and interwoven into the intervention plan. Don and Doris were provided with printed information regarding compensatory strategies and durable medical equipment recommendations. Because Doris has Alzheimer's disease, the majority of the patient education was directed at Don, who was serving as the caregiver and would follow through with the strategies at home. Don requested information in the most "straightforward way" and preferred to be hands-on during intervention sessions. He often wanted to try the various hand placements during functional mobility and wrote down when and how to provide verbal cues to Doris during self-care activities. Don mentioned, "Writing things down helps; that way, I will not forget what I learned." Don also requested help making memory books and sequencing cards to help Doris complete tasks on her own. These requests were incorporated into Doris' intervention sessions, and Don attended every one of them.

One of the critical components of processing life changes—especially changes in health or changes in environment—relates to coping style. The emphasis is less on context and more on how the older adult deals with the reality of a situation. Older adults generally have a well-established style of coping, and regardless of whether their style may be effective or ineffective, it should be a client factor that is taken into account during evaluation or intervention. As a group, older adults have seen wide-sweeping political, social, cultural, economic, and technological changes in their lifetimes. Some of the old support systems such as an extended family have changed for many older adults, whereas others have taken new caregiver roles within the extended family that were not prevalent in previous generations—such as parenting grandchildren.

New support systems have become available for this population through technology and the Internet. Computers and personal electronic devices play a large role in keeping older adults connected to family, friends, and grandchildren who live in other states or countries (Fig. 46.3). This population also utilizes chat rooms and online dating services to establish relationships or for companionship.[14] Learning to use a computer and the Internet can be challenging initially; however, many community centers provide workshops and tutorials on how to send e-mails, surf the Internet, or join social media sites like Facebook.[22] The Internet is also a way for older adults to learn more about any given topic, and like their younger counterparts, they can use the Internet to learn more about medical conditions, health concerns, and to become more informed.

FIG 46.3 A grandmother utilizing her personal electronic device and the Internet to communicate with her grandchildren across the miles. (Photo courtesy Julie Rafeedie Haar.)

The Aging Process

The aging process is complex; many theories for why and how people age have been researched and published in the field of gerontology (the study of aging). It is inevitable that people age, and with the aging process comes a change in body structure and function. There is increased prevalence of degenerative diseases and the potential for physiologic decline in several body systems. Gregory and Sandmire stated, “From a strictly scientific standpoint, however, the distinction between aging and disease is, at best, a blurry one” (p. 53).[57]

Distinctions between aging and disease include the fact that aging is a universal process, shared by all human beings; it is intrinsic and dependent on genetic factors. We are constantly aging and it is a progressive process, which may ultimately lead to decreased functional capacity. The aging process is not reversible. Disease, on the other hand, is a selective process and varies from person to person; it is categorized as intrinsic and extrinsic with genetic and environmental factors to consider, as well as uncertainty with respect to progression, regression, or termination/cure with treatment. Disease does cause damage but has the potential for being reversible, and disease may be treatable and often has a known cause.[57]

Many of the physiologic changes associated with aging can be slowed down or prevented with lifestyle choices, such as incorporating a healthy diet and exercise into a daily routine. Many of the chronic conditions seen in older adults can also be prevented by adjusting behaviors and habits; however, these changes should happen in early to middle life so that the maximum effect can be achieved. Occupational therapy practitioners can play a role in this prevention by working with younger and older clients in wellness, prevention, and primary care.

Most biologic theories of aging can be roughly grouped according to two major suppositions: genetic theories on aging and environmental theories on aging.[45,57,97] One genetic theory claims that **senescence**, or the process of deterioration with age, results from the gradual mutations (alternations in deoxyribonucleic acid, or DNA) in somatic cells of the body. This is known as the somatic mutation theory, and it is believed that over time, the radiation and environmental factors people withstand over time actually mutate and alter critical genetic code, changing the sequence of amino acids found in enzymes and other proteins.[44,139] Two other genetic theories are related to the endocrine and immunologic systems, where there is decline over time; however, hormones and “biological clocks” regulate and control the aging process.[57]

The environmental theories on aging branch off into another direction, with one theory known as the *wear-and-tear* theory of aging (sometimes referred to as **allostatic load**). This theory basically states that it is inevitable that cells, tissues, and organs gradually wear out from continued use over time.[57] There is another theory called the *rate-of-living* theory of aging, which states that each living organism is given the ability to burn up a fixed number of calories within the lifespan, and once that number is reached, the organism dies.[78] The rate-of-living theory led to the *free radical* theory, which is similar to the wear-and-tear theory, “but attributes cellular and organismal aging to random accumulating damage of macromolecules by the highly reactive by-products of oxidative metabolism known as free radicals” (p. 59).[57] What is clear is that the explanation for aging is unclear, given so many theories that are constantly challenged and reevaluated. It is important for occupational therapy practitioners to adopt a holistic view of the individual and appreciate that, for example, hypertension, high cholesterol, and diabetes increase health risk exponentially. Such a view can also be taken of other areas in a person's life. Older adults with low vision who also have difficulty hearing and who have diabetic neuropathy with altered sensation in their fingers will have a greater challenge in adapting daily activities to achieve functional independence. Because aging is a process that is generally predictable from infancy through older adulthood, it is helpful to understand and appreciate the body structures and functions by system and how they change, or have the potential to change, as a person ages.

Changes in Mental Structures and Functions

The brain decreases in weight and size with older age, even in those with normal cognitive function.[127,138] Some neurons shrink with age and others are lost. It is estimated that we use only a small percentage of the neurons in our brain, so the effect of these changes could be very small. It is also normal to see neurofibrillary plaques and tangles in older brains,[127,138] although excessive levels can be indicative of Alzheimer's disease (see Chapter 35 for more details). Messages moving through the nervous system may not get through as quickly as they used to,[138] thereby slowing the speed of some cognitive functions such as memory. This reduction in the efficiency of transmission of signals in the nervous system may contribute to the declines seen in some mental functions.

Changes in cognition often affect the ability to function because information processing and problem solving are so vital to safety and independence in ADLs. Actual cognitive decline can have a major impact on the quality of life, and this is compounded when physical function, especially sensation, is impaired as well.[87] Many of these cognitive changes are related to treatable, temporary, or manageable medical problems. Many important considerations when working with an older adult include medication side effects, alcohol and nonprescription drug use, vision and hearing deficits, nutritional deficiencies, stress, sleep dysfunction, depression, and medical illnesses such as diabetes, high cholesterol, and high blood pressure. These conditions may also be predictive of functional decline.[40,122] Cognitive decline becomes more substantial with each new medical condition that develops.

Occupational therapists find that cognitive capacity greatly affects the client's ability to benefit from rehabilitation. A more detailed discussion of cognitive aging can be found in other sources.[13,87,89,122] Cognition as a mental function is also discussed in Chapter 26. Age-associated differences are seen in almost all aspects of cognition in healthy older adults, but this difference is typically minor, with more time and more extensive processing being required. Age-associated differences in cognition do not generally present serious implications for ADLs and IADLs.[87,122] Researchers have found that cognitive processing efficiency, especially for working memory, information processing, and reaction time, is 1.5 times slower in older adults than in middle-aged or young adults.[75] Generally, older adults can, with effort and training, remember details with the same accuracy as that of younger persons.

Robnett and Bolduc[122] described the cognitive changes of aging, relevant for rehabilitation. In a typically aging adult, orientation, for the most part, remains intact as part of crystallized intelligence (basic knowledge and skills that accumulate over the lifespan). With lifestyle changes, like retirement, difficulty remembering the date or the day can occur in older adults. Attention (to sustain attention or focus on a task, alternate attention between two tasks, or divide attention between two or more tasks), or selective attention (to pay attention to relevant stimuli and ignore noise) generally remains intact if there are no distractions with a typically aging adult. However, as adults grow older, they tend to be less able to ignore distractions while trying to attend to a task (such as driving). Crystallized intelligence remains intact or may continue to improve as one ages, particularly for overlearned material and skills needed for work. Older adults tend to see the "gray areas" and pride themselves on seeing beyond the "black and white." Lastly, fluid intelligence is the ability to problem-solve and find meaning at times of confusion, with the ability to develop inferences and understand relationships of various concepts without acquiring new knowledge. This includes skills such as judgment, awareness, and problem solving (executive skills). Fluid intelligence shows decline with aging to a degree. Older adults have more challenges with multistep tasks, and because learning requires multiple-step tasks, this process may slow down but does not stop in typically aging adults.[121]

Loss of memory is a concern for many older adults because memory involves the retention, storage, and retrieval of information. Memory requires adequate attention to sensory-perceptual cues at the initial stages of reception and encoding.[13,88,130] Age differences have been found to affect working memory—one component of short-term memory. Older adults exhibit poorer function in complex deliberate processing (ie, simultaneously performing a cognitive task while trying to remember the information for a later task) than they do in automatic processing (ie, remembering how to perform an activity).[75,122,130] Older adults also have a decreased ability to inhibit thoughts that are irrelevant to the task.[88,122] Age-related deficits have been found in the recall of information when it is retrieved from secondary (storage) memory levels, and this deficit worsens with advancing age.[87,89] However, the overall effects of age-related differences or changes in memory on daily function are minimal. Most healthy older adults are able to compensate for reduced processing resources by using the relevant context of situations, targeting environmental cues, providing environmental supports, rehearsing with elaboration, and developing new skills built on personal associations.

Intervention for the cognitive changes of aging includes utilizing calendars for orientation and making sure that calendars or dry-erase boards are up-to-date at extended care facilities or nursing homes. To address attention, occupational therapy practitioners can eliminate distractions when older adults are attempting to complete a complex task. Repetition for learning is important; however, clinicians should not assume that the client will remember patient education and strategies without writing them down. Providing written instruction or having a client write information down will be more effective for intervention and carryover. Older adults are more likely to use written lists to recall important items, unlike their younger counterparts.[122] Generally speaking, if material to be learned is interesting and the client can draw associations to his or her life, it is more likely that the learning will take place. Multimodal sensory input, such as hearing the information, reading the information, and writing it down, will also increase the likelihood of recall.

When impaired cognition (especially memory) interferes with relationships, diminishes daily function, or affects quality of life, the causes should be explored because many of them are potentially treatable. Problems with memory tasks, whether subjective or objective, are the most commonly acknowledged types of age-related cognitive changes.[15] Displaying decreased memory skills does not, however, indicate that a person has dementia. Mild forgetfulness is experienced by the young and old alike, and it should not cause alarm or lead a person to think about dementia. In fact, decreased memory, or age-associated memory impairment (AAMI), "is widespread and refers to memory skills that are lower than average. AAMI is not as serious and may or may not relate to mild cognitive impairment" (p. 114).[122] AAMI is a part of normal aging, affecting as many as 90% of older adults.[87] This is not a psychiatric disorder. Among the criteria for these cognitive changes is a decline in memory that is sufficient to worry the older adult but not in excess of normal age function, as seen with dementia. The decline must be within normal limits when the client is compared, through psychometric testing, with others who are the same age. Older adults who are tired, under stress, sick, or distracted are more likely to experience slower thinking and recall, experience more difficulty attending to and organizing information, and have difficulty recalling information, especially names, placement of objects, and tasks requiring multiple actions.[87]

According to Petersen and colleagues,[114] memory loss that falls outside of normal limits by one standard deviation on test scores, with more severe memory lapses evident in recent memory that are persistent and begin to interfere with work and social activity (not ADLs), is identified as **mild cognitive impairment** (MCI). In 50% of individuals with MCI, dementia develops within 3 years, although symptoms may have been evident for up to 7 years previously.[87,114] When cognitive impairment becomes so severe that it affects daily function, particularly a significant decline resulting in dependence in ADLs, a diagnosis of dementia is often made. This was the case with Doris, as Don mentioned that she began needing assistance with everyday tasks that included balancing the checkbook and preparing meals. Don encouraged Doris to stop driving, and months later she needed assistance with simple tasks like bathing, dressing, and grooming. Don would oftentimes find Doris in layers of clothing sitting on the floor unsure of what she was doing. Doris was no longer able to keep records of the bills or teach piano to the children in the neighborhood, which was difficult for both Don and Doris, personally and financially.

Differentiated from dementia is delirium, a condition that is estimated to affect 30% of hospitalized older adults.[151] The cardinal features of delirium include a transient state of fluctuating cognitive abilities, often characterized by hallucinations, decreased ability to focus, poor memory, and increased confusion.[47] People who are delirious can have difficulty following multistep commands and have disorganized thoughts, as well as an altered level of consciousness. Delirium can fluctuate during the course of the day, even with lucid intervals occurring. Although delirium can resolve, most people with the condition still experience some symptoms 6 months after diagnosis. Treatment is often nonpharmacologic and focuses on reorientation strategies such as the use of clocks, calendars, familiar objects from home, and personal contact to reinforce orientation.[66] Also beneficial in communication is frequent eye contact and the use of clear instructions. It is important to maintain a quiet environment as much as possible and to involve the client in both self-care and general decision making.

Clinicians working with older adult clients will encounter varying degrees of cognitive decline, and it is essential that they screen for cognitive impairments and consider cognition as a major factor when planning the intervention approach and carrying out interventions. Levy has suggested that occupational therapists can make an important contribution in the early detection and monitoring of cognitive decline by regularly assessing mental status on an informal basis during intervention and formally screening both during the initial evaluation and periodically.[87] Assessments such as the Mini-Mental State Examination,[48] with scoring adjusted for age, culture, and educational level, are helpful as screening tools. Other standardized assessment tools include the Montreal Assessment of Cognition (MoCA),[101] the Saint Louis University Mental Status (SLUMS),[141] and the Executive Function Performance Test (EFPT).[17] An assessment tool such as the Functional Activities Questionnaire[143] has been used to assess functional abilities in IADLs to distinguish older adults who are experiencing more severe cognitive impairment from those who are experiencing MCI.[140]

Approximately 20% of the people age 55 years or older experience some type of mental health concern,[26] and at times, what seems to be a loss of memory or decline in cognition can actually be another medical condition in disguise. Pathologic mental conditions often occur in older adulthood because of physiologically based changes in brain function or brain disorders. Less frequently, the cause is an inability to adapt to changes, losses, and transitions, or these factors may exacerbate an existing condition. Older adults who have adjusted poorly to previous stressors, who are overwhelmed by multiple simultaneous stressors, or who have little social support are particularly vulnerable. Depression, anxiety, and severe cognitive disorders are of concern for the older adult population, as is substance abuse and suicide.[122]

Depression

At least 1 out of 20 older adults (65 years of age or older) who live in the community are diagnosed with clinical depression.[122] The percentage of older adults with depression increases among the population living in institutions or in the hospital setting.[72] Depression oftentimes does go unnoticed or is mistaken for other ailments, grieving, or health conditions; however, a person can experience impaired cognition and depression simultaneously. There are specific differences between depression and dementia, requiring careful diagnosis from an appropriate healthcare provider based on the patient and family report. Signs and symptoms indicative of dementia include a gradual onset of cognitive impairments (over a period of years), unawareness of memory deficits, impairments on various neuropsychological testing, and progressively worsening impairments over time.[120] Signs and symptoms indicative of depression include a more sudden onset of cognitive limitations that happens near the same time as other depressive symptoms, self-report of memory impairment, impairments that are more limited in scope and severity on various neuropsychological testing, and reports of cognitive impairment not advancing, but resolving with treated depression.[120] Older adults are reluctant to seek care from mental health practitioners; however, intervention is critical as depression can lead to withdrawal from social engagement or the inability to perform self-care. This can spiral and the older adult could become isolated and experience occupational dysfunction as a result.

It is important for occupational therapy practitioners to be aware of the signs and symptoms of clinical depression, screen for the condition, make referrals, and to seek out support for clients and their family members if depression is suspected. An occupational therapy practitioner can use the Geriatric Depression Scale[163] or the Beck Depression Inventory[18] to assess a client in any clinical setting. In general, a person may have a sad or depressed mood; decreased interest in activities, attention, concentration, or memory; feelings of guilt and worthlessness; apathy or a lack of motivation; changes in sleep, appetite, weight, energy, or sexual desire; as well as suicidal thoughts.[6] Despite the myths of aging, many older adults do not have depression; depression is not an expected outcome of aging. Suicide is “not always a consequence of depression, [however] death is the most definitive outcome of depression” (p. 126).[122]

Suicide is a major risk in late-life depression. Caucasian men between the ages of 60 and 85 years have an increased risk for suicide, especially if they are 85 and older, have a medical illness, or live alone. Common indicators of possible impending suicide include a past history of suicidal attempts, symptoms of depression or other psychiatric disorders, discharge from a facility against medical advice, spontaneous recovery from a depressed mood, substance abuse; bereavement, or giving very personal items away.[60] Through psychotherapy, electroconvulsive shock treatment, or medication management, depression can be treated, and more than 80% of older adults with clinical depression who are properly diagnosed and treated can recover and return to their previous level of functioning.[107]

Anxiety

Older adults are less likely to report mental health concerns and more likely to emphasize their physical ailments, therefore anxiety disorder can also go unrecognized or untreated in this population. According to the Anxiety and Depression Association of America (ADAA), older adults with anxiety disorder likely had one when they were younger, and it is just as common among the older population as it is among the younger generation of adults.[10] Recognizing that an older adult has anxiety disorder can present with challenges, as older adults may present with increased numbers of comorbidities and other health concerns. Some symptoms described by the ADAA include headaches, back pain, or a rapid heartbeat. Therefore it is difficult to separate these symptoms from other medical conditions.

Older adults may not be as open to discussing anxiety or seeking professional because they were raised during a time when mental illness was more stigmatized and less talked about than in today's society. They may also be concerned about the loss of friends and relatives, decreased mobility, isolation, and increasingly stressful situations and are unaware themselves that this could be a treatable disorder. Anxiety disorders can manifest in various forms including intense apprehension with shortness of breath and chest pain; fear and the disproportionate avoidance of a perceived danger; as well as chronic, persistent, and excessive anxiety.[50] Occupational therapy practitioners can perform a screen for this disorder with basic questions recommended by the ADAA,[10] inquiring about what triggers the anxiety, if the client has had concern or fretted about a number of things, or if there is anything going on in life that is causing concern. Referrals should be made to a physician or psychiatrist as needed.

Substance Abuse

Substance abuse is not as prevalent among older adults as it is with younger adults; however, the problem does exist. In fact, substance abuse is on the rise and the baby boom generation will have an increased need for treatment of illicit drug use, according to the Substance Abuse and Mental Health Services Administration (SAMHSA).[137] Age-related physiological and social changes make this population vulnerable to the harmful effects of illicit drug use.

SAMHSA estimates that 4.3 million adults who are 50 years of age and older have used an illicit drug in the past year.[137] However, the more pressing concern is the abuse of alcohol.[46] Older adults may be taking several prescription medications that would negatively interact with alcohol. Symptoms of alcohol abuse include an increased tolerance of the effects of the substance and increased consumption over time. Older adults are more susceptible to the effects of alcohol, even when they consume less of it, because of age-related changes such as possible decreased liver and kidney function and reduced water content and body mass. Substance abuse can lead to increased accidents, increased risk for falling, poor nutrition, poor hygiene, increased mental health problems, and increased suicide risk, among many other medical conditions. Older adults should be screened by occupational therapy practitioners and referrals made to self-help groups such as Alcoholics Anonymous, counseling, psychotherapy, and a primary care physician for intervention.

Changes in Sensory Structures and Functions

The sensory systems of the human body are not immune to the changes that occur with aging. Older adults are often more susceptible to a number of diseases and chronic conditions, or to the cumulative effect of having a disease for a long period of time, which can take a toll on the visual and hearing systems.

Vision

Normal aging of the visual system takes place at varying degrees, depending on genetic factors and lifestyle choices. These changes in the visual system are related to the eye structure itself and to the mechanisms of visual processing in older adults. (For a full discussion of how the visual system works, please refer to Chapter 24.)

Because vision is such a critical sensory system in humans and plays a significant role in social interactions and safety, any decrease in vision can have an impact on an older adult's ability to engage in occupations. An occupational therapy practitioner may be seeing a client with low vision as a primary diagnosis or as an underlying secondary diagnosis; at times no diagnosis has yet been made. The clinician should encourage the client to see an eye care professional to obtain the best correction if glasses are worn and so that the client's eye health can be evaluated and addressed. Recommendations should also be made to the many professionals serving individuals with blindness and visual impairment.

It is estimated that 33% of adults have some form of vision-reducing eye disease by the age of 65.[42,156] Normal aging in the eye creates a number of changes. As the eye ages, the cornea becomes thicker and more opaque and the lens becomes less elastic, which in turn decreases accommodation, or the ability to make a change from distance to near vision. This condition is called presbyopia. Presbyopia occurs so universally that nearly everyone older than 55 requires some type of corrective lens to be able to read.[57] The lens of the eye may also become more opaque and eventually result in a cataract. Clouding of the lens can be gradual enough that an older adult is not aware of a change in color vision and a decrease in overall vision until the disease is well advanced and occupations have been affected. The iris muscles tend to atrophy, which causes the pupil to constrict. This makes it more difficult for the eye to bring enough light in for the retina to work effectively. The macula (used for central vision), which is part of the retina, has a decreased number of cones and therefore a decrease in effective color discrimination. The rods (peripheral vision) of the retina decrease and are less sensitive. There is also a decrease in the ability to transition between light and dark. Night vision is more difficult for older adults. The need for additional light increases with each decade, and the cones need increased light to effectively discriminate colors. Contrast sensitivity also decreases because of these changes in the eye structures. All these changes in the anterior portion of the visual system make it more difficult to adjust for the changing visual requirements of life.[57,129]

In addition to the natural changes in the visual system, the incidence of macular degeneration and diabetic retinopathy, which can destroy central vision, is high. Any neurologic disease that affects the brain will more than likely affect the visual system. This can be seen with diseases such as multiple sclerosis and Parkinson's disease. Peripheral vision is affected by various conditions, including glaucoma, retinitis pigmentosa, and field cuts related to acquired brain injuries such as stroke. Vision accounts for a high percentage of the sensory information that we use to participate in occupations. When visual acuity is reduced, as can occur in older adults, self-sufficiency in ADLs and IADLs may decrease, the potential for falls increases, and an increase in depression may be seen. It is an all-encompassing system that has an impact on every other perceptual system in the body.[92,156]

Vision functionally can be divided into central field functioning and peripheral field functioning. Each category tends to have a different impact and different intervention goals. Central visual loss (which is experienced with macular degeneration) takes away part or all of the fine detailed vision that we use for reading, shopping, community mobility, and leisure activities.[113] Something key to remember in any assessment or intervention is that if a client wears glasses, they should be worn to elicit the best performance.

Key areas of intervention to enhance participation are magnification, lighting, contrast, and organization. Magnification helps make the object larger on the retina so that the brain has more sensory input for processing. This may be accomplished by bringing the object closer to the client, such as with lenses, magnifiers, and electronic magnification. Because of occupational therapy's involvement in assistive technology and with the increase in all areas of technology, electronic visual enhancement may become the most popular adjustment among older adults in the future. There are ways to read, or to be read to, that are now economically feasible for almost every client. Computers come with magnification programs already installed for those with a visual impairment. Other electronic magnification devices can be used in multiple settings to increase the ability to see functionally. Each state has an agency whose mission is to provide low-vision service for individuals who are blind or have a visual impairment. There are also national and local service agencies and vendors for products.[65]

Lighting is an important component of vision and includes not only the type of light but also where it is placed. It should be close to the task and in a position that will eliminate any glare. Glare may be controlled by window dressings or by changing locations in a room. Glare is a component of contrast sensitivity.[65]

Contrast sensitivity is the ability to detect detail when gradation between an object and the background is subtle. An example might be a white banister on a white wall in a hallway that a client is unable to see or a client's inability to distinguish coffee when it is being poured into a black cup. With poor contrast sensitivity, it would be impossible to discriminate between the background and the object. This has a functional impact not only on living tasks but also on mobility. Contrast and contrast sensitivity are important determiners of how well someone sees in order to function. They are strongly associated with reading performance, mobility, driving, and face recognition.[129] Persons with central visual loss may isolate themselves from friends and family because they can no longer recognize those close to them and are embarrassed.

Decluttering spaces, grouping items by function, and further organizing objects can eliminate what has been called “visual static.” An older adult with low vision is then able to more easily find and use the tools needed during a task.[65]

With peripheral field loss (such as seen with glaucoma or retinitis pigmentosa), mobility becomes an issue because of loss of part of the visual field. Central vision is often spared during this disease process. With field deficits, older adults can have difficulty using their environmental context effectively and consistently. Other areas of participation that may be affected by visual field loss include driving, shopping, financial management, and meal preparation. Grooming may also be affected by field loss.[155] Many older adults with peripheral field loss are able to function independently within their living environment because they rely on the habit of navigation rather than their vision. However, the field loss becomes more apparent and function decreases when the older adult is in an unfamiliar situation. Intervention would include more effective use of scanning for detection of items. It is within occupational therapy's scope of practice to work on mobility as related to familiar space and ADL training. Teaching of mobility outside of familiar surroundings should be referred to an orientation and mobility specialist.

Hearing

Hearing is a multistep process in which sound waves result in vibration of the eardrum and movement of the ossicles. This movement is transferred to the fluid medium of the cochlea within the inner ear. The hair cells in the cochlea turn these vibrations into nerve impulses. Any impedance such as ear wax, ear infection, or hair cells that have died will have an impact on what is perceived as sound.[57] Generally, with normal aging there is a gradual progressive loss called presbycusis. Environmental factors may contribute to an increase in this loss, as may genetic factors and gender differences. Sound seems muffled to older adults. It becomes more difficult for older adults to be able to separate background and foreground noise.[57] Hearing loss is a common chronic condition seen in older adults. Anywhere from 33% to 87% of the older population in the community have some form of impairment.[113] There is increasing evidence that in addition to the ear and its parts, the central nervous system plays a part in the ability to perceive speech in a naturalistic environment.[161] With hearing loss, participation may be limited in the area of phone use, socialization, safety, and participation. Because the sound is muffled or the older adult has difficulty separating foreground and background noise, it may take longer to process what is being said. This loss is gradual and a person often compensates through lip reading. Older adults affected by hearing loss may isolate themselves from others and stop participating and socializing with family and friends.[65] Hearing loss should be taken into consideration when planning intervention and recommending adaptive strategies to older adults, as well as making referrals to other healthcare providers who specialize in hearing loss.

Dual Sensory Loss

When one sense is impaired, the other senses are relied on more heavily to interpret social cues, physical cues, and safety cues. With visual and hearing loss, or what is often termed *dual sensory loss,* the impact is that much greater. It is estimated that 23% of people older than 81 years have some degree of dual sensory impairment.[20] Dual sensory loss is typically considered hearing and vision, although a decrease in the tactile system could also make participation and adjustment difficult for an older adult. The combination of loss in more than two sensory systems is considered multisensory loss.

Smell and Taste

The ability to detect smells and correctly identify smells decreases with age. Most people over the age of 80 years have impaired olfaction, or smell,[99] and there is a high prevalence of people age 65 and older who report decreased smell sensation and complete loss of smell.[122] This is a sensory loss of major concern for occupational therapy practitioners who are assessing safety in the home and one's ability to live independently. Compensatory strategies such as natural gas and smoke detectors can be critical, as well as a family member or friend checking for food spoilage.

Due to the fact that the sense of smell is connected so intricately with the sense of taste, a decrease in olfaction can negatively impact eating and nutrition. Olfaction impairments have been associated with depressive symptoms and poorer quality of life, which can also affect the enjoyment of food, drink, and socialization.[54] As people age, the ability to distinguish between salty, sour, and bitter decreases; therefore older adults may use more salt on foods. The thirst sensation can also decrease, placing an older adult at risk for dehydration.[123] Older adults may purposefully reduce the amount of fluids they drink to avoid frequent and energy-depleting trips to the bathroom. Food and water intake is monitored in hospitals, long-term care, and rehabilitation facilities. It is also critical for caregivers and family members to encourage proper nutrition and hydration in the home.

Changes in Neuromusculoskeletal and Movement-Related Structures and Functions

Although age-related changes do occur in the musculoskeletal system, older adults also have the capacity to maintain or even increase their strength in later years. Exercise is highly effective in older adults,[22,57] as is a program of functional activity, as long as it is adapted to the client's unique needs.

Early in life the body builds bone mass, with a peak at around 35 years.[38,127] After this age, calcium is gradually lost from the bones, which results in loss of bone strength. This condition is termed *osteopenia* when bone volume reaches below-normal levels because of bone resorption exceeding bone synthesis. This is different from *osteoporosis,* in which the reduction in bone mass is significant enough to cause fractures. Primary osteoporosis occurs when the bones become more porous but no other disease is causing this process. Secondary osteoporosis can be due to a number of different processes, including rheumatoid arthritis, diabetes, and drug use, especially corticosteroids.[127] In the United States it is estimated that 10 million people who are 50 years of age or older have the diagnosis of osteoporosis, whereas another 34 million older adults have bone mass that is lower than normal, putting this population at risk for bone fractures. Risks for osteoporosis include estrogen depletion, testosterone depletion, calcium deficiency, cigarette smoking, alcoholism, or physical inactivity. The loss of bone mass can also contribute to a collapse of spinal vertebrae causing a kyphotic appearance in the back with a possible impact on respiration.[57]

Joints also exhibit normal age-related changes. Over time a reduction in joint range of motion of 20% to 25% can be seen.[91] As people age, the water content in tissues, including cartilage, decreases.[127] Cartilage also becomes stiffer and has less of a cushioning effect for the joint over time.[38] The cartilage surfaces become rougher in areas of each joint with the greatest stress, thereby reducing the smoothness of movement. These changes are more significant in areas of increased wear and tear, but they are even seen in sedentary individuals. At a pathologic level, articular cartilage can degenerate to such a point that pain and stiffness result, as well as impaired movement, which can be diagnosed as osteoarthritis (see Chapter 38 for further details). Although pain and decreased joint mobility are often factors limiting a person's function, arthritic changes can be seen radiographically in the joints, even in individuals with no other symptomatology. Changes are seen in tendons and ligaments, which also have reduced water content over time.[91] Increased cross-linking of collagen fibers occurs and can cause stiffness of the collagen. Tendon and ligament strength declines with age,[127] as does the strength of attachment to bone, which results in decreased joint stability and greater risk for injury. Doris was diagnosed with osteoarthritis, and the physical changes in her hip joint placed her at an increased risk for injury, which occurred when she fell in her new home. The hip fracture was stabilized with open reduction and internal fixation. Don was grateful that a total joint replacement was not indicated at the time because, as he reported, he worried about how her therapy would go, as she would not remember any of the restrictions after a replacement. Her orthopedic surgeon cleared her to weight-bear as tolerated on her leg. Doris did not have postoperative pain nor did she have any other precautions or restrictions (for further information on hip fractures and lower extremity joint replacements, please see Chapter 40).

In general, older adults exhibit some muscle atrophy.[127] This is due in part to age and in part to disuse, and it is difficult to distinguish the two. Some motor units and muscle fibers are lost over time, with the loss being most pronounced in fast-twitch fibers.[127] Denervation of fast fibers in aging can be followed by reinnervation from slow fibers and result in this conversion. It takes more time for older muscles to recover from use, and the recovery may not be complete, resulting in decreased muscle endurance. The decrease in muscle mass and contractile force is termed *sarcopenia,*[91] which can be a consequence of age or a disease process and results in decreased muscle power. Encouraging older adults to continue exercising or to resume exercise after a hospitalization cannot be overemphasized for its benefits and therapeutic effects. Regular physical training can improve muscle strength and endurance, even in the older adult population.[93] This type of exercise program (completed with caution and under the supervision of a healthcare provider) is also beneficial to the cardiovascular system.

Changes in Cardiovascular, Hematologic, Immunologic, and Respiratory System Structures and Functions

The cardiovascular system is responsible for pumping blood throughout the body, enabling oxygen and nutrients to be delivered to all systems, as well as removing waste products from all parts of the body. Therefore damage to this system can have a negative impact on the functioning of the entire body. Cardiovascular disease is the most common cause of death around the globe; however, with improved diets, increased exercise, and less smoking, mortality rates are decreasing in the United States.[57]

Although high blood pressure is a pathologic function and not part of normal aging, it is normal for systolic blood pressure to increase with age because of increased stiffness of the arteries.[79] Athletic individuals have lower systolic pressure than do sedentary individuals, but systolic pressure is still, on average, higher than that in younger individuals. Veins also dilate and stretch with age, and their valves function less efficiently,[127] so blood return to the heart is slowed down. With age the heart requires slightly longer rest periods between beats, or longer recovery, which may have an impact during activities requiring a higher heart rate. The maximum attainable heart rate declines with age, though not as steeply as in those who exercise. Cardiac output is also somewhat decreased, which may explain some of the fatigue felt by older adults during strenuous activities.[127] During exercise, older adults may become short of breath (dyspnea) and fatigue more quickly than younger adults. Older adults are also susceptible to postural, or orthostatic, hypotension, which is a fall in systemic blood pressure upon changing positions (such as rising from supine to sitting at the edge of the bed) too quickly. This can cause a person to feel lightheaded upon standing, increasing yet another risk for a fall.[57] The reader is referred to Chapter 44 for further information on cardiac and pulmonary diseases.

Arteriosclerosis is hardening of the arteries, which can occur in older persons; symptoms may include headache or dizziness.[79] Atherosclerosis is a form of arteriosclerosis in which plaques decrease the diameter of the arteries, and it is the predominant change that occurs in blood vessels with age. These fatty plaques and the proliferation of connective tissue in the walls of the arteries contribute to the slow destruction of the arterial walls and can lead to blockage of the artery, especially when there is a blood clot. There is evidence that this accumulation of plaque in the walls of the arteries begins in the first decade of life, with complications of atherosclerosis beginning as early as the fourth decade of life.[57] Heart attacks are more common in individuals older than 50 years of age; and the coronary artery disease that causes the heart attack is the number one killer of people in the United States.[73] Given the prevalence of atherosclerosis in older adults, it is important that occupational therapy practitioners do their part and address diet and exercise, stress and weight management, smoking cessation and lifestyle modification, as well as medication management and adherence to prescription medications.

One important hematologic condition in older adults is anemia. Anemia is defined as "a lower than normal oxygen-carrying capacity of blood" (p. 81).[57] It can occur in older adults during a hospitalization or when placed in long-term care settings. There is no single cause for the disease; it is treated more like a syndrome that has many different causes. People with anemia generally have pale skin, fatigue, and shortness of breath. Occupational therapy clinicians should check with the physician or nurse prior to treating someone who may have these symptoms in a hospital setting, as the person may require a blood transfusion.

The immune system is important to ensure that our bodies remain free of infections and cancer. The white blood cells in the immune system must be able to recognize healthy cells from invading microorganisms and parasites, or abnormal cancerous cells.[57] Immunologic function is decreased at multiple levels and typically gives rise to three categories of illness that affect older adults: infections, cancer, and autoimmune disease. The thinner skin of elderly persons provides less of a barrier to infectious agents with increased risk for skin tears and subsequent infection. Fewer cilia are found in the lungs, which reduces the body's ability to keep infectious agents out of the lungs. There is also evidence that immunity is decreased at a cellular level, with a reduction in adaptive immune responses, such as those of T cells.[127]

The function of the respiratory system is to deliver oxygen to and remove carbon dioxide from the bloodstream.[57] Production of mucus in the respiratory system, which helps prevent respiratory infections, is decreased, and thus older adults' susceptibility to these ailments increases. The cough reflex is also less effective.[127] Numerous changes occur and can result in chest wall stiffness, such as kyphosis (appears hunched over), calcification of the costal cartilages, and scoliosis. This limits chest expansion and requires increased use of the diaphragm for breathing. This heightened energy requirement just to breathe can increase older adults' fatigue even when at rest or during light activities. The efficiency of oxygen–carbon dioxide exchange also decreases because of increased residual volume in the lungs, enlarged alveoli, and fewer capillaries.[21]

The normal age-related changes to the respiratory system can be coupled with common diseases that increase in frequency from the fifth decade of life and onward to complicate this picture. These conditions include emphysema, pneumonia, chronic bronchitis, and lung cancer. Emphysema and bronchitis can be grouped together and discussed as chronic obstructive pulmonary disease (COPD), which is primarily caused by cigarette smoking or long-term exposure to unhealthy air (see Chapter 44 for more details). Energy conservation and work simplification techniques should be incorporated into intervention when respiratory dysfunction is limiting engagement in occupations. Pursed lip breathing techniques and diaphragmatic breathing can also be incorporated into a stress management approach.

Changes in Voice and Speech Functions; Digestive, Metabolic, and Endocrine Functions; and Genitourinary and Reproductive Functions

The vocal mechanism is affected by age and results in weakness, reduced intensity, hoarseness, trembling, and alterations in vocal pitch, which is a common characteristic of the older adult's voice. These changes in the vocal mechanism are in part due to the aging larynx and supporting structures, as well as an increase in calcium and hardening of the cartilage in the larynx. Blood supply to the vocal mechanism may be decreased, and there may be edema of the vocal cords that impacts the quality of voice and speech functions. The vocal pitch of older male adults increases, whereas the pitch of older females decreases. The trembling or jittering of the voice is caused by a decrease in neuromuscular control of the muscles that support the larynx. These changes are subtle and usually are recognized only by a trained professional; they may have minimal impact on the daily communication functioning of an older adult.[25]

A major function of the digestive system is to process incoming foods in order to deliver nutrients to the body. A common problem experienced by older adults in eating and swallowing is due to tooth loss and compromised dentition. Aging causes tissue, glandular, and muscular changes in the jaw, as well as changes in the tongue, salivary glands, and throat with a decrease in the number of salivary glands and reduced taste sensation. These changes may cause an older adult to exert greater effort in swallowing and require more time to swallow food. Some older adults will choose foods that are soft and easier to swallow, whereas others reduce their food intake, impacting nutrition and weight negatively.[7]

Eating can also be challenging when there is not the proper amount of saliva in the mouth to create a bolus. This condition can be caused by decreased saliva production, cigarette smoking, or medication side effects. If a person is having difficulty swallowing, an assessment of swallowing is recommended for dysphagia (difficulty in swallowing). This would be an assessment of a complex coordination of several muscles of the tongue, palate, pharynx, and esophagus and can be administered by an occupational therapy practitioner with advanced practice or a speech and language pathologist.[57] See Chapter 27 for more information on the assessment and interventions for eating and swallowing.

In the stomach, food is chemically digested by gastric acid. As people get older, the amount of gastric acid secretions decreases, whereas the incidence of peptic ulcers and gastritis increases. This can be due to drug ingestion, aspirin, caffeine, or alcohol; it can also be caused by a genetic predisposition causing inflammation of the stomach lining. The liver's ability to detoxify many foreign and potentially damaging chemicals that enter (or are produced by) the body also decreases with age.[57]

One common problem with older adults is diverticulosis, which is “the development of small sacs where the large intestinal lining has herniated through the intestinal muscular wall” (p. 87).[57] These pockets can become impacted with feces, resulting in an ulceration and inflammation of the mucosal lining (known as diverticulitis). This can be a painful experience for older adults and can complicate the bowel routine by causing constipation. In extreme cases, it can also lead to an intestinal obstruction.[57] An occupational therapy practitioner can address issues of feeding, digestion, and bowel routine in collaboration with nursing and dietary services as well as the client and family. Doris had a diagnosis of diverticulitis, and when asked about her experience with it, Don mentioned that it did cause Doris a lot of pain and it was something that he felt was at times more painful than the hip fracture. Don believed a reason why Doris got up and went to the bathroom so much at night was because of the constipation and her attempts to have a bowel movement. Doris stopped taking her medications for diverticulitis; however, Don believed it was something she needed to resume taking to prevent the discomfort experienced prior to admission. A follow-up appointment with Doris' primary care physician was recommended.

The kidneys filter the blood and help remove wastes and extra fluid from the body. They also help control the chemical balance within the body. The kidneys work with the ureters, bladder, and urethra to excrete urine and waste, and this process can be affected by muscle changes and changes in the reproductive system with respect to bladder control. As a person ages, the kidneys and bladder change because the amount of kidney tissue decreases, the number of filtering units (nephrons) decreases, and the blood vessels supplying the kidneys become hardened, causing the kidneys to filter blood more slowly. The bladder wall changes and the elastic walls become tough and less elastic, limiting how much urine the bladder can hold. The bladder muscles weaken and can cause the bladder or vagina to fall out of position (prolapse) in women. In men, the urethra can become blocked by an enlarged prostate gland. These conditions can place an older adult at risk for urinary incontinence or urinary tract infections. Collaborating with the client and the family, as well as the nursing team, to work on a bladder program is under the scope of practice of an occupational therapy practitioner and is a critical component of self-care and independence with ADLs.[149]

Oftentimes, occupational therapy practitioners work with clients who are undergoing dialysis for chronic (or acute) renal failure. Dialysis is a treatment that replaces the function of the kidneys by removing waste, salt, and extra water to prevent them from building up in the body. It also keeps a safe level of certain chemicals in the blood, such as potassium, sodium, and bicarbonate. One other effect is that of maintaining control of blood pressure.[109] Clients who are undergoing dialysis treatments can experience exhaustion after a treatment, weakness in the lower extremities, decreased blood pressure, muscle cramps, itching, insomnia, anemia, bone disease, fluid overload, and depression. It is critical to pace any occupational therapy intervention and teach energy conservation and work simplification techniques. Caregivers and family members should also receive the attention of the clinician, as dynamics in family responsibilities and relationships can be altered.[95] Meal planning and grocery shopping can be included in the intervention plan, as patients receiving dialysis must maintain a special diet with supplements and an extensive prescription medication list.

The endocrine system is another regulatory system in the human body and controls many aspects of the body's physiology, such as body temperature; basal metabolic rate; growth rate; carbohydrate, lipid, and protein metabolism; stress response; and reproductive events.[57] Because the endocrine system is responsible for producing and secreting hormones into the body, dysfunction of this system has widespread impact on the health and well-being of an older adult.

Gregory and Sandmire have described a hierarchy of control,[57] which starts with the higher brain centers that influence the activity of the hypothalamus. The hypothalamus releases hormones that control the activity of the pituitary gland, which in turn releases hormones that control the activity of lower endocrine glands and other tissues. These lower endocrine glands release hormones that control other body functions related to the thyroid gland, adrenal gland, testes, and ovaries. An overall decline in the production and secretion of hormones and the impact this has on the human body goes beyond the scope of this chapter; however, one condition that is prevalent in the older adult population is diabetes mellitus (DM).

Diabetes is a condition in which the body does not properly process food for use as energy. The pancreas makes a hormone called insulin to help glucose get into the cells of the body. With diabetes, the body either does not make enough insulin or cannot use its own insulin as well as it should. This causes sugars to build up in the blood.[29] Long-term complications such as blindness (resulting from cataracts and retinal damage), renal failure, nerve damage, atherosclerosis, and gangrenous infection often necessitating amputation (below or above the knee) are all factors that will impact participation in occupations. Non-insulin-dependent diabetes mellitus (NIDDM), or type 2, accounts for approximately 90% to 95% of all cases. In the United States, 21 million people have been diagnosed with DM, and 27% of those 65 years of age and older have the disease.[29] This is another area where occupational therapy practitioners can intervene with lifestyle modification programs, weight management, exercise and diet programs, and stress management. The client and family should be working closely together to address the needs of an older adult with DM.

Reproductive function will also change as a person ages. For women, menopause is associated with physiologic and psychological changes that can influence sexuality. There is a decrease in estrogen levels, which impacts the menstrual cycle as well as vaginal lubrication. The changes in estrogen levels also affect the vascular and urogenital systems. Women may experience changes in mood, sleep, and cognitive function, which can contribute to lower self-esteem, decreased self-image, and decreased sexual desire. Prescribed medications and current medical status can also impact sexuality and sexual drive.[12] There are medications and hormone replacement therapies that can be utilized to address these issues medically; therapy and counseling can also be of benefit psychologically.

For men, there is not a major or rapid change in fertility with age as there is with women. The changes are gradual in nature, and the condition is referred to as **andropause**. The changes for men primarily occur in the testes, with decreased testicular mass and a gradual decline of testosterone;

these changes may make it more challenging to achieve an erection. The testes continue to produce sperm; however, the rate of sperm cell production decreases and the tubes that carry the sperm may become less elastic with age. With the enlargement of the prostate gland, urination and ejaculation are negatively affected. Approximately 50% of older men are diagnosed with benign prostatic hypertrophy (BPH).[150] Fertility varies among older men; age does not predict male fertility. The volume of fluid ejaculated usually remains the same; however, there may be a decreased amount of sperm. Some men experience decreased sex drive, which can be caused by psychological concerns, lack of a willing partner, medication side effects, or other chronic medical conditions.[150]

Erectile dysfunction (ED) may also be a concern for aging men; however, this is not because of the aging process itself but because of other medical conditions or medication side effects. Hypertension and DM are known causes of ED, and medications can be used to treat this condition. Prostate cancer and bladder cancer are more likely to occur with age, and preventive measures and visits to a primary care physician are encouraged for early detection.[150] Occupational therapy practitioners can utilize their interview skills and the EX-PLISSIT model for sexuality to obtain information and provide information in the area of sexuality. There are also clinicians who have advanced practice in this area and can provide more intensive and comprehensive therapy. Referrals should also be made to sex therapists as needed.

Changes in Skin and Related Structure Functions

The integumentary system consists of the skin as well as accessory structures such as the nails, hair, oil glands, and sweat glands. An obvious sign of aging is the change in hair color to gray, as well as the thinning and loss of hair, experienced by many older adults. Because skin covers the entire body, another obvious sign associated with aging is the changing skin. As the aging process progresses, skin becomes more vulnerable to shearing forces, abrasions, and blister formation.[57] It is important for occupational therapy practitioners to protect the client's skin during functional mobility and ADL transfers from surface to surface, to avoid any shearing or tearing of the skin. Any open tears or wounds should be covered to protect the client and the clinician.

It is also important for older adults to protect the skin from ultraviolet rays of the sun. The turnover rate of the epidermis shedding and replacing itself every month starts to slow down with aging, slowing the amount of protective melanin pigment produced. This makes the ultraviolet light more dangerous and leaves older adults more prone to developing skin cancer.[57]

The thinning and wrinkling of the skin are results of the decreased amounts of collagen and elastin in the dermis of the skin. With the loss of elastin, the skin loses its resilience as a person ages, and with the loss of collagen, the skin is more susceptible to wear and tear. These changes are accompanied by a decreased flow of dermal blood supply, impacting the typical signs of inflammation in the skin. Older adults may not show initial signs and symptoms of tissue injury like sunburn, bacterial infection, or even skin cancer. Because the dermal layer of the skin holds sensory receptors, the changes in this layer will also affect tactile sensitivity of the skin while increasing the pain threshold at the fingertips.[57] These changes may make it difficult for older adults to perform fine motor movements, such as turning on a hearing aid, snapping buttons, or putting in earrings. Fine motor movements and dexterity should be assessed and compensatory strategies should be integrated into intervention for the completion of ADLs such as grooming and other meaningful activities.

Aging is a natural process and the changes described here are expected and typical. "It is this interdependence of our organ systems that, on the one hand, allows for appropriate compensatory adjustments to homeostatic disturbances in younger, healthy individuals but, on the other hand, can create a chain reaction of dysfunction in older, less healthy persons with decreased physiologic functional reserve" (p. 82).[57] When there is a chronic medical condition or injury, the aging process becomes more complicated; therefore it is important to consider prevention and wellness with the older adult and intervene with our clients when they are younger adults, if possible.

Threaded Case Study

Doris, Part 3

Strengths that were identified for Doris included the fact that she required minimal assistance or less during functional mobility and could feed herself with supervision. These were two areas that did not require much physical assistance from Don. Doris also showed active range of motion and strength in her upper extremities, which were considered within functional limits. Doris had a passion for piano and teaching young children to play piano, which was also a strength, as it was motivating for her and provided her with hope. Supports included her relationship and assistance from Don and their loving family. Don and Doris lived right behind the rehabilitation facility, and Don could visit Doris and learn from the occupational therapist each day for family/patient education.

Areas of potential occupational disruption included resuming instrumental activities of daily living and resuming her roles in the home management tasks of bookkeeping and paying the bills secondary to her cognitive deficits and expected limitations in the future, given her diagnosis of Alzheimer's disease. Barriers included safety in the home (and at the facility) secondary to the cognitive component, which is progressive in nature, requiring more and more compensatory measures. There is also concern about Don's health and his abilities to serve as the sole care provider upon discharge to their home.

Priorities included patient and family education, particularly with Don, in preparation for discharge. Don identified two major goals for Doris as being very important: safely performing toileting activities (particularly in the middle of the night) and resuming piano instruction. The occupational therapy practitioner recommended that Don also consider a caregiver support group and in-home support services for the physical work that he may not be able to complete with Doris, due to his own physical limitations and heart condition.

Doris' case has several layers, including a new home environment and medical conditions that added to the complexity of the aging process. All of these layers had to be considered when designing an intervention plan that could meet Doris' and Don's needs. Compensatory strategies and environmental adaptations were recommended for Doris, and caregiver education was paramount for the carryover and execution of the strategies in the home. Attention was given to the caregiver and his needs, as Don himself is an older adult with a complicated medical condition who also demonstrated physical limitations in his role as caregiver.

Don brought Doris' keyboard to therapy, and as Doris progressed in occupational therapy, she began to play the keyboard again. She was able to complete bathing and dressing activities with minimal verbal cues utilizing sequencing cards designed in therapy and was soon inviting other residents at the facility to the rehabilitation gym to sing along as she played the keyboard. Don said she finally looked like herself again. He attended a support group specifically designed for caregivers who were spouses of loved ones with Alzheimer's disease, and he agreed to in-home support services and respite services so that he could take time for himself. The new apartment was organized, and the hallways and floors were cleared. Don and Doris felt ready for the discharge to their home.

Summary

Older adults are an extremely diverse population with whom occupational therapy practitioners work; they provide complex challenges yet offer rewarding experiences and opportunities in both habilitation and rehabilitation settings. Older adults bring a lifetime of experiences, habits, wisdom, and problem-solving strategies to the occupational therapy process, as well as the possibility of functional decline as a result of the aging process. From the stories of "when I was your age" to the excitement experienced while surfing the Internet, this population presents opportunities and potential for the field of occupational therapy to truly make a difference with people who deserve comprehensive and holistic care.

Empowering older adults, their families, and their caregivers is a reflection of the respect and dignity the older adult population deserves. Baby boomers must be a priority to society and to healthcare, because their needs are growing as they continue to age. Meanwhile, the healthcare policies and systems driving reimbursement and documentation continue to challenge the delivery of services. An occupation-based, client-centered approach makes sense when addressing the needs of an older adult, because like any other client, the desired outcome is to live life to its fullest.

Review Questions

1. Describe four elements of treatment to enhance participation by an older adult with low vision, impaired hearing, impaired sensation, and low endurance.
2. Name three cognitive changes associated with aging, and provide three strategies to enhance the learning of new information.
3. List five age-related physical changes that a therapist would consider in a client who is 80 years of age.
4. Identify areas of occupation to assess when working with an older client who recently had significant weight loss.
5. Describe three key considerations when assessing an older adult's home for the potential to age in place.
6. What are the benefits to a shared governance structure in facilities providing care to older adults?
7. Describe the paradigm shift that can occur when "flipping a nursing facility."
8. Describe the significance of policies established for older adults in the United States with respect to documentation and reimbursement.

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47

HIV Infection and AIDS

Michael Pizzi, Graham Teaford

CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Understand the stages of HIV and AIDS.
2. Describe the impact of medical interventions on HIV.
3. Describe how to assess a person with HIV or AIDS holistically.
4. Identify occupational therapy interventions directed toward optimizing health as an occupational participation.
5. Understand the importance of a health promotion and prevention perspective in occupational therapy services for people with HIV and AIDS.

KEY TERMS

Acute HIV infection
AIDS-dementia complex
Antiretroviral therapy
Opportunistic infection
Retrovirus
Seroconversion

Threaded Case Study

Billy, Part 1

Billy is a lawyer and internal medicine physician living with Tom, his partner of 15 years. He has lived for more than 20 years with a diagnosis of HIV infection, and the mode of infection for Billy is unknown. Billy has been practicing medicine successfully, as well as doing pro bono work as a legal advocate for people infected with HIV and with AIDS. He began highly active antiretroviral therapy approximately 15 years earlier. His $CD4^+$ count has remained above 500, and he has not had any opportunistic infections. He continues to be active in his career as a physician and with his pro bono legal work.

He has recently noticed that he has more difficulty with his memory, decreased fine motor coordination, difficulty coordinating his movements, burning sensations in his hands and feet, and lower extremity weakness. These changes have had an impact on his life in a variety of ways, such as difficulty remembering his appointments, taking his medications as scheduled, writing, and awakening at night because of pain.

During the course of developing an occupational profile, he stated that his primary concerns involve how these changes have affected his professional activities. He values his roles as both physician and attorney, as well as his paid employment and his pro bono work. His work has been affected by his diminished writing skills (requiring more time and effort to write legibly) and his pain (limiting his rest and causing him to have difficulty concentrating on work tasks). However, he is most concerned with his changes in memory because it has caused him to forget appointments and miss deadlines, has compromised the quality of his work, and has placed his professional competence and identity at risk. This deficit became his greatest concern because of his pride in having what he calls a “mind like a steel trap.” As a health professional, Billy possesses the knowledge required to care for his own health and well-being; however, he does not apply this knowledge to his own daily life. His partner, though supportive, is becoming increasingly angry, irritable, and concerned, and these emotions appear to have impaired his own occupational performance in work, home, and leisure occupations.

Origins and Current Status of HIV Infection

An estimated 36.9 million people globally are infected with human immunodeficiency virus (HIV) or have acquired immunodeficiency syndrome (AIDS).[55] In 2014, approximately 1.2 million people died of HIV/AIDS, and an estimated 2 million persons were newly infected with HIV. An estimated 34 million people have died of HIV/AIDS since the virus was first detected.[59]

HIV originated in Africa and has likely been present in humans since the late 19th century.[11] The virus has been present in the United States since the 1970s, possibly decades earlier, and has since spread globally.[27]

AIDS was first clinically identified in the United States in 1981.[16] These initial cases of AIDS in the United States were concentrated in men having sex with men, injection drug users, and persons receiving contaminated blood supplies (from transfusions or clotting factor for persons with hemophilia). By 1983, HIV, the virus that causes AIDS, was identified.[20] It soon became apparent that HIV is spread by contact with specific body fluids (including blood products, semen, and vaginal fluids). The eventual discovery of HIV as a virus made it apparent that AIDS does not discriminate among gender (Table 47.1 and Fig. 47.1), race (Table 47.2 and 47.4), culture, sexual orientation (see Table 47.1), or age (Tables 47.3). HIV affects all of humanity. It affects not only the people infected with the virus but also their parents, siblings, friends, lovers, children, and coworkers. After one's diagnosis of being HIV positive has been confirmed, an individual can become immobilized and drastically alter his or her occupational performance and participation in society, or the individual can treat the diagnosis as an impetus to act in positive, life-transforming ways.

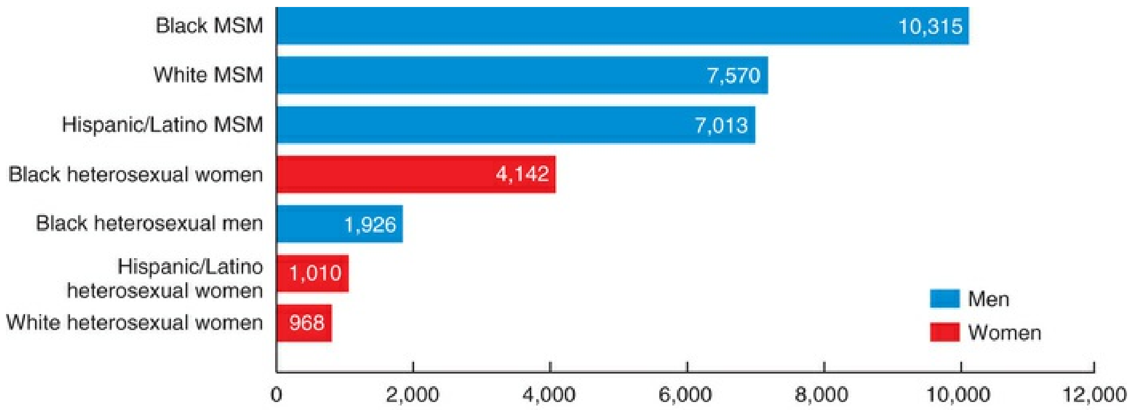
TABLE 47.1

Distribution of the Estimated Number of Diagnoses of AIDS in Adults and Adolescents in 2015

Exposure Category	Male	Female	Total
Gay and bisexual men	26,375	_____	26,375
Male to male sexual contact	1202	_____	1202
Injection drug use	1412	980	2392
Heterosexual contact	2948	6391	9339

In 2015, 39,513 people were diagnosed with HIV infection in the United States. The number of new HIV diagnoses fell 19% from 2005 to 2014. Because HIV testing has remained stable or increased in recent years, this decrease in diagnoses suggests a true decline in new infections. The decrease may be due to targeted HIV prevention efforts. However, progress has been uneven, and diagnoses have increased among a few groups.

Centers for Disease Control and Prevention https://www.cdc.gov/hiv/statistics/overview/ataglance.html



Source: CDC. Diagnoses of HIV infection in the United States and dependent areas, 2015. HIV Surveillance Report 2016;27. Subpopulations representing 2% or less of HIV diagnoses are not reflected in this chart. Abbreviation: *MSM*, men who have sex with men.
Centers for Disease Control and Prevention
https://www.cdc.gov/hiv/statistics/overview/ataglance.html

FIG 47.1 New HIV diagnoses in the United States for the most affected subpopulations, 2015.

TABLE 47.2

Estimated Cumulative Cases by Race/Ethnicity

In 2015, the number of diagnoses of HIV infection in the United States was as follows:	
Race or Ethnicity	**Number of Diagnoses of HIV Infection, 2015**
American Indian/Alaska Native	209
Asian	955
Black/African American	17,670
Hispanic/Latino*	9,290
Native Hawaiian/Other Pacific Islander	79
White	10,509
Multiple Races	801

*Hispanics/Latinos can be of any race.

For more details on HIV infection and race/ethnicity, see CDC's Populations and Surveillance fact sheets.

TABLE 47.3

HIV Diagnoses by Age

Age in Years	Number of cases in 2015	Percentage
13-19	1,723	4
20-29	14,594	37
30-39	9,631	24
40-49	6,720	17
50-59	4,870	12
Over 60	1,855	5

Centers for Disease Control and Prevention https://www.cdc.gov/hiv/statistics/overview/ataglance.html

TABLE 47.4

AIDS Information Tracked by CDC on Various Racial and Ethnic Groups*

In 2015, the number of persons in the United States with diagnosed HIV infection classified as stage 3 (AIDS), by race/ethnicity, was as follows:		
American Indian/Alaska Native	96	3,543
Asian**	325	9,932
Black/African American	8,702	506,163
Hispanic/Latino†	3,870	222,227
Native Hawaiian/Other Pacific Islander	22	845
White	4,668	439,207
Multiple Races	620	35,000

*From the beginning of the epidemic through 2015.

**Includes Asian/Pacific Islander legacy cases.

†Hispanics/Latinos can be of any race.

For more details on AIDS and race/ethnicity, see CDC's fact sheets.

The majority of global HIV cases are caused by exposure to HIV type 1 (HIV-1), with HIV type 2 (HIV-2) being much less common and primarily found in western Africa. The global patterns of the HIV epidemic are complex and vary greatly by region and within different regions. The 2013 United Nations Global AIDS Report[54] identifies a number of trends:

- The estimated annual number of new infections globally declined from 3.4 million in 2001 to 2.3 million in 2012 (a 33% reduction).
- An estimated 1.6 million people died of AIDS in 2012, a decline from an estimated 2.3 million in 2005.
- Women account for 52% of the people living with HIV in low- and middle-income nations. In sub-Saharan Africa, the region most impacted by HIV, women account for 57% of persons living with HIV.
- Access to antiviral treatment has expanded, with the number of persons receiving treatment tripling in a 5-year period. As the number of persons receiving treatment has increased, life expectancies for persons infected with HIV have also increased. However, globally only a third of the persons eligible for treatment are currently receiving antiviral medications, with some populations and regions facing significant challenges. Among the most significant challenges are ensuring that more persons are aware of their HIV status.
- Tuberculosis deaths, the leading cause of death for persons living with HIV, have declined globally,
- Service integration is a priority as nations move from initial programs that developed in response to the health crisis posed by HIV toward a long-term integrated approach within the medical

system. These approaches vary considerably from nation to nation depending on needs and target populations.

- Global AIDS funding remains inadequate to meet the demands of the crisis.
- Discrimination against persons with HIV remains a barrier to treatment and prevention efforts.

Currently, an estimated 1.2 million persons in the United States have diagnosed or undiagnosed HIV/AIDS.[21] As of 2012, 12.8% of persons infected with HIV in the United States are unaware of their HIV-positive status.[10] According to estimates from the Centers for Disease Control and Prevention (CDC), more than 50,000 new cases of HIV infection occur in the United States each year. The number of new infections per year (incidence rate) has remained relatively stable. However, the number of persons living with HIV (prevalence rate) has continued to grow as mortality rates from HIV have decreased, in large measure as a result of available and effective antiviral medications.[13] The demographic trends in the United States have changed since the earliest years of the pandemic.

Although overall rates of new infections have been relatively stable in the United States, certain groups are at greater risk for HIV infection and bear a disproportionate burden of HIV. Among ethnic groups, African Americans are the most disproportionately affected population in the United States. African Americans represent approximately 12% of the U.S. population but account for 44% of all new infections and 41% of all persons living with HIV.[12]

Hispanics/Latinos are also disproportionately affected by HIV in the United States. Though representing 17% of the United States population, in 2013 Hispanic/Latinos accounted for 23% of new HIV infections.[9]

The earliest cases of HIV infection in the United States, though having a broad impact on society, were concentrated in white males.[16] In contrast, current infection patterns in the United States demonstrate changes in the groups currently at risk, as well as underscore the fact that HIV infection is not a concern of only one ethnic group.[11]

Although male-to-male sexual contact remains the most common means of transmission of new infections, heterosexual contact accounts for nearly a quarter of all new HIV infections.

The course of the HIV pandemic has changed significantly with the advent of effective medical treatments. For persons with access to effective medications, management of HIV has, to some extent, changed the focus of medical management to the chronic medical needs of persons with HIV infection rather than more acute management of **opportunistic infections**. In the earliest years of the pandemic, before effective pharmaceutical treatment, death typically occurred within 10 years of HIV infection and 1 to 2 years after the onset of AIDS.[7] Mortality rates and the frequency of opportunistic infections have decreased significantly. However, this also presents public health concerns. The health delivery model in the United States is not always effective in addressing the increasingly chronic needs of persons infected with HIV rather than the more acute cases that were more common in the earlier years of the pandemic.[19] Occupational therapy (OT) practitioners can potentially play a significant role in the promotion of health and management of chronic medical needs to ensure that persons remain active participants in meaningful occupations.

Infection Process

HIV is the virus that causes AIDS[20] and belongs to a class of viruses known as **retroviruses**. Retroviruses share a unique process of replication characterized by the viral genetic material being encoded by RNA rather than DNA. Retroviruses, including HIV, replicate as viral RNA is transcribed into DNA in the host cell. The cellular process is complex, with many components and processes occurring. The following is a simplified description of the infection process.

The process begins as the virus binds to a cell surface receptor.[39] During the attachment phase, HIV binds with the surface protein receptors on the cell membrane. The receptors operate in a lock-and-key fashion, with CD4 being the primary receptor for HIV (although other receptors and processes are also critical in the process of HIV cellular infection). The initial binding with surface receptors is a necessary stage for cellular infection.

Once the initial binding to cell receptors is completed, the virus passes through the cellular membrane and enters the cytoplasm. On entering the cytoplasm, the retrovirus uses an enzyme called reverse transcriptase to synthesize a proviral DNA copy from the viral RNA template (a process referred to as reverse transcription). During this process, the transcriptase reads the RNA material as it is converted to DNA that can be integrated into the host cells' genetic material. However, errors are frequently made in the replication process. As a result, not all copies of HIV DNA are identical. The modifications or mutations during this process contribute to the resistance of the virus to the body's immune system and to certain antiviral treatments.

The completed proviral DNA migrates to the nucleus of the host cell and is inserted into or integrates with the host cell DNA. Once this integration occurs, the integrated viral DNA (or provirus) is replicated along with normal cellular genes as part of the routine cellular division process. Virions containing HIV RNA and HIV proteins are assembled within the host cell body, and an enzyme called protease is required at this phase to divide the polypeptide chain into discrete functional enzymes. The completed HIV virions (containing HIV RNA and HIV proteins or enzymes) are released from the host cell membrane in a process referred to as budding. Once the virions are released and the transcriptase has completed division of the proteins, the mature virus is capable of infecting additional cells. The newly created mature virus resembles the original virus but may also have undergone some variation during the replication process, thus complicating medical treatment.

Transmission

HIV is transmitted through exchange of certain body fluids (blood, semen, preseminal fluid, rectal fluid, vaginal fluid, and breast milk) from a person with HIV. Sexual behaviors and injection drug use are the most common means of transmission for new infections.[22] Less common means of transmission include mother to child during pregnancy, birth, or breast feeding, and accidental exposure to infected needles (primarily occupational exposure). HIV is not transmitted through casual (nonsexual) contact with persons.[7]

In the early years of the AIDS pandemic, many people were infected with HIV because of contamination of the blood supply (primarily through transfusions or clotting factor given to persons with hemophilia). However, the blood supply is tested for HIV in the United States.[8] The risk of contracting HIV via blood products, transfusions, or organ/tissue transplants is very low.

The risk of infection to healthcare providers is also very low.[22] The risk for HIV infection following a needle stick is 0.3%, and the risk for infection after exposure of infected blood to the eyes, nose, or mouth is 0.1%.[18] The risk with exposure of nonintact skin to infected blood is less than 0.1%, and exposure of infected blood to intact skin probably poses no risk at all. It is important to remember that healthcare workers, or any other persons, are not at risk for HIV infection through casual, everyday contact with persons infected with HIV. The CDC recommends that healthcare workers practice universal precautions.

Universal precautions in the workplace include assuming that blood and body fluids from all clients are potentially infectious.[23] Healthcare workers should take certain precautions when working with all clients. Such precautions include the routine use of barriers (such as gloves) when anticipating contact with blood or body fluids. Workers should also wash hands and other skin surfaces immediately after contact with blood and body fluids. Finally, although the risk for HIV infection from an accidental needle stick is very low, this route of transmission constitutes the most likely risk for infection in healthcare workers. Workers should practice careful handling and disposal of any needles or potentially infectious sharp objects.

Diagnosis

HIV may be detected by using a variety of tests.[7] In general, three broad categories of tests are available: antibody tests, combination tests, and nucleic acid tests (NATs).[10] Antibody tests detect the presence of HIV antibodies following the initial HIV infection. It is important to note that during the process of **seroconversion** (the immune response producing detectable antibodies), the person may be infected but not have a positive antibody test result. The process of seroconversion (producing a positive antibody detection test result) may take up to 2 months after the initial infection, and the infected person is capable of transmitting HIV during this time. It is recommended that antibody tests be repeated 3 months after exposure if the initial test failed to detect antibodies. Combination tests detect both the antigen and HIV antibodies. NATs detect the virus itself in the blood rather than the presence of antibodies. It is expensive and is not typically used for standard screening purposes.

HIV infection can be categorized along a continuum ranging from asymptomatic persons with high $CD4^+$ counts to persons with clinical AIDS (representing the most advanced and serious stage of HIV infection). In 1993, the CDC revised the categories that determine HIV or AIDS status.[17] They include the following:

- Category 1 (C1): counts of 500 or more $CD4^+$ cells per microliter of blood
- Category 2 (C2): counts from 200 to 499 $CD4^+$ cells
- Category 3 (C3): counts below 200 $CD4^+$ cells

The second set of categories relates to the expression of HIV from a clinical perspective:

- Category A: individuals who have been asymptomatic except for persistent, generalized lymphadenopathy seroconversion syndrome. This includes the initial acute onset of HIV exposure.
- Category B: individuals who have never had an AIDS-defining illness but have had some symptoms of HIV infection, such as candidiasis, fever, persistent diarrhea, oral hairy leukoplakia, herpes zoster, idiopathic thrombocytopenic purpura, peripheral neuropathy, cervical dysplasia, or pelvic inflammatory disease.
- Category C: individuals who have or have had one or more of the AIDS-defining illnesses.

An individual is determined to have HIV infection if one category from each set applies. For example, AIDS would be diagnosed if the person is designated category 3 (<200 $CD4^+$ cells) and has had at least one AIDS-defining illness. Categories 1 and 2 and A and B are considered HIV positive (a less grave condition), whereas categories 3 and C are defined as AIDS. These categories are used primarily to pinpoint an individual's placement along the continuum of HIV infection.[37]

Occupational therapists and OT assistants have the opportunity to positively affect the daily lives of people with HIV and AIDS in all of these stages of illness. Promoting health, quality of life, and well-being is one focus of OT intervention.[2]

Threaded Case Study

Billy, Part 2

Billy appears to have more mental health issues surrounding his illness than physical concerns at this time. He does experience fatigue and slight memory problems. The occupational therapist may ask the following questions:

1. Is the fatigue experienced related to the medical condition or the mental health issues that Billy is experiencing?
   In this case, the fatigue that Billy reports could certainly be related to both physical and mental health issues. He could be experiencing **AIDS-dementia complex** (ADC), which is manifested, in the context of occupational performance, as altered cognitive processing and impaired memory. ADC appears to be related to the destruction of subcortical structures in the central nervous system (CNS) and is estimated to be present in more than half of individuals in whom AIDS is diagnosed. A peripheral neuropathy may also be developing, among other conditions. Having an awareness of these disease processes could lead to increased anxiety, fear, and possibly

depression, especially with regard to the impact on his worker role. Billy should be encouraged to discuss these fears in the context of his daily living occupational performance.
Billy's ability to use effective habits and routines in the workplace might reduce his anxiety about his diminished memory. Devices such as electronic organizers and calendars may be helpful to Billy as memory aids. A conversation about these issues would involve Billy's knowledge of his life situation, thus making the OT sessions very client centered.

2. If Billy is preoccupied with his change in health status, how does he function in his work, home, community, and other contexts?
   Using specifically guided questions, the therapist might examine the contexts in which Billy engages to elicit information that might have been unknown to him before OT interventions. He would benefit from an evaluation such as the Pizzi Holistic Wellness Assessment (discussed later).

3. Are there mental and physical health issues that can be incorporated into a prevention and health promotion OT program?
   Billy could engage in a reality-checking exercise in which he explores the positive aspects and strengths in his life (eg, good social support, advanced knowledge in the area of healthcare). These strengths can help him maintain a positive sense of self and engage in more health-promoting behavior on a physical level, such as a regular exercise program.

Pharmacology

After well over a quarter century of the HIV epidemic, there is still no cure. Over the years, researchers have made extraordinary progress in the development of medications to alter the course of the disease. The medications used to treat HIV infection have helped promote healthier functioning in people with HIV and AIDS, which facilitates continued occupational participation.[40]

Several classes of antiretroviral drugs are used to treat HIV infection.[7] They can be grouped into different classes of medication based on the mechanism by which the drug limits viral replication. These medications act on specific enzymes required for viral replication. By restricting viral replication, these medications can increase the $CD4^+$ cell count and thus improve immune function and, as a result, limit the individual's susceptibility to opportunistic infections. The general categories or classes of drugs are listed in Box 47.1.

Box 47.1

Antiretroviral Drugs Used to Treat HIV Infection

Reverse transcriptase inhibitors: These drugs influence the ability of the enzyme reverse transcriptase to convert HIV RNA into DNA.

Protease inhibitors: These drugs influence the ability of protease to activate proteins in the newly developed viruses and result in immature viruses that are incapable of infecting additional cells.

Fusion inhibitors: These drugs limit the ability of HIV to enter cells by methods that include blocking the specific receptor sites.

Integrase inhibitors: These drugs act on the integrase enzyme to prevent HIV DNA from being integrated into cellular DNA.

Entry inhibitors: These drugs (also known as fusion inhibitors) interfere with the binding of HIV to host cell receptors.

Data from McCutchan JA: Human immunodeficiency virus (HIV). In Merck manual online, 2009. http://www.merck.com/mmpe/sec14/ch192/ch192a.html.

HIV has considerable variation as a result of the replication process described previously. HIV quickly develops resistance to any of the antiretroviral medications used individually because of these mutations occurring during replication. Antiretroviral treatment is most effective when the medications are used in combination. Current protocols use multiple antiretroviral medications simultaneously to limit the ability of the virus to develop resistance to a single medication. The combination of medications has the benefit of reducing HIV blood levels more than is possible with a single medication, the combination helps prevent drug resistance, and some of the medications used in combination have a synergistic effect (increasing levels of other HIV drugs in blood). The most common combinations of medications include three reverse transcriptase inhibitors or two reverse transcriptase inhibitors and one or two protease inhibitors.

These combined antiretroviral medications are referred to as **antiretroviral therapy** (ART). The introduction of ART has significantly changed the course of the AIDS pandemic.[53] In the United States, more people than ever before are living with HIV. The increased survival rate is most likely due to a combination of an increasing percentage of persons knowing their HIV infection status and persons receiving access to ART. It is particularly important for people to be tested and be aware of their HIV status. This is significant because it increases the likelihood that these persons will receive ART at an appropriate time, but it is also significant that persons who are aware of being HIV positive are less likely to transmit the virus (further reducing the incidence of infection).

The use of ART has significantly extended the life expectancy of persons infected with HIV. Many persons treated with ART live decades after the initial infection.[53] As a result of the effectiveness of this treatment, the overall prevalence rate of HIV infection in the United States has increased despite incidence rates of the infection remaining relatively stable (see the section "Origins and

Current Status of HIV Infection"). Overall hospital use has declined since the introduction of ART, as well as morbidity and mortality in persons infected with HIV.[6] Medical management of persons infected with HIV now includes multiple medical conditions associated with aging or chronic conditions.

The improved survival rates resulting from access to ART have become a significant factor in the management of HIV infection. However, it should be noted that ART is not a panacea. Despite prevention and treatment successes (including ART), people still die of AIDS. The overall survival rate trends are encouraging, but there remain too many persons in whom HIV is not diagnosed until late in the course of the infection process, and this represents a missed opportunity for prevention and treatment.[21] ART also has potential complications resulting from medication side effects and other issues.

Adherence to ART is correlated with viral suppression, improved immune function, increased survival from HIV, and improved quality of life.[25] However, maintaining medication compliance is challenging for reasons other than side effects. Persons who begin ART are often young and frequently display minimal symptoms from HIV at the initiation of ART. Because HIV infection is a lifelong condition, it may be a challenge for persons to continue adhering to the medication regimen as prescribed. Reasons for poor adherence are many and complex, but there are several predictors of poor medication adherence. Low levels of literacy, psychosocial issues (including depression, limited social support, stress, and dementia), active substance use, cognitive impairment, complex regimens, age-related changes, medication fatigue, and medication scheduling issues are all predictors of poor medication adherence independent of side effects of the medications.[25]

Effective use of medications for the treatment of HIV requires consistency in maintaining the schedule of administration of the medications.[25] Failure to maintain consistency with the medications may result in HIV developing resistance to medications and allowing viral replication. ART reduces the viral load and allows the immune system to continue to function and prevent the presence of opportunistic infections. The effectiveness of the ART regimen can be measured by detecting the level of viral load present and by monitoring helper T-cell counts. In many instances, persons taking ART have a nearly undetectable level of virus. However, once a person is infected with HIV, that person is always able to transmit the virus.

Unfortunately, these life-enhancing medical regimens are associated with myriad side effects, many of which clients receiving OT services will experience. Understanding these side effects is important because they affect occupational performance. Side effects include CNS disorders, peripheral polyneuropathy, gastrointestinal disorders, hepatotoxicity, anemia, pancreatitis, osteopenia and osteoarthritis, lipodystrophy, hyperlipidemia, diabetes, and hyperglycemia. Because of the extensive and varied pharmacologic side effects, many people with HIV have great difficulty in deciding the appropriate time to begin a drug regimen.[32] Persons taking ART may also be at risk as a result of being unable to take ART consistently. This can occur because of either side effects or poor medication management (for example, persons with HIV-related neurocognitive deficits are 2.5 times more likely to be at risk for medication noncompliance than are persons without dementia).[31]

ART has been an effective medical intervention that has significantly altered the landscape of HIV infection by creating improved health and well-being for many infected individuals. Unfortunately, access to affordable healthcare is limited or nonexistent for millions of people worldwide, but recent efforts have made these important medications more accessible.[56] Despite best practice in medicine, a cure for AIDS remains elusive. However, thanks to medical advances, people continue to live full and productive lives while coping with the daily issues of living with HIV.

Aging and HIV Infection

A few issues related to aging in persons infected with HIV are important and require the attention of the OT practitioner. As ART prolongs the life of persons with HIV, the presence of HIV with other age-related conditions is becoming more common. Research has indicated that both hospitalizations and deaths from HIV-related causes have declined. The reduction in opportunistic infections and clinical AIDS has resulted in alternative causes of mortality in aging persons infected with HIV. Elderly persons with HIV are more likely to have additional medical comorbid conditions.[58]

Several considerations influence the health outcomes of elderly persons with HIV.[29] The elderly (classified by the CDC as persons older than 50 years) are a growing demographic in the United States for HIV infection. The number of persons older than 50 years infected with HIV has increased because of at least two factors. The first is sometimes referred to as an *aging cohort effect,* which describes a group of persons infected with HIV earlier in life and who age as a result of ART prolonging life expectancy. The other factor involves new infections diagnosed in persons older than 50 years. The incidence and prevalence of HIV infection have both increased in persons older than 50.

Some research suggests that persons in whom HIV infection is diagnosed after 50 years of age have worse outcomes than their younger cohorts do. One important factor appears to be that HIV infection diagnosed in persons older than 50 is at a more advanced stage than in their younger counterparts.

Possible explanations for the more advanced progression at the time of diagnosis in older persons with HIV includes less common routine screening for HIV in this population, poorer awareness of the risks for HIV infection and safer sex practices in this age group, and physicians perhaps being less likely to consider HIV clinically. The symptoms or signs of HIV infection may also be more likely to be attributed to comorbid medical conditions or to other conditions more commonly associated with aging populations.

Neurologic Sequelae of HIV/AIDS

Various medical complications are associated with HIV/AIDS, and multiple body functions and body structures can be affected by HIV/AIDS. Neurologic disorders related to HIV infection are common and may be potentially debilitating in the performance of activities of daily living (ADLs) and instrumental activities of daily living (IADLs).[35] Estimates of the frequency of neurologic disorders vary, but it appears that as many as 66% of persons with HIV may have peripheral neuropathy.[34] It is likely that at least 20% of persons with HIV infection have some type of neurocognitive impairment,[49] and some evidence suggests that more than 50% of persons on ART may have cognitive deficits.[30,52] The estimated prevalence of neurocognitive impairment varies considerably, in part because of the clinical standard used to determine the presence of cognitive impairment. If mild cognitive impairment is used as the criterion, the prevalence of neurocognitive impairment is significantly higher.[48] Despite the effectiveness of ART in improving overall immune function, neurologic deficits have persisted, although advanced stages of dementia are less common than before the use of ART.[53]

Neurologic disorders are of particular concern to occupational therapists working with persons with HIV/AIDS. HIV is capable of passing the blood-brain barrier and entering the CNS.[36] HIV has been detected in CNS structures, as well as in cerebrospinal fluid, in persons infected with HIV, including those who are asymptomatic and with functioning immune systems. The neurologic sequelae of HIV/AIDS can be an indirect result of the virus via opportunistic infections (resulting from compromised immune function) or a direct or primary effect of HIV. The presence of neurologic opportunistic infections has been greatly reduced in the United States since the advent of antiretroviral therapies.[49] However, primary effects of HIV on the CNS remain common and should be considered when addressing the needs of this population. Various neurologic conditions or clinical manifestations are associated with HIV/AIDS. However, this section focuses on neuropathies (the most common neurologic complication of HIV/AIDS) and AIDS-related dementia (which can have a profound impact on occupational performance) (Box 47.2). Not all persons display clinically significant neurologic deficits. However, neurologic deficits will develop in a significant number of persons as a result of this process.

Box 47.2

Neurologic Complications of HIV-1 Infection

HIV-1 Associated

HIV-1 encephalopathy

HIV-associated cognitive-motor disorder

HIV-1 meningitis

Vacuolar myelopathy

Peripheral neuropathy

Distal sensory polyneuropathy

Antiretroviral toxic neuropathy

Ascending neuromuscular syndrome

Mononeuritis multiplex

Inflammatory demyelinating polyneuropathy

HIV-associated polymyositis

Opportunistic Infections

Cerebral toxoplasmosis

Tuberculosis

Cryptococcal meningitis

Cytomegalovirus retinitis/encephalitis/polyradiculitis

Progressive multifocal leukoencephalopathy

Other viral/fungal/bacterial/protozoal central nervous system infections

Neoplasms

Primary central nervous system lymphoma

Metastatic systemic lymphoma

Metastatic Kaposi's sarcoma

Some changes in the course of neurologic deficits do appear to be a result of ART. Before ART, the more advanced stages of AIDS dementia were commonly found in the advanced stages of clinical AIDS. As ART has improved immune functioning and decreased the number of persons with advanced clinical AIDS, the number of advanced dementia cases appears to have decreased as well. Although HIV dementia is common in advanced AIDS,[47,51] it is also found early in HIV infection and without AIDS or in the presence of opportunistic infections. The prevalence rate is significantly higher when including persons displaying signs of neurologic involvement detected by neuroimaging but without clinical changes or when including persons with mild cognitive impairment.

Despite the effectiveness of ART in improving overall immune function, neurologic deficits have persisted,[53] and prevalence rates for dementia, when including mild cognitive impairment, have increased since the advent of ART, although advanced dementia is less common.[3,4,24,26] Some evidence also suggests that the cognitive deficits may be related to a combination of the aging process, extended period of HIV infection, medication side effects, and the comorbid neurologic conditions that are more common in aging persons.[5]

Neuropathies

Peripheral neuropathies are the most common neurologic complication of HIV. They can occur both as a primary effect of the virus and as a side effect of antiviral medications used to treat HIV.[36] It is often difficult to distinguish clinically between the two causes of neuropathy. Although many peripheral nerve disorders are associated with HIV, distal sensory polyneuropathy is by far the most common disorder. Persons with distal symmetric polyneuropathy frequently have burning, painful sensations on the distal end of the lower extremities, often accompanied by numbness or tingling sensations. Individuals may also have decreased sensation of thermal stimuli. If lower extremity weakness is present, it is more likely to be distal than proximal. Distal sensory polyneuropathy follows a stocking-glove distribution of sensory impairment involving the feet and hands (typically with greater lower extremity involvement initially), and impairment spreads proximally as the condition progresses.

The functional deficits associated with peripheral neuropathy may include numbness or impaired sensation, loss of balance because of diminished proprioception in the lower extremities, and abnormal pain sensations (dysesthesias). Distal sensory polyneuropathy results in damage to both large myelinated and unmyelinated nerve fibers and is clinically similar to diabetic neuropathy (in that small sensory fibers are also involved).

Occupational therapists should assess clients for pain. Chronic pain is a common condition associated with HIV infection in general and with distal symmetric polyneuropathy in particular. The pain may limit occupation performance and is frequently underdiagnosed and undertreated. Current evidence suggests that the pain sensations are probably caused by dysfunctional regulation of pain fibers in both the central and peripheral nervous systems and that it results in severe pain out of proportion to the extent of epidermal nerve fiber loss.

In HIV-associated distal sensory polyneuropathy, it is hypothesized that the abnormal pain may be caused by damage to peripheral nerve fibers as a result of multifocal inflammation and infiltration of activated macrophage into peripheral nerves, with subsequent abnormal activity occurring in uninjured neighboring nociceptive fibers. The abnormal inflammatory response and macrophage infiltration are also found in the dorsal root ganglion. It is possible that this results in changes in neuronal calcium and sodium channels and ectopic impulse generation causing abnormal neuronal hyperexcitability. Finally, it is possible that remodeling occurs in the dorsal horns as a result of A-fiber sprouting and synaptic formation within lamina II of the spinal cord.

Dementia

AIDS dementia complex (ADC) is also referred to as AIDS-related dementia, HIV-associated dementia, AIDS encephalopathy, or HIV encephalitis and is a common neurologic condition associated with HIV infection.[46] Dementia associated with HIV infection has been identified since the earliest years of the HIV/AIDS pandemic and has been characterized by the cardinal features of progressive dementia with motor and behavioral deficits.[41] ADC appears to be a result of the presence of HIV in the CNS and is a primary effect of the virus. HIV can enter the CNS shortly after the initial infection. The most likely mechanism for entry appears to be infected monocytes passing through the blood-brain barrier.[52] The precise mechanism by which infected cells within the CNS are activated and cause dementia is not known at this time. It is possible that the brain may act as a sanctuary for HIV replication inasmuch as the blood-brain barrier may prevent ART from passing through the barrier to the CNS and create a viral reservoir.[43] The cells that are most frequently infected are macrophages, microglial cells, and astrocytes (although many other cells may also be infected within the CNS). It appears that neurons are rarely if ever infected by HIV.

ADC remains a complication in persons infected with HIV despite the introduction of ART.[50] ADC is characterized by subcortical involvement and is considered a subcortical dementia. There is evidence of damage to the basal ganglia and caudate nuclei,[28,42] and the clinical manifestations of ADC have some similarities to other subcortical dementias, including Parkinson's disease and Huntington's disease. Persons with ADC frequently display motor disturbances, such as imbalance, unsteady gait, tremors, difficulty performing fine motor tasks (including handwriting), weakness, and motor-processing delays and reduced speed of motor responses (primarily in the more advanced stages of ADC) (Box 47.3).

Box 47.3

Clinical Manifestations of AIDS-Dementia Complex

Affective: Apathy (Depression-Like Feature)

Irritability

Mania, new-onset psychosis

Behavioral: Psychomotor Retardation (Slowed Speech or Response Time)

Change in personality

Social withdrawal

Cognitive: Lack of Visuospatial Memory (Misplacing Things)

Lack of visuomotor coordination (eye movement abnormalities)

Difficulty with complex sequencing

Impaired concentration and attention

Impaired verbal memory (word-finding ability)

Mental slowing

Motor: Unsteady Gait, Loss of Balance

Dropping things

Tremors, poor handwriting

Decline in fine motor skills

ADC may cause impairment of visuospatial function, executive function, and recall of information, as well as slowed psychomotor speed. Persons with ADC may have impaired episodic memory (the ability to remember facts, places, and subjective historical information) and deficits in retrieving information. It appears that ADC spares semantic memory (ability to recall facts and information unrelated to personal experience) and the ability to retain information until the relatively advanced late stages of ADC. Unlike Alzheimer-type dementia, persons in the earlier stages of ADC may not have significant deficits in naming objects or other language functions associated with the cerebral cortex but will probably have deficits in retrieving and manipulating retained information, as well as slowing of information processing.[38]

Persons with ADC may also exhibit behavioral changes, potentially including increased agitation, apathy, isolation, or changes in personality. Cognitive deficits are also present in the earliest stages of ADC. The cognitive deficits are most likely to involve executive function (including delays in information processing, limited attention to tasks, and visuospatial deficits). In the early stages of ADC, the manifestation of these deficits in executive functioning is different from dementia of the Alzheimer type, in which the person typically has more pronounced memory deficits, word retrieval deficits, decreased comprehension or other language difficulties, and disorientation. However, as the dementia reaches more advanced stages and the deficits become more global, it may be difficult to differentiate ADC from dementia of the Alzheimer type.

ADC appears to influence dopamine production, and a subtype of persons with ADC may exhibit mood disorders, including mania, probably as a result of the dopaminergic changes caused by ADC.[38] The likelihood of dopamine involvement is also supported by the movement disorders described previously.

The incidence and prevalence of HIV dementia or ADC have changed in the ART era. It appears that the incidence of ADC has decreased with the use of ART, but prevalence rates are increasing. One hypothesis is that new multiple patterns or progressions of ADC have arisen following the introduction of ART.[36] The first type is a subacute progressive form of dementia that is seen in untreated persons and marked by severe progressive dementia similar to the pattern seen before ART. The second pattern involves a chronic active dementia seen in persons prescribed ART who have poor compliance or exhibit viral resistance. These persons are at risk for progression of the dementia. The final category is chronic inactive dementia, in which persons receiving ART with good adherence and viral suppression remain neurologically stable but have some degree of cognitive impairment or early-stage ADC.

Advanced ADC was most common in the late stages of AIDS before the use of ART. The use of ART appears to have decreased the frequency of advanced stages of dementia in persons infected with HIV. However, the incidence of cognitive impairment and ADC has not abated despite the use of ART. It appears that mild cognitive impairment and early-stage ADC are more common than later stages of ADC as a result of ART, but the overall incidence of cognitive deficits has remained at higher than 20% for persons infected with HIV.

It is important to be aware of the clinical manifestations of ADC during different stages of the dementia.[41]

Early Stages of AIDS-Dementia Complex

During the early phases of the disorder, it is possible for the deficits to be overlooked or be attributed to other causes. The early stages are consistent with subcortical dementia and are characterized by difficulty concentrating and attending to tasks and delayed processing of information, which may require extended time for completion of ADLs; minor forgetfulness and difficulty with executive functioning tasks are not unusual. Motor deficits also occur frequently and include tremors, gait imbalances, lower extremity weakness, and slowing of motor function. Persons may also display behavioral changes, including increased withdrawal from ADLs or social situations, agitation or irritability, and other changes in personality.

The early stages of ADC can potentially have an impact on a number of ADLs and IADLs. Persons may have particular challenges with IADLs involving executive functioning and may have difficulty managing finances, medications, or scheduling and keeping appointments. In particular, tasks involving multiple steps and sequencing may be problematic and lead to difficulties with related IADLs. Persons with HIV-related neurocognitive deficits are much more likely to be at risk for medication noncompliance than are persons without dementia.[31] Persons may also have difficulty with tasks requiring sustained attention (for example, the person may have difficulty reading or listening to lengthy conversations). The motor deficits related to ADC may be minimal in the early stages but may be observed by noting difficulty with ADLs involving fine motor coordination, including handwriting, managing clothing fasteners, using utensils during meals, and performing grooming activities (such as shaving or applying makeup). The person may also have difficulty maintaining balance while walking, tremors, and weakness.

Later Stages of AIDS-Dementia Complex

As ADC progresses, the deficits become more generalized or global and may be difficult to distinguish from other types of advanced dementia. It is worth noting that given the use of ART, many persons with ADC or minor cognitive impairment have maintained relatively stable cognitive functioning without significant progression of symptoms over an extended period. In these cases, although deficits are present, the person may not progress to later stages of ADC. Late-stage ADC remains most common in people with significant progression of HIV or AIDS. By the late stages, ADC is characterized by global deterioration involving cognition, motor skills, behavioral deficits, and limited insight into the client's condition and deficits. As ADC progresses, the person will probably exhibit significant cognitive deficits, disorientation, general confusion, and impaired speech and language ability. Motor symptoms also progress at this point, with continued weakness, changes in muscle tone (spasticity in particular), ataxia, and dyskinesia. Some behavioral changes are also common as ADC progresses, including disinhibition of behavior and incontinence of the bowel or bladder. At this point in the disorder, persons with HIV will probably require assistance in performing all IADLs and most ADLs. Refer to Table 47.5 for a summary of the stages of ADC.

TABLE 47.5

Staging of AIDS-Dementia Complex

Stage/Grading	Manifestation
0	Normal
0.5	Subclinical or equivocal—Minimal or equivocal symptoms Mild (soft) neurologic signs No impairment in work or activities of daily living
1	Mild—Unequivocal intellectual or motor impairment Able to do all but the most demanding work
2	Moderate—Cannot work or perform demanding activities of daily living Capable of self-care Ambulatory, but may need a single prop Major intellectual disability or cannot walk unassisted
3	Severe—Major intellectual disability or cannot walk unassisted
4	End-stage—Nearly vegetative Rudimentary cognition Paraplegic or quadriplegic

HIV/AIDS Pathologies: Client Factors

People with HIV are living longer and healthier lives as a result of improvements in medications, health education, and behavioral changes. However, medications are costly and often provided only to those who can afford them or have other access to them. Thus people with HIV who are not privy to information on community resources or whose accessibility is otherwise limited experience numerous opportunistic infections (infections resulting from a compromised immune system), such as *Pneumocystis pneumoniae* infection or Kaposi's sarcoma (the latter being less common).

OT practitioners may see a diverse population of people with AIDS who have numerous occupational deficits. Many physical and psychosocial factors indicate the need for OT. Factors experienced by people with HIV and AIDS include, but are not limited to, the following:

- Fatigue and shortness of breath
- Impairment of the CNS
- Impairment of the peripheral nervous system
- Visual deficits
- Sensory deficits (including painful neuropathies)
- Cardiac problems
- Muscle atrophy
- Altered ability to cope with and adapt to changes that the illness creates
- Depression
- Anxiety
- Guilt
- Anger
- Preoccupation with illness versus wellness

All of these factors affect clients' occupational performance in meaningful, health-promoting daily occupations. OT can benefit all people with HIV and AIDS who experience any of the aforementioned problems.

Positive Prevention

Reflecting the changing needs of people with HIV and in consideration of the improved drugs to combat the disease and its secondary conditions, the term *positive prevention* has been developed and used by the CDC.[15] The Serostatus Approach to Fighting the Epidemic (SAFE) helps reduce the risk for transmission to supplement current risk reduction programs. Several action steps are recommended that focus on diagnosing HIV: linking infected persons to appropriate preventive services, helping them adhere to treatment regimens, and providing support to develop healthy habits for sustaining behavior that reduces the risk associated with HIV infection. It is one of the first programs to dovetail traditional infectious disease control with behavioral interventions. Although occupational therapists may primarily intervene with people who have already been infected, prevention can still be integrated into a holistic program of care.

Prevention and health promotion can be a primary area of intervention in OT. In primary prevention, the practitioner may develop and implement health education and risk reduction strategies to help individuals and communities understand the impact of reducing risk in occupational participation. An OT primary prevention strategy could be the establishment of a developmentally appropriate lecture or workshop on abstinence and safe sex for schools, religious groups, and community centers. These workshops could incorporate mental health strategies, culturally relevant information, and interpersonal skill-building exercises, areas in which OT practitioners are well educated.

Secondary prevention, wherein OT services are provided for people who are already infected with the virus, would include activities that create and promote healthy lifestyles and thereby prevent future opportunistic infections and promote balance and well-being. OT intervention focused on providing secondary prevention can significantly affect communities that have large numbers of people who are infected with HIV. An emphasis on establishing and maintaining the habits and routines that support engagement in occupations would be appropriate for secondary prevention programs.

Tertiary prevention is provided when clients suffer from a disability that is secondary to the disease. Tertiary prevention includes a strong emphasis on rehabilitation; health promotion programming can also be included to positively affect a person's lifestyle and provide hope for continued and healthful functioning. Strategies that support continued participation in occupations, even if the occupation has been modified, would be addressed in tertiary prevention programs. An example would be the use of adaptive equipment to support continued engagement in a desired occupation (eg, woodworking, cooking) when muscular weakness or peripheral nerve damage compromises occupational performance.

Assessment

Pizzi has developed two assessments that focus on enhancing health and well-being (see Chapter 5): one is for general use, and the other is for use in people infected with HIV.[45] The one related to HIV specifically is the Pizzi Assessment of Productive Living for Adults with HIV Infection and AIDS (PAPL; Fig. 47.2).

Pizzi Assessment of Productive Living for Adults with HIV Infection and AIDS (PAPL)

Demographics

Name____Age__________

Sex______Lives with (relationship)____

Identified caregiver____

Race _____________Culture___________Religion_____________________________

Practicing?____________________How does spirituality play a role in your life, if any?____

Primary occupational roles:

____

Primary diagnosis:

____

Secondary diagnosis:

____

Stage of HIV____

Past Medical History:

____

Medications:

____

Activities of Daily Living (use ADL performance assessment)

Are you doing these now?

____

Do you perform homemaking tasks?

____

(For areas of difficulty) Would you like to be able to do these again like you did before?_________ Which ones? ____

Work

Job ______________________________________When last worked___________

Describe type of activity____

Work environment ____

If not working, would you like to be able to?______________________________

Do you miss being productive?____

Types of activity engaged in____

If not, would you like to?________Which ones?______________________________

Would you like to try other things as well?______________________________

Is it important to be independent in daily living activities?_____________________

Play/Leisure (interests and current participation)__________________________

____

Sleep issues (habits, patterns)____

Physical Function

Active and passive range of motion:

Strength:

Sensation:

Coordination (gross and fine motor or dexterity):

Visual-perceptual:

Hearing:

Balance (sit and stand):

Ambulation, transfers, and mobility:

Activity tolerance/endurance:

Physical pain:

Location:

____

Does it interfere with doing important activities?___________________________

Sexual function:

Cognition

(Attention span, problem solving, memory, orientation, judgment, reasoning, decision making, safety awareness)

Time Organization

Former daily routine (before diagnosis)

Has this changed since diagnosis?____

If so, how? ____

Are there certain times of day that are better for you to carry out daily tasks?

____

Do you consider yourself regimented in organizing time and activity or pretty flexible? ____

What would you change, if anything, in how your day is set up?

____

Body image and self-image

In the last 6 months, has there been a recent change in your physical body and how it looks?___________How do you feel about this?______________________________

____

Social environment (Describe support available and utilized by patient)

Physical environment (Describe environments where patient performs daily tasks and level of support or impediment for function)

Stressors

What are some things, people, or situations that are/were stressful?_______________

____

What are some current ways you manage stress?______________________________

____

Situational Coping

How do you feel you are dealing with:

a) your diagnosis

____

____

b) changes in the ability to do things important to you?

____

____

c) other psychosocial observations

____

____

Occupational Questions

What do you feel to be important to you right now?

Do you feel you can do things important to you now? In the future?

Do you deal well with change?

What are your hopes, dreams, aspirations? What are some of your goals?

Have these changed since you were diagnosed? How?

Do you feel in control of your life at this time?

What do you wish to accomplish with the rest of your life?

Plan:

STG:

LTG:

Frequency:

Duration:

Therapist:

FIG 47.2 Pizzi Assessment of Productive Living for Adults with HIV and AIDS (PAPL). LTG, long-term goals; STG, short-term goals. (Courtesy Michael Pizzi © 1991.)

One of the first assessments in OT specifically designed as a client-centered and subjective health promotion tool is the Pizzi Health and Wellness Assessment (PHWA).[45] An occupational history format is used. The emphasis of the PHWA is to explore an individual's self-perception of health and strategies for self-responsibility. It is vital that practitioners incorporate the goals, beliefs, values, attitudes, and occupational meanings identified by the client being served. Reductionistic interventions (eg, range of motion, strengthening, cognitive retraining) are incorporated into meaningful occupations and not addressed separately.

The PHWA is a self-assessment tool that incorporates both a qualitative and a quantitative component. Clients self-assess six areas of health on a scale of 1 through 10. They then address each area with the help of the practitioner in terms of their self-perception of occupational participation in the respective area. This dialogue helps clients become aware of important health issues affecting their daily occupational performance. In each area of health, the client explores strategies to optimize health and determines which strategies could be used to promote health and well-being.

Even when it appears that a specific intervention positively changes occupational performance, the person experiences wellness through self-discovery of how to best manage his or her well-being. After self-discovery, the therapy process unfolds collaboratively between the client and therapist.[45]

Immediate and meaningful occupational areas and self-identified health concerns are identified through this assessment. A holistic view of the client is inherent in the assessment and is guided by the principles of health promotion and the values of OT.

PAPL (see Fig. 47.2) is a holistic assessment for therapists to gather data on the physical, psychosocial, emotional, and spiritual aspects of the client's life. The resultant data are synthesized via the practitioner's clinical reasoning skills to produce a collaborative intervention that is client centered. All areas of occupational performance are addressed.

Holistic assessments are useful for practitioners because they address the multitude of issues and problem areas experienced by people with HIV and AIDS. The clinical reasoning of practitioners will then be challenged to integrate knowledge and skill in all areas of OT to best serve the client's needs.

In as many as 10% of persons infected with HIV and experiencing chronic pain, no specific cause is known.

Intervention

The OT intervention process involves both the therapeutic use of self by the practitioner and the therapeutic use of occupations and activities. OT practitioners engage and facilitate engagement in meaningful and productive daily life occupations through a variety of techniques, strategies, and inventive programming. Promotion of healthy lifestyles while living with the disease is crucial for all clients infected with HIV. Interventions are individually tailored to meet the many physical, psychosocial, and contextual issues of people with HIV and AIDS. Because of the diverse features of HIV and AIDS, there are many considerations for practitioners when developing plans and goals. These considerations, listed in the following sections, also incorporate several occupational interventions that can be implemented.[44]

Prevention of Disability

Occupational therapists can play a significant role in primary prevention by participating in occupation-based education for various community groups to reduce the risk for infection and by promoting health. Occupational therapists can address secondary prevention through various health promotion strategies to enhance occupational engagement and performance with an emphasis on maintaining performance patterns, including significant habits, routines, rituals, and roles. OT intervention addressing tertiary prevention can focus on health promotion and rehabilitation to enhance occupational performance.

Education and Health Promotion

Occupational therapists can provide educational opportunities for clients to address multiple concerns, including energy conservation strategies to address fatigue, generalized weakness, and deconditioning, which are primary physical manifestations of HIV. Energy conservation, work simplification, and occupational adaptations are used to enhance productivity and participation. Education can address proper nutrition, which is vital for people with HIV and AIDS. In addition, occupational therapists can provide educational interventions to promote awareness of clients' medical status and medication management, as well as to improve awareness of side effects of the medications.

Maintaining and Restoring Performance

Occupational therapists work with clients with HIV/AIDS to maintain or restore occupational performance in the presence of changes in client factors related to HIV/AIDS. Considerations for OT interventions include the following:

1. Control and choices of daily living options must be provided as much as possible. Frequently people infected with HIV feel a sense of loss of control as the virus slowly invades body systems and manifests itself by further limitations in occupational performance. Providing choices can prove beneficial to clients when the virus compromises control in life.

2. Most clients with symptomatic HIV and AIDS have an altered worker role. Specific interventions regarding alternatives to work and productive living are necessary if work is a valued role. Physical as well as psychosocial work assessment for holistic work-hardening programming is vital.

3. Habit training and adaptation of the routine of daily living are essential interventions and include performance of favored occupations with respect to physical and cognitive status; the level at which the person feels comfortable adapting routines; and times of day, contexts, and with whom the person chooses to perform the occupations. Whenever possible, clients must be given choices of scheduling within their own personal routines and not those that fit health professionals' schedules.

4. Short- and long-term goals must be readily adapted and changed as needed.

Complementary therapies must be considered as interventions before and during occupational performance. Such therapies can include progressive relaxation, biofeedback, prayer, therapeutic touch, traditional Chinese medicine techniques, myofascial release, craniosacral therapy, imagery, and visualization.

Modifications, Adaptations, and Compensatory Approaches to Intervention

Occupational therapists can provide intervention that includes a variety of modifications, adaptations, and compensatory techniques to promote occupational performance skills and patterns. Such approaches include the following:

1. Adaptive equipment and positioning can be used to assist clients in returning to independent performance of ADLs, work, and leisure occupations. Often people with HIV may reject such equipment even though it can benefit them. This rejection signals a rejection of the sick role and sometimes a denial of diminished abilities. This attitude must be respected until the time when the person chooses, if at all, to use the equipment.

2. Changes can be made in the physical environment or performance patterns to help the client continue important roles despite medical changes, including fatigue. Energy conservation approaches and work simplification can be useful to allow continued participation in ADLs.

3. A variety of strategies can be used to compensate for cognitive changes that may have an impact on occupational performance, including activities that involve executive function (medication management, work responsibilities, financial management) and motor performance. Occupational therapists can adapt tasks to compensate for neurologic deficits, including sensory loss related to peripheral neuropathies. Therapists can also be involved in modifications to optimize function in persons with ADC and related cognitive deficits.

Advocacy and Psychosocial Considerations

Occupational therapists can be involved in both advocating for clients with HIV/AIDS and helping support client efforts for personal advocacy. More unique psychosocial aspects of HIV rehabilitation are present than in most other physical or psychosocial cases.

Many people with HIV have lost numerous friends to the same disease for which they are receiving therapy; have undergone loss of work and family as a result of discrimination, rejection, or physical inabilities; and may have lost life partners to the same disease. For many clients, all of these losses can occur before the age of 40. Women with HIV experience the aforementioned losses but must also frequently cope with poverty and homelessness; women are often underrecognized in the epidemic.

There is no known cure or vaccine for HIV to date, although research is promising. This is a major consideration as a stressor of daily living.

The aforementioned considerations are several areas of intervention that can help maintain and restore occupational performance and prevent secondary conditions and impairments from emerging.

Threaded Case Study

Billy, Part 3

Billy required assessment to determine how the changes in client factors and body functions have altered various areas of occupation and life roles. After developing the occupational profile, several types of OT interventions are needed to strengthen the mind, body, and spirit. Promotion of the therapeutic use of self, with a nonjudgmental and caring, compassionate attitude, will help Billy relax during OT sessions and engage him in discovering the best ways to establish balance and well-being in his life. As a result of his apparent depression and fatigue, he may be experiencing altered occupational role performance. Fatigue and depression can also impair cognition. Understanding exactly how these roles are compromised and the underlying impairments in body function will help the therapy process unfold, with specific interventions being implemented as appropriate. Billy, as determined through the occupational profile, is a habit-oriented man. Helping him explore his daily habits and routines, understanding the areas in which he senses an impairment (along with OT evaluation data), and encouraging him to adapt to change can help him to restore both his emotional health and his physical well-being.

Using an occupation- and client-centered approach and understanding the disease process afford the occupational therapist unique insight into the best ways to assess and treat people with HIV and AIDS. Promoting health and well-being will also establish a higher quality of life. The focus of OT is always to enable participation in meaningful life occupations that support life satisfaction and quality of life.

Summary

Many changes have taken place since the earliest days of the HIV/AIDS epidemic. These changes include the demographics of persons infected by the virus, the areas globally in which infections are concentrated, populations infected in the United States, treatments available, survival rates, and medical management of the condition. Fortunately, the development of antiretroviral treatments has extended the life expectancy of many persons with HIV in the United States (and increasingly on a global basis). These encouraging developments also present a number of challenges in managing the chronic health and medical needs of persons infected with HIV.

OT has many roles in addressing the needs of persons with HIV/AIDS. It can help address the range of client factors and performance skills that are affected by HIV/AIDS. Prevention is critical in the management of HIV, and OT can help emphasize prevention and reduce the incidence of HIV infections. OT can also address the needs of persons infected with HIV.

OT assessment should focus on developing an occupational profile that includes the individual's previous occupational performance patterns, roles, habits, and routines to better understand how HIV influences function. Specific assessments can identify which client factors are most affected by HIV and provide guidance for OT interventions. Of particular importance in assessing client factors are the common neurologic deficits that can greatly influence functional performance and are often present even in the absence of opportunistic infections or AIDS.

Occupational therapists can promote function and independence in ADLs and IADLs by a variety of means and interventions. These approaches include prevention of disability, education/health promotion, maintaining/restoring performance, modifying/adapting environments, compensatory strategies, advocacy, and addressing psychosocial factors. Through the use of these interventions, OT can help persons with HIV maintain active participation in individual meaningful daily activities and be active in the community.

Review Questions

1. What is the difference between HIV infection and AIDS?
2. What are the routes of HIV transmission?
3. Name three side effects of the drug regimen that affect the quality of life of persons who have HIV or AIDS.
4. Differentiate primary, secondary, and tertiary prevention programs.
5. Identify one potential neurologic, physical, and psychosocial problem seen in clients who have HIV or AIDS.
6. Why might a client be hesitant to accept the use of adaptive equipment to engage in occupation?
7. What are at least three health promotion and prevention goals for a client with HIV? For a client with AIDS?
8. How might you address caregiver concerns regarding sexuality issues when both partners are in their sexual prime?
9. If a client with AIDS came to you about the perception of prejudice from other healthcare personnel, how might you respond?
10. List and discuss at least four strategies to promote the health and well-being of Billy and his partner, Tom.

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Polytrauma and Occupational Therapy*

Sharon Dekelboum, Karen Parecki

CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Understand the definition of polytrauma.
2. List several standard occupational therapy assessments used for polytrauma patients.
3. Understand the areas in which the occupational therapist needs basic knowledge to care for polytrauma patients.
4. Understand the term *emerging consciousness*.
5. Understand the importance of an interdisciplinary approach to polytrauma care.
6. Describe the continuum of care process available within the Veterans Affairs system of care.
7. Describe the multisystem effects of a blast injury.
8. Understand the impact of posttraumatic stress disorder on the recovery process.
9. Identify the use of assistive technology in this population.
10. Describe how return-to-work/return-to-school programs can be included in rehabilitation services.
11. Understand the importance of treating the client and family as a unit.
12. Understand the implications of sensory loss for the rehabilitation process.

KEY TERMS

Age-appropriate treatment interventions

Amputation

Assistive technology
Blast injury
Emerging consciousness
Interdisciplinary
Polytrauma
Posttraumatic stress disorder
Sensory loss
Shrapnel
Skull flap
Traumatic brain injury
Triage

Polytrauma

Threaded Case Study

Alex, Part 1

Alex, a 25-year-old Caucasian man, sustained a polytraumatic injury from the blast of an improvised explosive device (IED) while serving in Iraq. As a result of the blast, Alex incurred a traumatic head injury (diffuse axonal injury and temporal lobe contusion with subarachnoid hemorrhage), a right arm degloving injury, maxillary and mandibular fractures, and traumatic amputation of his right leg below the knee along with a femoral fracture. Additionally, his injuries included a penetrating eye injury with subsequent surgical excision of the foreign body. He also demonstrated clinical signs of posttraumatic stress disorder. Alex is married and his wife was 3 months pregnant at the time of his injury. He was living in Hawaii before his deployment to Iraq; there are two steps at the entrance of his single-level home. His role in the Marines was corpsman (medic).

Alex was referred to occupational therapy 1 month after injury when he arrived, medically stable, at the polytrauma rehabilitation ward. Initially, Alex had a Rancho 2-3 level with an altered level of consciousness and was evaluated with the Coma Recovery Scale–Revised (CRS-R).[15] Additionally, he was assessed for positioning needs, splinting needs, range of motion (ROM), and gross strength. Because of decreased arousability, restlessness, and an inability to consistently follow commands, much of the psychosocial components, including occupational history and profile, were obtained by interviewing his wife.

Within a week Alex demonstrated improved cognitive abilities as measured by the CRS-R, and functional mobility and activities of daily living (ADLs), and cognitive and visual-perceptual screening was initiated. Alex required minimal assistance for bed mobility, maximal assistance for transfers and wheelchair mobility, and moderate to maximal assistance for all ADLs. Cognitively, he was able to follow simple one-step commands 80% of the time, easily became overstimulated and distractible in anything but a quiet environment, had poor endurance, easily became frustrated, and had difficulty with orientation, problem solving, and other executive skill functions. Safety awareness was also impaired. In addition, Alex's visual-perceptual skills were impaired, and he demonstrated dysmetria and double vision. Strength and ROM in his left upper extremity were within normal limits; however, his right hand had decreased strength and ROM. Coordination was slightly impaired on the right but normal on the left. Alex also demonstrated signs of hypervigilance and reported difficulty sleeping.

The objectives of occupational therapy intervention included (1) increasing independence in performance of ADLs; (2) increasing independence in transfers and wheelchair mobility; (3) achieving and maintaining optimal ROM in all joints of the right upper extremity for function and maintaining ROM in all other joints for optimal seating and positioning; (4) improving visual-perceptual skills or implementing compensatory strategies to promote safety and ease in ADLs, mobility, and performance of instrumental activities of daily living (IADLs); (5) promoting the highest level of functional cognition, including implementation of compensatory strategies and cognitive prosthetics to increase independence and safety in all functional skills; (6) achieving optimal independence in performing IADLs, including parenting skills; (7) optimizing independent ability to access the community, including transportation; (8) optimizing independence in return-to-school and return-to-work skills; (9) receiving appropriate durable medical equipment to meet both short-term and long-term needs (including wheelchair, cushion, ADL equipment, and prosthetic limb care needs); (10) optimizing the ability to relax and promoting good sleep hygiene; and (11) educating the family and patient in all aspects of care needs, compensatory strategies, and safety recommendations.

Because of significant impairment in cognitive skills, an interdisciplinary team approach was implemented to ensure that compensatory strategies were carried over throughout the day. As Alex gained insight into his deficits and how they were currently having an impact on his life (community skills, employment, parenting, independence in self-care, and self-efficacy), he had mood fluctuations that ranged from depressed to feeling hopeful and accepting of his current situation. Additionally, supporting the family members and working with Alex and his wife as a couple on their roles in the relationship and how those roles have changed were addressed through psychology service and with a family therapist.

Throughout the chapter, consider the short-term and long-term consequences of Alex's injuries. The many body systems that were affected with this type of polytraumatic injury will have effects on client factors, performance skills and patterns, and the relationship of activity demands to the selection of optimal equipment and strategies to optimize his performance in all aspects of his life.

Critical Thinking Questions

1. How would you determine what occupations need to be addressed and in what order would you address them?
2. Thinking about client factors, how would you prioritize treatment interventions?
3. How would you integrate your treatment plan and interventions with the needs of the client, family, and whole treatment team?

The definition of **polytrauma** stems from the Latin *poly*, meaning many, and *trauma*. The term is generic and has been in use for a long time for any case involving multiple trauma. U.S. military doctors commonly use the term to describe seriously injured soldiers returning from Operation Iraqi Freedom (OIF, Iraq) and Operation Enduring Freedom (OEF, Afghanistan).[34]

The term *polytrauma* is now consistently used by U.S. military medical personnel and the Veterans Administration (VA) to describe the multiple, extreme, often totally incapacitating complex of traumatic injuries that individual U.S. service members suffer in the aftermath of war. The severity and complexity of these multiple wounds and injuries would have proved fatal in previous wars. Advances in medicine, especially in battlefield medicine, as well as quick evacuation of these patients to complex trauma centers have decreased the mortality rate. Many polytrauma injuries include multiple, severe **shrapnel** injuries leading to multiple **amputations**, wounds, loss of normal body function and systemic complications, brain damage, sensory impairment, and partial to full paralysis. These types of complex injuries are not typically seen, even in the trauma centers of major urban areas that are accustomed to gang warfare.

Polytrauma centers have been developed throughout the Department of Veterans Affairs to address the complex medical and rehabilitation needs of these patients. The VA defines polytrauma as “injuries to more than one physical region or organ system, one of which may be life threatening, and which results in physical, cognitive, psychological, or psychosocial impairments and functional disability.”[10] Not only has the VA taken on the challenge of finding best-care practices to optimize the long-term outcomes of these clients, but the civilian sector has also begun to adopt the term *polytrauma* and has set out to provide treatment for this population as well.

Types of Blast Injuries

One of the most common causes of polytrauma is exposure to a blast, such as from an improvised explosive device or a rocket-propelled grenade. According to the Defense and Veterans Brain Injury Center (DVBIC),[8] **blast injury** can have different effects on the body based on proximity to the blast and the body's reaction to the blast. The DVBIC indicates that “exposure to blast events can affect the body in a number of ways, in addition, these different injury mechanisms can interact and result in more impairments or prolonged periods of recovery.”

- *Primary blast injury* is the result of exposure to the overpressurization wave or the complex pressure wave that is generated by the blast itself. This blast wave travels at high velocity and is affected by the surrounding environment; for example, the effects of the blast wave may be increased in a closed environment such as a vehicle. Air-filled organs such as the ear, lung, and gastrointestinal tract and organs surrounded by fluid-filled cavities such as the brain and spinal cord are especially susceptible to primary blast injury.[13,23] The overpressurization wave dissipates quickly and causes the greatest risk for injury to those closest to the explosion.
- *Secondary blast injury* is the result of energized fragments flying through the air; these fragments may cause penetrating injuries.
- *Tertiary blast injury* may occur when the individual is thrown from the blast into a solid object

such as an adjacent wall or even a steering wheel. These types of injuries are associated with acceleration/deceleration forces and blunt force trauma to the brain, similar to that observed following high-speed motor vehicle accidents.

- Finally, with severe blast-related trauma, *quaternary blast injury* can occur as a result of significant blood loss associated with traumatic amputations or even the inhalation of toxic gases released by the explosion.[9]

Impairments from a polytraumatic injury are not predictable, and the outcome for each individual is unique. Some of the common sequelae include brain injury; spinal cord injury; amputation; infections; orthopedic problems such as fractures; wounds; psychological stressors such as **posttraumatic stress disorder** (PTSD); crush injuries; burns; auditory and vestibular impairments; eye, orbit, and facial injuries; dental complications; renal, respiratory, cardiac, and gastrointestinal compromise; peripheral nerve injuries; and pain (Table 48.1).

TABLE 48.1

Overview of Explosive-Related Injuries

System	Injury or Condition
Auditory or vestibular	Tympanic membrane rupture, ossicular disruption, cochlear damage, foreign body, hearing loss, distorted hearing, tinnitus, earache, dizziness, sensitivity to noise
Eye, orbit, face	Perforated globe, foreign body, air embolism, fractures
Respiratory	Blast lung, hemothorax, pneumothorax, pulmonary contusion and hemorrhage, arteriovenous fistulas (source of air embolism), airway epithelial damage, aspiration pneumonitis, sepsis
Digestive	Bowel perforation, hemorrhage, ruptured liver or spleen, sepsis, mesenteric ischemia from air embolism, sepsis, peritoneal irritation, rectal bleeding
Circulatory	Cardiac contusion, myocardial infarction from air embolism, shock, vasovagal hypotension, peripheral vascular injury, air embolism–induced injury
Central nervous system injury	Concussion, closed and open brain injury, petechial hemorrhage, edema, stroke, small blood vessel rupture, spinal cord injury, air embolism–induced injury, hypoxia or anoxia, diffuse axonal injury
Renal injury	Renal contusion, laceration, acute renal failure from rhabdomyolysis, hypotension, hypovolemia
Extremity injury	Traumatic amputation, fractures, crush injuries, compartment syndrome, burns, cuts, lacerations, infections, acute arterial occlusion, air embolism–induced injury
Soft tissue injury	Crush injuries, burns, infections, slow-healing wounds
Emotional or psychological	Acute stress reactions, posttraumatic stress disorder, survivor guilt, postconcussive syndrome, depression, generalized anxiety disorder
Pain	Acute pain from wounds, crush injuries, or traumatic amputation; chronic pain syndrome

Adapted from the Centers for Disease Control and Prevention: *Explosions and blast injuries: a primer for clinicians.* http://www.cdc.gov/masstrauma/preparedness/primer.pdf.

Although the polytrauma population is defined as a unique population, the principles of treatment and the factors that must be considered when planning treatment are applicable to all rehabilitation populations.[16,28] Some of the factors include young age at the time of injury, developmental stage and life role participation, including work and family role, familiarity with **assistive technology**, and military culture, as well as ethnic background, PTSD/acute stress reaction, previous or current substance abuse, high incidence of mental health complications and suicide risk, and vocational and community reintegration factors. Additionally, this population may need the support of a case manager for an extended period because their life roles and secondary conditions start to have an impact on their function (Fig. 48.1). The need for services over the course of time requires that age-appropriate treatment interventions be provided to meet the client's occasional needs.

FIG 48.1 Learning to assemble a new wheelchair.

Treatment and implementation of treatment **triage** begin at the acute onset of injury.[12] The priority in the field and once in the hospital is medical stabilization. Once the patient is medically stable, the occupational therapist (OT) may be consulted, even while the patient is in the intensive care unit. As soon as the individual is ready for a rehabilitation program, his or her needs are again triaged to see which type of rehabilitation program will be the best fit. Within the VA system is the polytrauma system of care, which is broken down into several levels of rehabilitation programs, the most acute being the polytrauma rehabilitation center (PRC—inpatient rehabilitation), the polytrauma transitional rehabilitation program (PTRP—residential treatment), polytrauma network sites (PNSs—outpatient rehabilitation), and polytrauma support clinic teams (outpatient rehabilitation).[10] Additionally, the VA offers polytrauma telehealth for those who are not able to come to a local polytrauma site (Fig. 48.2).

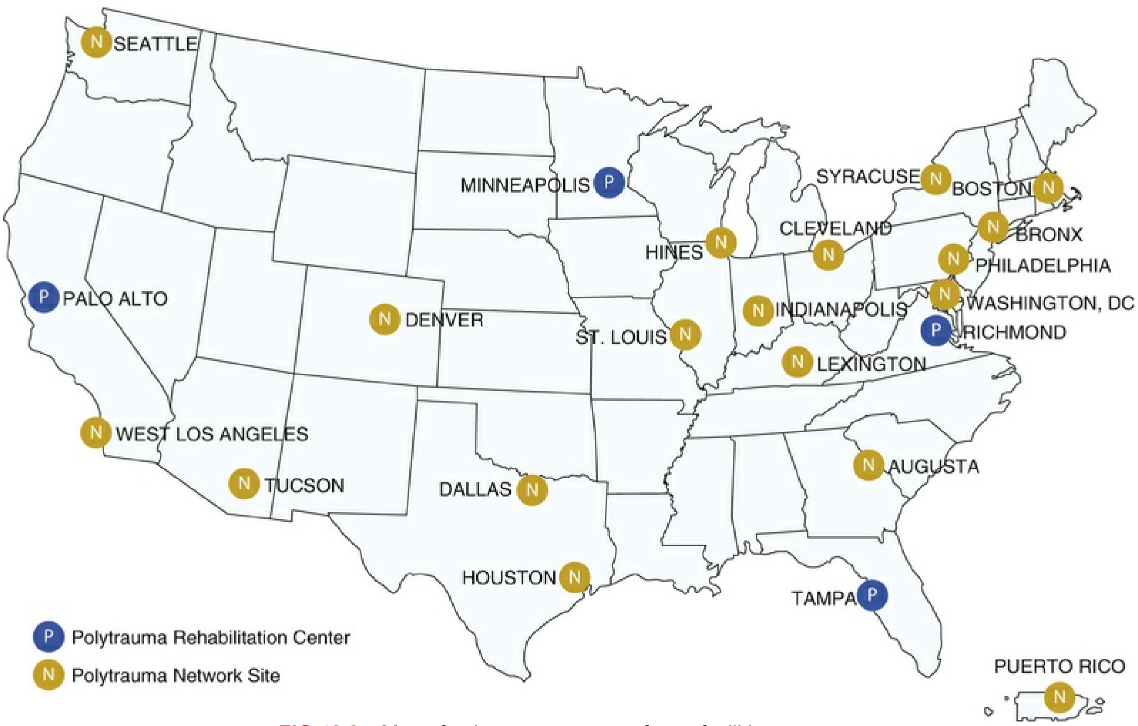

FIG 48.2 Map of polytrauma system of care facilities.

Polytrauma Rehabilitation Centers

Polytrauma rehabilitation centers (PRCs) provide acute, comprehensive, inpatient rehabilitation and comprehensive **interdisciplinary** evaluation of patients with varying levels of acuity or severity. A patient at any level on the Rancho Los Amigos (RLA) Level of Cognitive Function Scale[17] may be admitted (see Chapter 34 for further information on RLA levels). These evaluations help determine the range and types of services needed to manage the full scope of medical, rehabilitation, and psychosocial sequelae resulting from combat injury and the most appropriate setting in which to deliver these services.[10] PRCs maintain a full team of rehabilitation professionals, as well as consultants from other specialties related to polytrauma. PRCs also serve as consultants to other facilities in the polytrauma system of care.

As an OT serving on a polytrauma team, it is imperative to have knowledge and experience in treating a wide variety of conditions. For example, rehabilitation care is often focused on head/brain injury. Therefore the therapist must have specialized skill in the rehabilitation of **traumatic brain injury** (TBI), including cognitive rehabilitation, visual-perceptual skill training, **sensory loss** training, and behavioral skill training.[16,28] Additionally, OTs need to have a solid understanding of the rehabilitation of physical disabilities, including upper extremity rehabilitation, amputation care, functional mobility, burns, wound prevention, balance, and hand therapy, including splinting.

Moreover, the OT must be skilled in psychosocial rehabilitation, with a focus on family care, as well as how to work with patients with PTSD, anxiety, and pain.[18] Finally, the OT must be proficient in retraining patients in the performance of ADLs and IADLs, as well as community reintegration training.

The OT is just one member of an interdisciplinary team assigned to the PRC. Some of the other team members include the rehabilitation physician (physiatrist), nurses, social work case managers, speech-language pathologists, physical therapists, recreation therapists, counseling psychologists, and neuropsychologists. Some teams also include family therapists, military liaisons, blind rehabilitation and outpatient specialists, and massage therapists. Consulting services play a large part in the care of these patients. Consultants frequently involved in care include plastic surgeons, orthopedists, pain management specialists, psychiatrists, dentists, audiologists, neurologists, ophthalmologists, and internists. The key component in the treatment of more acute polytrauma patients is working within and in conjunction with a large team to best serve the patient. The interdisciplinary team meets regularly to ensure that all treating specialists are working as a fluid team to address the primary issues and ensure that the treatment is clinically appropriate and patient centered. Interdisciplinary communication is essential to ensure that all members of the team are reenforcing techniques and compensations that are initiated by the different disciplines or to collaborate on what techniques and compensations may be most effective to implement for that patient. This often requires co-treatment between disciplines to ensure the best care.[7,35,36]

Once a patient is admitted to a PRC, the OT is consulted. The OT will always start with a chart review and assess the precautions for the client. This population frequently has **skull flaps** removed and must therefore wear helmets when out of bed. Clients with polytrauma often have infections such as methicillin-resistant *Staphylococcus aureus* and *Acinetobacter*, which require contact precautions (gown and glove); they may also be at risk for seizures, have visual deficits, be at risk for falling, and have behavioral difficulties, as well as PTSD. Once the OT is aware of the patient's background and precautions, the next step is to contact the treatment team to determine whether any additional information is available and then meet with the client. One of the most important pieces of information to gather is the client's and family's goals and expectations for the rehabilitation program. These goals, as well as the extent of the brain injury, will direct care of the client.

The occupational therapy evaluation is tailored to the needs of the client. For example, clients at RLA levels 1 to 3 will be evaluated with the Coma Recovery Scale–Revised (CRS-R)[14] and the Coma–Near Coma Scale.[31] Clients will generally be considered to be at the level of **emerging consciousness** if they demonstrate minimal arousal, limited capacity to interact with the environment, a significantly impaired ability to follow commands and communicate, and little to no intentional movement.[2] At this level there is no functional use of objects, which limits the client's engagement in ADLs. A client at the level of emerging consciousness will then follow a different pathway from an acute rehabilitation patient. Interventions for these clients often include sensory stimulation, maintenance and restoration of neuromuscular and movement-related functions, prevention of secondary disability, and family education and involvement (see Chapter 34 for additional details). The goal of occupational therapy intervention is to increase arousal, improve functional use of objects, work with the speech-language pathologist to determine the most accurate form of yes/no communication, and be able to follow basic commands. In addition, the OT is involved in maintaining or restoring ROM to the upper extremities through passive ROM exercises, splinting, and tone management techniques. The OT will also ensure optimal positioning for seating and maintenance of skin integrity through cushion and wheelchair evaluation. Once a patient emerges from the minimally conscious state, he or she will transition out of the emerging consciousness program and become an acute rehabilitation candidate (Fig. 48.3).

JFK COMA RECOVERY SCALE - REVISED ©2004

Record Form

This form should only be used in association with the "CRS-R ADMINISTRATION AND SCORING GUIDELINES" which provide instructions for standardized administration of the scale.

Patient:	Diagnosis:	Etiology:
Date of Onset:	Date of Admission:	

Date																
Week	ADM	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
AUDITORY FUNCTION SCALE																
4 - Consistent movement to command*																
3 - Reproducible movement to command*																
2 - Localization to sound																
1 - Auditory startle																
0 - None																
VISUAL FUNCTION SCALE																
5 - Object recognition*																
4 - Object localization: Reaching*																
3 - Visual pursuit*																
2 - Fixation*																
1 - Visual startle																
0 - None																
MOTOR FUNCTION SCALE																
6 - Functional object use†																
5 - Automatic motor response*																
4 - Object manipulation*																
3 - Localization to noxious stimulation*																
2 - Flexion withdrawal																
1 - Abnormal posturing																
0 - None/flaccid																
OROMOTOR/VERBAL FUNCTION SCALE																
3 - Intelligible verbalization*																
2 - Vocalization/oral movement																
1 - Oral reflexive movement																
0 - None																
COMMUNICATION SCALE																
2 - Functional: Accurate†																
1 - Non-functional: Intentional*																
0 - None																
AROUSAL SCALE																
3 - Attention																
2 - Eye opening w/o stimulation																
1 - Eye opening with stimulation																
0 - Unarousable																
TOTAL SCORE																

Denotes emergence from MCS†

Denotes MCS*

FIG 48.3 JFK Coma Recovery Scale. (From Giacino JT, Kalmar K, Whyte J: The JFK coma recovery scale—revised: measurement characteristics and diagnostic utility, *Arch Phys Med Rehabil* 85(12):2020–2029, 2004.)

Acute rehabilitation begins with an evaluation of the patient and leads to clinical decision making for triage of needs. Goal setting is based on clinical reasoning with direct input from the client and family members. Goals must reflect occupational performance of functional outcomes. Common evaluation tools focused on assessing body functions include basic goniometry for upper extremity ROM; manual muscle testing; and coordination testing, including standardized assessments such as the Moberg Pickup Test, Purdue Pegboard Test, Jebson-Taylor Hand Function Test, and the Minnesota Rate of Manipulation. Sensory testing is performed, and if needed, Semmes-Weinstein filaments can be used. Basic ADLs and IADLs are assessed. Some examples of assessments that are used for ADLs/IADLs are the Kohlman Evaluation of Living Skills, Executive Function Performance

Test, Canadian Occupational Performance Measure, and the VALPAR 5 Workstation Analysis. Transfers and functional mobility are assessed, in addition to skin maintenance and seating needs. Visual-perceptual skills are evaluated; some standardized tools that are used include the Motor Free Visual Perceptual Test, the BiVABA, and Dynavision, and nonstandardized assessments for neglect, saccades, acuity, and color perception are also administered. Finally, basic cognitive skills are evaluated with tools such as the Loewenstein Occupational Therapy Cognitive Assessment, Test of Everyday Attention, Contextual Memory Test, and informal assessments such as components of functional task performance.

Once the evaluation is complete, it is the OT's role to ensure that the client engages in functional activities that promote and maintain optimal upper extremity ROM for later functional tasks. This includes basic self-care tasks along with tone management, splinting, and ROM exercises. Additionally, maintenance of skin integrity is a priority. Many polytrauma clients have shrapnel wounds, burns, and pressure wounds from bed surfaces, seating surfaces, and splints. It is critical that the OT work with the medical provider, nurses, and physical therapist to ensure that the client has optimal skin integrity and contact surfaces that relieve pressure.

If sensory impairments are present, they must be addressed for the client to function within the environment. With decreased sensation in areas such as pain, touch, and temperature, the OT must make sure that the client has training in the use of compensatory strategies for safety. If the patient has hearing loss, it is critical that the therapist face the patient when speaking, speak at a louder volume, or ensure that the client uses appropriate devices to compensate for the hearing loss. Finally, with visual loss, it is important to maintain a clutter-free environment for the client, keep all necessary items and furnishings in the same place at all times, and orient the client for safe functional mobility within the room. The OT also works closely with the blind rehabilitation outpatient specialist to ensure that the client can perform basic ADLs and IADLs by using low-vision or blind rehabilitation techniques and devices.

After these performance components are evaluated, the OT can focus on basic ADLs. This includes issuance of and training on any assistive devices or durable medical equipment needed to optimize independence. For example, a client may need a long-handled mirror to inspect the skin for wounds or observe a healing amputation site. A client may also require specialized feeding tools such as plate guards or rocker knives for one-handed feeding. In addition, clients may require shower benches or grab bars if balance or mobility issues are present. Part of basic ADL performance includes the ability to get to places safely, such as the toilet or shower. Therefore the OT must address any seating and mobility needs for a client who is nonambulatory. A seating evaluation can be performed as part of the wheelchair assessment for a client who is nonambulatory. Wheelchair issuance includes training on safety, training on mobility, and an evaluation of visual-perceptual skills for safe propulsion of the chair. Ambulatory clients who have deficits that affect getting to the toilet or shower safely because of balance issues or motor planning would also need occupational therapy services. Caregiver training is also initiated with ADL and functional mobility training, and, as a client progresses, the training needs to be readdressed.

IADLs are also addressed for this population. It may start with simple meal preparation, basic money management, or simple homemaking skills and progress to higher-level money management skills; work-, school-, and family care–related skills; time management; and community living skills. It is important to incorporate cognitive retraining and compensatory strategies to optimize independence in these skills. Clients are often issued and trained on the use of cognitive prosthetic tools such as electronic cognitive devices (ECDs), alarm watches, and global positioning system (GPS) devices. Use of these tools and the strategies provided for executive skill functions such as pathfinding, problem solving, organization, and planning is then integrated into community reintegration sessions. Community reintegration also includes training on use of public transit, as well as driving rehabilitation.

Many clients who have sustained polytrauma experience PTSD, anxiety, and pain. A polytrauma OT may initiate training in the use of biofeedback for management of stress, relaxation, and management of pain. Additionally, the OT addresses sleep hygiene in conjunction with psychology services, medical service, and nursing. The client is able to learn and practice these sleep hygiene techniques while in the PRC to support the use of these skills after discharge.

Throughout the inpatient stay, a client with polytrauma may have many medical procedures and off-unit medical appointments that interrupt the scheduled occupational therapy sessions. These procedures may result in a change in status and thereby necessitate reevaluation and reassessment of the client's functional and cognitive status. Updating of goals and priorities must continually be on the forefront as the client's status or the client and family goals change. The families are generally very involved in all aspects of the client's care and are incorporated into the treatment-planning process.

Threaded Case Study

Alex, Part 2

On completion of his inpatient PRC stay, Alex was independent in basic ADLs, transfers, and manual wheelchair mobility on indoor and outdoor surfaces. He was fitted for a prosthetic limb and had achieved functional grip strength in his right hand and sufficient coordination to don and doff the prosthesis. Alex was issued an ECD to assist in his memory deficits, performance of IADLs, and organizational skills. He still required minimal assistance to perform basic IADLs such as meal preparation, household management, and financial management. With visual-perceptual skill retraining, Alex no longer complained of double vision and was able to identify and reach for targets accurately. With the use of compensatory strategies, such as deep breathing, biofeedback, and sleep hygiene skills, Alex was sleeping well and was less anxious, and his tolerance of frustration had improved. Distractibility continued to have a negative impact on his time management skills and ability to follow through with assignments; however, he was able to create a less distracting environment for himself with cueing. His safety awareness improved, although supervision was still required for higher-level judgment and safety. As Alex transitioned to the polytrauma transitional rehabilitation program (PTRP), his occupational therapy program continued and progressed in accordance with his inpatient recommendations. Occupational therapy objectives for the PTRP included (1) promoting the highest level of functional cognition, including implementation of compensatory strategies and cognitive prosthetics to increase independence and safety in all functional skills; (2) achieving optimal independence in IADLs, including parenting skills; (3) optimizing independent ability to access the community, including transportation; (4) optimizing independence in return-to-school and return-to-work skills; and (5) receiving appropriate durable medical equipment to meet both short- and long-term needs.

Polytrauma Transitional Rehabilitation Program

The PTRP provides comprehensive, postacute cognitive retraining and community reentry rehabilitation to patients with TBI who have progressed beyond the needs of basic rehabilitation interventions. The goals of this program are to integrate clients back into their community, assist them in achieving independent living, and help them return to their life roles. Not all clients who enter the PTRP have been through a PRC; many are direct referrals from other VA facilities, from PNSs, and from outside private facilities or military treatment facilities. Because these clients have already achieved the goal of basic inpatient rehabilitation—that is, independence in ADLs and basic functional mobility—the focus while involved in the PTRP is on the higher-level skills needed to return to the community. There is more of a cognitive retraining focus with an emphasis on group work and community. The majority of clients reside within the PTRP facility; however, some clients have already transitioned back to the community and come to the facility for the day program.[20]

As is similar with all rehabilitation settings, the occupational therapy program begins with an evaluation of the patient and leads to clinical decision making. Goal setting is based on clinical reasoning, input from the patient and family, and the interdisciplinary team goals. OTs in the PTRP use many functional nonstandardized evaluation tools, but they also use standardized TBI evaluation tools such as the Mayo-Portland Adaptability Inventory (MPAI-4).[21] The MPAI-4 focuses specifically on the most frequent sequelae to be considered during rehabilitation planning or other clinical interventions, such as physical, cognitive, emotional, behavioral, and social problems. MPAI-4 items also assess major obstacles to community integration that may result directly from a brain injury, as well as the environment and context of the activity. With input from other team members, including psychology and neuropsychology, speech-language pathology, and physical therapy, realistic goals and community reintegration training can be initiated.

The OT addresses a client's ability to participate in basic IADLs such as money management, including establishing banking accounts, budgeting, financial planning, and paying bills. Additional areas addressed include cooking skills, home management and organization, health management and maintenance, child rearing, pet care, safety awareness and emergency responses, and shopping. The use of compensatory strategies and cognitive prosthetics is integral for IADL retraining, especially for clients with disorders in memory and executive functions. Many of these clients are issued and trained on use of an ECD, which is then reinforced throughout all therapies within the program.

Community reintegration training facilitates the client's ability to access the community. This includes training a client on the use of public transit, addressing driving needs, or addressing the client's ability to procure transportation in the community. It also requires the client to learn pathfinding skills, often with the use of a GPS device, and executive skill functions such as trip planning, budgeting, time management, and problem solving. The OT provides opportunities for practice in using strategies and cognitive prosthetics (such as ECDs, smart phones, or GPSs) to aid the client in becoming successful in this occupational performance area.

Another key component of this rehabilitation program is training and interventions to assist the client in meeting the goals of returning to school and learning. This includes training in basic academic skills such as math, note taking, and general study habits. It also includes exploration of educational needs and interests, some of which may lead to prevocational or vocational participation. The OT must also address any assistive technology needs such as computer access, ECDs, and specialized software designed to increase ability to succeed in school-based programs.

If return to work is the primary goal for the client, the OT must assist him or her in gaining the skills needed to return to productive employment or volunteer activities. The OT may work on goals to identify and select work opportunities based on the client's level of function, as well as likes and dislikes. Occupational therapy services are often provided to retrain the client in how to identify job opportunities, complete and submit appropriate application materials, and prepare for interviewing. Work habits, such as attendance, punctuality, appropriate relationships with coworkers, appropriate dress, completion of assignments, timeliness, and compliance, must also be addressed. The use of cognitive prosthetics is incorporated to assist the client in succeeding in these areas. Finally, the client may not be ready to engage in full-time or even part-time paid employment, and thus volunteer exploration and participation may be the first step in returning to the workforce. The OT may provide job coaching at the work or volunteer site to identify adaptive or compensatory strategies for successful performance.

The OT also needs to address leisure exploration, participation, and social skills to improve a clients' reintegration into the community. Key elements in addressing these skills include social skills groups, practice on appropriate interactions within the milieu or environment, and role-playing with feedback. Peer interaction, both within the program and within the community, as well as family and community interactions allow greater practice and skill training. Leisure exploration may include administering interest checklists and assessing abilities and opportunities available. It also includes training in the ability to plan for leisure, obtaining and maintaining equipment and supplies, and balancing leisure participation with work and self-care needs. The OT may work in conjunction with the physical therapist and the recreation therapist to ensure that adaptive sporting equipment and assistive technology are available as needed to best meet the leisure needs of the client.

Stress management also needs to be addressed. Many of these clients experience stress related to adjusting to their limitations, changes in their life roles and patterns, pain or sleep issues, and PTSD. Biofeedback may be used to aid these clients in learning techniques to decrease overall stress reactions, manage pain, and improve sleep. Sleep hygiene education, as well as various mind-body techniques, can also be introduced and incorporated into this program.

Overall, OTs working in the PTRP have to address all the aforementioned areas in the context of clients' current physical and cognitive abilities while also addressing how to improve their current functional abilities. Any physical limitations in areas such as ROM, strength, and coordination are addressed to improve functional performance. A client's sensory issues, such as low vision or visual-perceptual skill deficits, must be addressed and compensations incorporated into treatment planning for all the previously mentioned areas of function. Finally, cognitive skills, remediation, and compensation must be addressed to ensure that the patient has an optimal outcome in these areas of function.

As the patient transitions out of the PTRP, the OT plays a role in helping the patient relocate to appropriate housing, makes recommendations for levels of assistance still needed, addresses caregiver training if required, and ensures that prerequisite skills for the housing option are in place. The OT will address any durable medical equipment and environmental modifications that the client may need.

Threaded Case Study

Alex, Part 3

After 3 months in the PTRP, Alex demonstrated improved integration of his ECD into performance of IADLs. He is now using it for appointment reminders, direction finding, list making, note taking, and medication management, with occasional cueing from the therapist. Although Alex is still unable to drive, he has learned to use the local public transport system and is able to access restaurants, malls, grocery stores, and specialty stores in the local area. Pathfinding with use of the ECD and computer maps is adequate for familiar areas. Safety awareness has improved, and Alex is now safe to be left alone for long periods, is able to independently access his local community, and demonstrates improved reasoning and insight in decision making/problem solving. Alex is now independent in light hot meal preparation and basic home management tasks such as laundry and cleaning. He began to volunteer part-time in the local preschool program to address work skills and child care skills. Training in the use of biofeedback has continued, and Alex has become more skilled at self-regulation.

As Alex completed the PTRP, he moved home with his pregnant wife and was referred to a PNS for further occupational therapy intervention. The objectives of OTs in the PNS included (1) promoting the highest level of functional cognition, including implementation of compensatory strategies and cognitive prosthetics to increase independence and safety in all functional skills; (2) achieving optimal independence in IADLs, including parenting skills; (3) maximizing his ability to independently access the community, including transportation; (4) optimizing independence in return-to-school and return-to-work skills; (5) receiving and training on appropriate durable medical equipment to meet both short- and long-term needs; and (6) optimizing independence in the use of stress management and coping skill strategies, including mind-body techniques.

Polytrauma Network Sites

PNSs are outpatient clinics that serve two roles. The first is to provide specialized, postacute rehabilitation in consultation with rehabilitation centers. The OT consults with and provides follow-up based on recommendations made by the inpatient therapists. Depending on the client's current status and outcomes, the client's occupational needs can range from reeducation of caregivers in skilled nursing facilities to seating and mobility needs for returning to school or the workplace. Ambulatory clients who have deficits that affect getting to the toilet or shower safely because of balance issues or motor planning would also need occupational therapy services. Another focus may be on reinforcing the integration of assistive technology and other compensatory techniques for optimal independence in performance skills and patterns. The OT creates a treatment plan based on the client's needs (environment, client factors, client and family goals, activity demands, and current performance skills), not one that is based on the particular diagnosis. Treatment is provided in the context and environment most appropriate to meet the needs of the client.

A significant increase in the incidence of mild traumatic brain injury (mTBI) has been seen in service members as a result of serving in the OIF/OEF conflicts.[11] There is no standard, agreed-on definition of mTBI. The Department of Veterans Affairs uses the following definition of mTBI in all its TBI screening evaluations: a client with mTBI is one who has experienced a traumatically induced, physiological disruption of brain function as manifested by at least one of the following[8,22,24,30]:

1. Any period of loss of consciousness

2. Any loss of memory of events immediately before or after the accident

3. Any alteration in mental state at the time of the accident (eg, feeling dazed, disoriented, or confused)

4. Focal neurologic deficit or deficits that may or may not be transient but in which the severity of the injury does not exceed the following:

a. Loss of consciousness of approximately 30 minutes or less

b. After 30 minutes, an initial Glasgow Coma Scale (GCS) score of 13 to 15

c. Posttraumatic amnesia not longer than 24 hours

Common symptoms of mTBI include headache, dizziness, nausea and vomiting, sleep disturbances, sensitivity to light, sensitivity to noise, slowed processing, memory difficulties, irritability, depression, and visual changes. An individual may experience symptoms at the time of the event or weeks later following the mTBI. In most people who sustain mTBI, symptoms resolve within 3 months.[33] However, 15% to 30% of individuals have ongoing symptoms and are at risk for developing postconcussive syndrome.[1,29] In postconcussive syndrome, the aforementioned symptoms or clusters of symptoms persist for longer than 3 months.[5]

Postconcussive syndrome can have an impact on outcomes at any stage of polytrauma rehabilitation. Sometimes postconcussive syndrome does not become apparent until many of the life-threatening injuries have been stabilized.[19,30] While in the acute phase of rehabilitation, the symptoms may have an impact on function; however, the focus may be more on the acute injury, not on the persistent postconcussive symptoms. While in the postacute phase, postconcussive symptoms are identified during higher-level functional activities. Clients can also be treated for PTSD when mTBI and postconcussive symptoms are recognized.

Clients who experience multiple blast exposures are at higher risk for more complicated mTBI. This, in conjunction with exposure to stressful environments, increases the risk for mTBI and acute stress reaction/PTSD. This is true for mTBI sustained in automobile accidents in the private sector as well.[4] The stressful environment, multiple exposures, and acute stress reaction/PTSD can have a significant impact on natural recovery from mTBI.

The symptoms of acute stress reaction, depression, and PTSD are very similar to those of mTBI/postconcussive syndrome and can include difficulties in memory and concentration, sleep problems, impaired attention, irritability, and headache. The best approach for identifying the cause of the various symptoms is to incorporate the treatment team. The PNS uses an interdisciplinary team model to determine the most likely cause of the deficits and the most appropriate treatment to address the symptoms (Fig. 48.4).

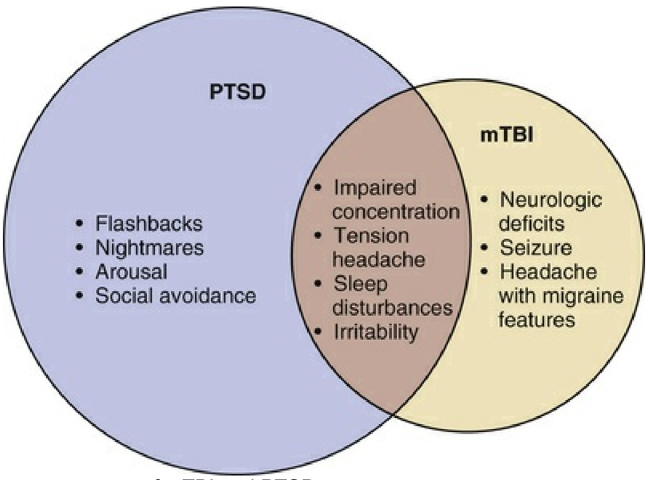

FIG 48.4 Common symptoms of mTBI and PTSD. (From Ruff RL, Riechers RG, Ruff SS: Relationships between mild traumatic brain injury sustained in combat and post-traumatic stress disorder, *F1000 Med Rep* 19:64, 2010 [government publication].)

When the PNS system was developed in 2007, there were no standards for rehabilitative treatment of mTBI. As this diagnosis became so prevalent from the OIF/OEF conflicts, the Department of Defense and the Department of Veterans Affairs developed best-practice guidelines.[11] Additionally, an occupational therapy– and physical therapy–specific guideline was developed by the Proponency Office for Rehabilitation and Reintegration (OT/PT: Clinical Practice Guidance: Occupational Therapy and Physical Therapy for Mild Traumatic Brain Injury). The clinical guidance document recommended treatments focused on client education, visual dysfunction, headache, cognition, resumption of roles, and emotional well-being.

Studies show that mTBI needs to be approached and treated differently from moderate or severe TBI. The goal is to increase awareness of deficits in those with more severe TBI, whereas with mTBI, studies have shown that focusing on abilities, stress management/coping skills, and compensatory strategies improves outcomes.[3,6,8,27,32,37] Clients with mTBI tend to be overly sensitive to errors and have decreased perceived self-efficacy, which can lead to decreased self-esteem, depression, and isolation. These factors can affect return-to-life roles and community reintegration. Clients may be able to follow through with routine and familiar tasks yet may demonstrate difficulty in problem solving, insight, and self-control.[26]

OTs working in the PNS system start the initial interaction with the client during the evaluation. This includes the use of standardized assessments, self-report tools, and observation of performance of functional tasks. The therapist also provides visual-perceptual screening because visual deficits are frequently seen in clients exposed to multiple blasts. From that screening, the therapist can then refer the client for further assessments as needed. The evaluation also includes screening for ADL needs, cognitive deficits, current use of assistive technologies, home modification needs, home management skills, organizational skills, predriving skills, physical rehabilitation needs, emotional regulation, sleep hygiene, pain, headache, and relaxation skills. Additionally, the OT will address current needs in relation to study skills, vocational needs, community reentry skills, return and transition to life roles (including follow-through with entering school, the workforce, or both), managing a household for the first time, higher-level money management, and parenting skills.

The therapist focuses on client goals in relation to activity demands and any deficits identified. The therapist will address the aforementioned areas by intervention consisting of remediation techniques and training in compensatory strategies, assistive technology, and biofeedback/mind-body techniques. This may include removing distractions, creating routines, and integrating self-awareness training tools. Client education is also an integral part of treatment. Client education may consist of discussing the effects of mTBI, expected outcomes, and how typical stressful situations and sleep problems can have an impact on function. Within the context of this education, the therapist must provide guidance on strategies for increasing insight, using compensatory mechanisms, and achieving effectiveness in participation in desired occupations. Overall, it has been documented that outcomes are better for mTBI when clients receive adequate education.[25,28]

Because the PNS works with many returning service members who bring combat driving skills to the civilian environment, their safety in driving skills must be assessed. Such driving skills include attention, multitasking ability, reaction speed, and visual-perceptual skills, as well as addressing stress reactions and hypervigilance. Many soldiers avoid driving or rely on others for assistance. OTs address predriving skills by assessing and remediating performance components. The VA has therapists who are driving rehabilitation specialists. These specialists are trained to evaluate this population by working both with driving simulators and behind the wheel. They also can provide driver's training and adaptive controls or vehicles as indicated.

The PNS as a team is tasked to monitor and follow clients' needs for their lifetime. These network sites provide proactive case management for existing and emerging conditions and identify local resources for both VA and non-VA care.

Threaded Case Study

Alex, Part 4

Alex was initially evaluated by the OT at the PNS on a weekly basis and then once a month. Alex's primary concern on initial PNS evaluation was the upcoming arrival of his baby. Although some child care skills were addressed during his volunteer experience, he was unsure of how to care for a newborn, combined with the stressors of lack of sleep, poor tolerance of frustration, and distractibility. Trial and training with a programmable infant simulator were successful in the integration of self-regulating strategies and ECD use and increased his confidence in his abilities. After training in the use of GPS, a feature of his ECD, Alex is able to navigate in unfamiliar areas with confidence. He also completed a driver's rehabilitation program and has been cleared to drive independently. Alex has enjoyed his volunteer experience and has identified teaching as a vocational goal. He is now taking one course per semester at the local community college and is implementing the study skills taught during his PNS sessions.

Monthly, Alex brings in a list of difficulties identified (tracked in his ECD) in work, home care, and child care, and he works with the OT to further address these needs. At the 1-year postinjury mark, Alex reports that he has a well-balanced life with volunteering, school, family, and social/leisure activities.

Long-Term Management/Polytrauma Support Clinic Teams

Long-term polytrauma management is accomplished in clients' home communities where they are monitored by either the PNS or polytrauma support clinic teams. These teams are groups of rehabilitation providers who deliver follow-up services in consultation with regional and network specialists. They assist in managing the long-term effects of polytrauma through direct care, consultation, and the use of tele-rehabilitation technologies, as needed. Polytrauma telehealth is a burgeoning field in rehabilitation. Telehealth is the use of electronic information and telecommunications technologies to support long-distance clinical healthcare, client and professional health-related education, public health, and health administration.

Technologies used in telehealth typically consist of videoconferencing, the Internet, store-and-forward imaging, streaming media, and terrestrial and wireless communications. Even though new applications are increasingly being found for the use of these technologies, significant barriers remain in making these technologies an integral part of daily healthcare practice.[38] The OT's role in telehealth is either as a presenter, consultant, or direct care provider.

The polytrauma system of care encompasses all the programs described earlier and ensures that there is a smooth, seamless continuum of care for these clients, including case management for life.

Summary

Polytrauma can result in substantial impairments that affect all areas of occupation. The injuries can vary from mild to severe and can include multiple body systems and affect performance skills and patterns. When treating these clients a therapist must take into consideration the specific client factors and the context and environment in which activities will occur. The goal of occupational therapy is to facilitate the client's achievement of optimal independence and functioning at each stage of recovery. Polytrauma affects the entire family unit, and thus rehabilitation goals must be client and family centered and coordinated and reinforced by all those working with the client.

Review Questions

1. What is the definition of polytrauma?
2. Differentiate between primary, secondary, tertiary, and quaternary blast injury.
3. What are some common sequelae of polytrauma?
4. What makes a polytrauma client from the OIF/OEF conflicts unique in today's rehabilitation population?
5. In the inpatient/acute unit, what primarily drives the rehabilitation course?
6. Why is an interdisciplinary team more effective than siloed care in treating polytrauma patients?
7. What are the common symptoms of and interventions for mTBI and PTSD?
8. What are the roles and treatment interventions for OTs in treating an emerging consciousness patient?
9. How does the focus of treatment change as the patient progresses through the polytrauma system of care?
10. How does PTSD affect the recovery process for a polytrauma patient?

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[*]The opinions expressed in this chapter do not necessarily represent those of the Department of Veterans Affairs.

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Occupational Therapy in Hospice and Palliative Care

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CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, the student or practitioner will be able to do the following:

1. Define hospice and palliative care.
2. Explain the therapeutic value of occupational engagement while living with a life-threatening illness.
3. Describe the role of occupational therapy in hospice and palliative care, as described in the current (2014) OT Framework ("Occupational Therapy Practice Framework: Domain and Process," third edition[4] [OTPF-3]). Discuss how clinical reasoning adjusts to accommodate the dying process.
4. Identify outcome measures for hospice and palliative occupational therapy.
5. Articulate strategies for clinician self-care.

KEY TERMS

Actively die
Chronic disease
Chronic illness
Clinician self-care
Dying trajectories
Grief
Grieving process

Hospice
Loss
Palliative
Palliative care
Terminal
Terminal illness
Terminal phase
Transitions

Case Study

Kay

Kay watched Dr. Kato's lips move. "You have pancreatic cancer …" The movement of his mouth didn't seem to match the sounds she heard. "… with liver metastasis and biliary duct obstruction …" Kay slowly turned to watch her daughter Liz frantically write down every word. Dr. Kato further explained that surgery was not indicated, given the extent of metastasis (ie, the cancer's spread to multiple organs), but palliative chemotherapy might slow the growth of the tumors. and a stent in her biliary duct could reduce her jaundice. These procedures would lessen her symptoms but were not curative. Dr. Kato paused and then said, "You have a **terminal** disease and probably 6 months or less to live." Liz's pen froze in place. As she and Kay recalibrated their gaze on Dr. Kato, he suggested hospice to support Kay and her family during this difficult time.

Kay followed through with the recommended treatment plan in disbelief. Divorced at age 50, Kay had worked long hours as a housecleaner to support herself and four children until her retirement at age 62. At 82, she highly valued being able to take care of herself and remained fiercely independent. Kay enjoyed spending time with family and friends, attending church on Sundays, participating in a weekly Bible study, traveling, and cooking for others. "I can't be dying," she would say to herself, "I have plans to travel, see the grandkids married, and be a great-grandmother!"

Within 3 months of her diagnosis, Kay began experiencing increased fatigue, weakness, and abdominal discomfort. The hospice nurse and physician adjusted her medications to control her pain, but she became frustrated by not being able to maintain her self-care routines. Each day, she was less able to do for herself. An unspoken realization arose within her and her family that she would not get better and now required more help. Her children and grandchildren assisted with homemaking, financial affairs, and transportation, but Kay insisted on attending to her own bathing, dressing, and toileting as much as possible. She compromised by moving in with Liz, her eldest daughter, in order to get assistance as needed. Seeing Kay's angst about remaining as independent as possible, the hospice team consulted occupational therapy (OT) services.

Critical Thinking Questions

1. Is the hospice team appropriately consulting OT services for someone who is declining and dying?
2. How will the occupational therapist help Kay meet her goals as she continues to decline?
3. How will the occupational therapist know if the intervention is effective?

Kay is one of more than 1.5 million Americans who receive **hospice**, or end-of-life care, annually.[92] In addition, an estimated 133 million Americans live with a **chronic disease**, or an incurable illness not yet in the terminal stages of the disease process.[32,45,88] The geriatric population in the United States tripled in the past 50 years and is expected to triple again in the next 50 years.[113] In the foreseeable future, more people will be living longer with chronic conditions[32] but dying with more complex diseases.[90] The needs of those with incurable illness, chronic or terminal, will increase exponentially. *What is occupational therapy's role in addressing this crisis? Is occupational therapy, a profession known for promoting health and well-being through occupational engagement, effective with people* *who are declining and dying?*

This chapter provides a background on hospice and palliative care, presents the evidence base for hospice and palliative care OT, describes the role of OT with this population within the parameters of the current (2014) OT Framework, the "Occupational Therapy Practice Framework: Process and Domain," third edition[4] (OTPF-3), and recommends clinician self-care strategies to support ongoing quality care.

Hospice and Palliative Care

Derived from two Latin words, *hospis,* for both host and guest, and *hospitium,* for the dwelling offering hospitality,[35,93] *hospice* initially referred to monastery-based hostels during the 11th to 15th centuries that were set up throughout Europe along pilgrim routes to provide shelter for weary travelers, the poor, and the sick as they sojourned to sacred places.[7,35,97,107] When religious orders lost their influence and the monasteries ceased to exist in Britain, the number of hospices waned for three to four centuries.[77,97]

In the 17th century there was a resurgence of hospice care. In 1633 St. Vincent de Paul founded the Sisters of Charity in Paris to care for the orphaned, sick, and dying in the community.[35] In 1842 Madame Jeanne Garnier further defined hospice by being the first to use the term “hospice” to specifically describe care for the dying.[7,35] In 1879 the Irish Sisters of Charity opened Our Lady's Hospice of Dublin, which expanded to England with the opening of St. Joseph's in 1905 in London.[7,93]

As hospice care developed, the mid-20th century brought advances in modern medicine. The discovery of antibiotics and the development of cardiopulmonary resuscitation brought hope that certain fatal illnesses could be cured.[14,45] Healthcare shifted from a model of healing to a biomedical culture focused on cure and the elimination of disease.[14,45] Health became defined as “the absence of disease.”[110] Those living with an incurable, terminal disease, however, were ignored and marginalized, considered as failures of medical advances in this new model of healthcare.[14,45]

In response to the neglected needs of the terminally ill, Dr. Cicely Saunders opened the first modern hospice, St. Christopher's Hospice, in south London in 1967.[14,45] Taking a radically different approach from that of previous hospice centers, Saunders based St. Christopher's Hospice on solid research. Dr. Saunders was a strong opponent of euthanasia and desired to find effective pain management options so patients could live fully until the end of their lives.[56] Defying conventional fears of addiction and the practice of only using opioids as a last resort, she integrated evidence on the effective use of opioids for pain management with a fixed-schedule dosing regimen to promote pain control, rather than dosing only as pain occurred.[14] Based on her own research of 340 cases in 1960 and 1100 in 1967, Saunders defined “total pain” as the integral relationship between physical, mental, and spiritual suffering and gathered an interdisciplinary team to provide medical, psychosocial, and spiritual support through the dying process.[14,93]

Soon the modern hospice movement came to the United States. In 1975 the first U.S. hospices opened in Connecticut and New York, funded by grants and contributions.[45] In 1982 Congress established the landmark Medicare Hospice Benefit, providing federally funded home hospice care.[23,89] Today, hospice care is defined as noncurative comfort care and psychosocial support for those with a life expectancy of 6 months or less.[114] As of 2013 there were approximately 5800 hospice programs in the United States, spanning all 50 states, the District of Columbia, Puerto Rico, Guam, and the U.S. Virgin Islands.[92] Sixty-six percent of hospice care is provided in the client's home (private residence, nursing home, or residential facility), 26.4% in an inpatient hospice facility, and 7% in an acute care hospital.[92] Although the Medicare Hospice Benefit has fallen below the cost of care and the Affordable Care Act will further reduce hospice payments by 11.8% over the next 10 years, hospice care remains accessible to all Americans.[89]

As the needs of the terminally ill were gradually being addressed, the needs of the chronically ill became more apparent.[45] **Palliative care** subsequently formed to help alleviate suffering of those with life-limiting illness not yet in the terminal phase, or end-stage, of the disease process.[45] Both hospice and palliative care affirm life; see dying as a normal process; seek to provide relief from pain and distressing symptoms; help clients remain as active as possible until death; neither hasten nor prolong death; and provide support to both client and family.[87,119] Palliative care, however, can be used at any stage of the disease process and in conjunction with curative treatments, whereas hospice is a specialty of palliative care, reserved for the last 6 months of life.[1]

When Kay considered her doctor's recommendations for hospice, she wondered if she would die faster while on hospice care as opposed to pursing aggressive treatments. Using retrospective statistical analysis of 4993 clients, Conner et al.[24] compared the mean survival rate of hospice clients with that of nonhospice clients who had congestive heart failure or colon, lung, pancreatic, prostate, or breast cancer, at similar stages of illness. The mean survival rate of the six diagnoses combined revealed that hospice clients lived an average of 29 days longer than nonhospice clients who pursued curative treatments. In another study, Ternel et al.[109] found that lung cancer clients who received palliative care in the early stages of their disease process lived 2.7 months longer and reported lower rates of depression than lung cancer clients who waited until the end-stages. Researchers speculate that hospice clients may live longer due to avoidance of aggressive, cure-directed interventions that carry a high mortality risk for debilitated clients (eg, high-dose chemotherapy); improved treatment monitoring; increased social support among the multidisciplinary team; and early symptom management, which stabilized the disease process.[24,109]

Based on this current evidence and given the extensiveness of her disease process, Kay will most likely live longer and have a better quality of life with early symptom management and hospice care. Her doctor exemplifies how healthcare providers need to understand the benefits of hospice and palliative care. Knowing about local services, initiating discussions about end-of-life issues, and making timely referrals may promote early symptom management, increase psychosocial support, minimize needless suffering, and support the utmost quality of life in the end of life.

Evidence Base for Occupational Therapy Services

Kay's daughter wanted to support her mother's independence and ability to do things that mattered to her, but her mother was dying. *Is there evidence that OT is effective with someone like her mother?*

Occupational therapists are uniquely qualified to address the critical needs of the terminally ill.[32,61] According to the National Consensus Project for Quality Palliative Care (2009), occupational therapy optimizes function and supports the best quality of life for both client and family within an interdisciplinary team.[87] Occupational therapists support occupational engagement through consideration of environmental, contextual, and personal factors that may limit a client's participation and satisfaction[3] while simultaneously preparing clients and families for death through the relinquishment of occupational roles, closure, and legacy transmission.[9,48,51]

Notwithstanding occupational therapy's unique qualifications for hospice and palliative care, OT remains underused, dependent upon referring providers. Under the Medicare Hospice Benefit, OT services are made available on an as-needed basis to all hospice clients by a physician's order.[17] Outside of hospice care, Medicare does not recognize the term **palliative**.[91] However, with a physician's order, palliative OT services are covered as a home health benefit under the standard Medicare Part B, with a therapy cap per calendar year of $1,920; as an inpatient hospital benefit under Medicare Part A; and under Medicaid and private insurance with variances in reimbursement and copayments.[18,19,92] In the context of constrained funds and insurance reimbursement, occupational therapy is reliant on the referring provider's understanding of OT services and its therapeutic benefits.

Unfortunately, providers often presume that their hospice and palliative care clients do not need OT services. Despite literature showing that clients with incurable diseases desire rehabilitative services to address their unmet occupational engagement needs,[60,104,120] the terminally ill are not seen as "proactive, occupational beings … who engage purposefully in occupations as part of living with a life-threatening illness."[78] Providers often deem OT services unnecessary due to the client's assumed decline.[9,78,104,120] Medicare also narrowly defines OT's role as rehabilitative; that is, to provide adaptive equipment training, home safety assessment, and caregiver instruction for safe body mechanics.[20] Providers may not realize their client's unique occupational needs beyond mere activities of daily living (ADLs) nor understand the range of services occupational therapists can offer beyond equipment training. Occupational therapy is not being used to its fullest capacity to support the needs of people living with chronic and **terminal illness**.

Weakening OT's cause further, there is a paucity of evidence supporting the efficacy of OT in hospice and palliative care. Palliative rehabilitation has been shown to promote function and quality of life in palliative and hospice clients with cancer, congestive heart failure, and respiratory diseases; however, studies have frequently focused on the effect of exercise on function or have not distinguished OT outcomes from those accomplished from the rest of the multidisciplinary team.[54,85,122] There is currently no high-level evidence study that generalizes the value of occupational engagement and the efficacy of OT intervention in the end of life.[62] Some researchers speculate that the limited literature may be due to lack of an accepted and a specific OT outcome measure[82]; the difficulty distinguishing OT-specific outcomes from those achieved by other members of the interdisciplinary palliative care team[34]; and the ethical issues of research as a client's symptoms worsen.[121] Cyclical in nature, lack of evidence results in lack of funding and workforce, further reducing therapeutic efficacy.[44,61]

Like beacons in the dearth of literature, studies by Jacques and Hasselkus,[53] Lala and Kinsella,[72] Lyons et al.,[78] Vrkljian and Miller-Polgar,[116] and Sviden et al.[108] have emerged, highlighting the therapeutic value of occupational engagement for clients living with a life-threatening illness and thus implying the need for OT in hospice and palliative care. Based on qualitative design methods, semistructured interviews, and participant observations, these five studies found that occupational engagement helps develop a sense of normalcy, restoration, health, well-being, and pleasure. Occupational disengagement can lead to loss of control, a sense of helplessness, and disruption of self-identity.[72,116] Adjustment and modification, and/or engagement in new occupations foster a renewed sense of health, efficacy, and meaning.[78,108,116] This research establishes that occupational engagement is essential for health and wellness throughout the life span, regardless of the person's disability, diagnosis, or prognosis. However, further investigation is urgently needed to directly support occupational therapy's role in hospice and palliative care.[61]

Despite the lack of evidence supporting the use of OT in hospice and palliative care, Kay's hospice team had already seen positive OT outcomes with previous clients. The team knows that OT is effective not only for equipment and caregiver training, but also for problem-solving in innovative ways to help people "do what is important." Regardless of Kay's prognosis, her declining function, and ample help, an OT consult was highly appropriate to uphold what Kay found meaningful. Upon receiving a doctor's referral, Tess, an occupational therapist, called Kay to arrange an initial visit.

Role of Occupational Therapy

What would Tess's role be in Kay's care? Similar to other areas of care, hospice and palliative occupational therapy seeks to promote health and well-being through engagement in meaningful occupation, yet distinguish itself with specialized knowledge of the grieving process, dying trajectories, and the terminal phase of life. Integration of these factors into the OT Framework (OTPF-3) shapes the unique role and purpose of occupational therapy in the care of those living with life-threatening disease.

The Grieving Process

Central to working with Kay is understanding how she is responding to the loss of her life. Rando[98] defines two types of **loss**: *physical loss* and *symbolic loss*. Physical loss is tangible, such as Kay's loss of strength and ability to care for herself. Symbolic loss relates to psychosocial significance, such as her consequent loss of independence, self-reliance, and privacy.

Grief is a normal, universal, individualized, and emotional reaction to loss.[69,97] Anticipatory grief can also occur in expectation of eventual loss.[69] Grief responses may be culturally and socially defined and expressed in social, physical, cognitive, spiritual, psychological, and emotional behaviors.[69,99] Expression about loss may be directly articulated ("I am angry that I am dying") or wrapped up in an indirect symbolic language ("I am angry that my wheelchair does not work properly").[70,98] It is essential that Tess identify Kay's losses, both physical and symbolic, and the meaning Kay assigns to these losses, to fully support her **grieving process**.[69,98]

Dr. Elisabeth Kübler-Ross's five stages of grief model remains the best-known and cited theory on the grieving process.[70,106] Although research refutes sequential progression through all stages,[49] Kübler-Ross's five stages (denial, anger, bargaining, depression, and acceptance) provide a framework for clinicians to understand the dynamic process clients and their loved ones may experience through disease progression and dying.

Tess had yet to meet and assess Kay, but she had experience working with clients at different stages of the grieving process. In *denial* of being in the end-stages of heart disease, Paul, one of Tess's clients, vehemently declined OT services because he was "taking care of himself fine." Unfortunately, it took a collapse at home for him to accept that he indeed was ill and needed help. Simona, another client, readily accepted OT services but constantly lashed out in *anger* at Tess for not fully addressing and "fixing" her functional limitations rather than acknowledging that her cancer was progressing. *Bargaining* for more time, Bob followed all of Tess's recommendations with great fervor. Tess had to gently and repeatedly explain that therapy would help make the most of today but would not cure him. Dissimilarly, seeing his situation as futile, Kevin remained tethered by *depression* and refused any of Tess's interventions despite potential for rehabilitative gains. Realizing her disease was progressing, Joan was in *acceptance* that she was dying. She knew OT would not cure her but remained open to Tess's visit to maximize her ability to transfer to a wheelchair so she could sit out on her porch. When Joan transitioned toward the end-stages of the dying process and became unable to get out of bed, she positively reflected on being able to sit out in the sun for a few days and was at peace ending OT services.

Initially, Kay was in denial of her illness. As symptoms began to affect her daily life, she became angry with God that she was sick and would likely not see her great-grandchildren born. Her anger sapped her energy further. She prayed for God to save her, but as she became more ill, she began to accept she was dying. When Tess contacted her, Kay thought she had nothing to gain, but perhaps nothing to lose, working with an occupational therapist. She agreed to meet Tess later that week.

Dying Trajectories

Although there are uncertainties regarding when people will die, there are some evidence-based patterns, or **dying trajectories**, that describe common changes in health status as the client approaches death. Lunney et al.[76] interviewed 4190 terminal U.S. clients and their caregivers and identified four common trajectories of dying: the sudden or unexpected death trajectory; the chronic organ failure trajectory; the dementia/frailty trajectory; and the cancer trajectory. A knowledge of established dying trajectories helps guide and suggest appropriate and timely interventions.

Sudden or *unexpected death* may be due to trauma, cardiac arrest, or a cerebrovascular accident.[45,47] Clinicians are unable to provide treatment for the client at this point; however, bereavement support is still imperative for family and friends. Grief may be complicated by violence, lack of making amends prior to death, or inability to say a final "good-bye." Survivors may have emotional, financial, or psychosocial dependence on the deceased. Caregivers may be lost without their caregiving roles. For these individuals, bereavement support draws upon the multidisciplinary team and may include counseling services, social services, support groups, and training in life skills for role transitions into a new period of their lives.

The *chronic organ failure trajectory* applies to conditions such as heart failure and chronic obstructive pulmonary disease and is characterized by decline with an oscillating, or sine wave, pattern between chronic health and acute exacerbations.[45,86] The span of decline can be 2 to 5 years, with a low health status in the last 6 to 24 months and significant decline in the last 3 months.[45,86,102] With each acute event, the client has a sharp decline and a period of recovery; however, the client typically does not return to his or her previous baseline. Although clients may have gains after medical intervention and return home, the cumulative effect is an overall functional decline. Each acute event also has a risk of death; despite long-term functional decline, death may still seem sudden.[86]

Occupational and physical therapists are often consulted to rehabilitate only to have the client quickly readmitted for another rehabilitation course after a sequential exacerbation. Clients and their families are stressed by being on "a roller coaster of decline and transient improvement."[45] To alleviate unnecessary pain and suffering, it is critical that palliative care be incorporated to educate clients and their families on the complexity of the disease process, initiate discussions about goals of care, and provide reasonable options that support quality of life.[45]

People who do not develop organ failure or cancer often develop dementia or generalized frailty of multiple body systems.[45,86] Less predictable than the cancer trajectory, the *dementia/frailty trajectory* is a progressive decline that begins at a low baseline of cognitive or physical function and may be variable over 6 to 8 years.[86] Dementia is typically characterized by gradual cognitive and functional decline, whereas frailty is defined by weakness, weight loss, fatigue, slowed performance, and low activity.[39] This general decline often leads to inability to recover from trivial illnesses.[39,86] Death may soon follow an acute event, such as a femoral neck fracture, pneumonia, infection, or aspiration.[39,83,86,101] Mitchell et al.[83] found that of 323 nursing home residents with dementia, 40% endured at least one burdensome intervention in the last 3 months of life, such as hospitalization, tube feeding, or parenteral therapy; residents with proxies who understood the resident's poor prognosis and dementia/frailty trajectory were less likely to have burdensome interventions in the last 3 months. Given the lengthy period of decline of these chronic conditions, palliative care is essential to control pain and other negative symptoms; maximize functional status through rehabilitation, wellness programs, and psychosocial support; educate clients and their families on the disease and dying process; and initiate discussions and care planning in order to avoid unnecessary, burdensome interventions at the end of life.[39,83,101]

The *cancer trajectory* is one of the most predictable patterns.[45,86] Many cancer clients may remain quite functional until 5 to 6 months before death.[45] In the last 2 to 3 months, clients begin to experience weight loss, decreased self-care performance, and increased pain management.[45,86] During the rapid decline phase, clients often become bedridden and typically die within a few months to weeks.[38,45,86]

Because the hospice nurse had reported that Kay was still getting up and getting dressed daily and walking household distances, Tess foresaw a meaningful window of time to help Kay develop and work toward personal goals.

The Terminal Phase

With experience in hospice care and self-study, Tess has learned much about the dying process, or the **terminal phase**. Understanding what dying "looks like" is an asset not only to educate and allay the fears of her clients and families, but also to appropriately direct Tess' interventions. Although there is some variation if the client has an acute event or a sudden death, common patterns typify the terminal phase.

During the months before death, the client endures changes caused by disease and prepares for death. In the 6 to 12 months before death, clients may be less active; complain of increased fatigue, weakness and pain; have bowel and bladder problems (incontinence, constipation, or diarrhea); and functionally decline.[50] In anticipation of death, they may begin to withdraw from others, experience a range of emotions, and ponder spiritual and existential concerns.[50] In the last 1 to 3 months, the dying may be less communicative, sleep more, and eat less.[58]

There are many salient changes as clients **transition** and begin to **actively die**. In the final weeks to days they may be less responsive and more disoriented to their surroundings, yet have a surge of energy and be restless.[50] They have minimal to no oral intake, exhibit hemodynamic changes (decreased blood pressure, faster or slower pulse, and tachycardia), and have decreased to no urine output.[47,50,58,84] Clients' extremities may become **mottled** (purplish discoloration of skin) and feel cold to touch.[47,58] They may have hallucinations of deceased relatives and express an urgency to "leave" ("I need to catch the train").[45,50] In the last days to hours, fluid may accumulate in the pharynx, causing a crackling sound in the chest, commonly known as a **death rattle**.[12] Caregivers and family may observe **Cheyne-Stokes breathing**, which is marked by periods of **agonal** breathing (rapid, shallow breaths) separated by **apneic** periods (no breathing) for 1 to 3 minutes.[47] When breathing stops, the heart will cease to beat several minutes later.[47] Death is confirmed upon determination that the heart has stopped; breathing has ceased; and the pupils are dilated and fixed.[84]

As clients progress from the beginning to final stage, regular communication with the hospice team is imperative to help manage physical symptoms, discontinue unnecessary interventions, and address psychosocial needs in order to provide the utmost care for clients and their families.

OTPF-3—Domain

The domain describes the body of knowledge and expertise of occupational therapy. Constructs include occupations, client factors, performance skills, performance patterns, context, and environments. *How does the charged nature of life-threatening illness shape the domain of occupational therapy?*

Occupation

Occupational engagement is critical to a person living with a life-threatening disease.[72,78,116] Regardless of the level of performance, participation in ADLs promotes involvement in life[108] and maximizes physical and mental function.[78] Rest and sleep are essential as "a respite from physical discomfort and psychological stressors."[31] Educational and play occupations encourage social engagement with peers, feed a need to learn, foster discovery of new occupations, build self-esteem and mastery, and promote goal setting.[30,118] Work occupations provide means to make contributions to one's community.[78] Social and leisure occupations foster social support, a sense of belonging, and enjoyment (Fig. 49.1).[78]

FIG 49.1 Participating in ADLs, such as a father walking his daughters to school, helps to keep a client with a life-threatening illness engaged in living.

Research has also identified occupations specific to the end of life. Jacques and Hasselkus[53] found that hospice clients gravitated to activities "that mattered." In the context of dying, the most mundane tasks, such as playing cards or sharing a pie with family, transformed into extraordinary events. Precious time focused on preparing for death by putting one's affairs in order, making amends, and saying good-bye to loved ones. Bye[9] noted that clients often desired closure, such as going home to die. Bye[9] and Hunter[51] both identified the importance of building a legacy through passing on belongings or instilling one's values.

Although the hospice team had requested OT for Kay primarily to help her with self-care tasks, Tess looked forward to speaking with Kay further to inquire about other occupations of interest that she may be capable of performing.

Although the team requested OT for Kay primarily to help her with self-care tasks, Tess looked forward to speaking with Kay further to inquire of other occupations of interest, if able. It is critical clinicians not dismiss opportunities to engage in occupation based on a patient's prognosis nor get locked into occupation only being ADLs. We need to take the time to identify the client's valued occupations; determine whether client factors, performance skills, performance patterns, context, and environment support participation in choice occupations; and see if modification can allow continued engagement.

Client Factors

Client factors are "specific capacities, characteristics, or beliefs that reside within the person and that influence performance in occupation"[4] (OTPF-3, p. S8). The OTPF-3 further breaks down client factors into values, beliefs, spirituality, body structures, and body functions.[4] The disease and dying process can affect each of these constructs.

Values, beliefs, and spirituality.

Values, beliefs, and spirituality collectively connect meaning with our occupational experiences. **Values** are principles that personally define "what is good, right, or important"[4] (OTPF-3, p. S22). **Beliefs** are assumptions about the world, with or without evidence, that shape our values.[4] **Spirituality** is the process of finding meaning in our lived experiences and connection with others.[4,79] When we satisfactorily participate in valued occupations, we experience coherence with our beliefs, validation of our actions, and a sense of purpose in our lives.

Incurable disease may cause angst and struggle with our values, beliefs, and spirituality. Although life-limiting illness may help prioritize "what matters" with regard to remaining time and resources,[53] disease may limit the ability to satisfactorily maintain valued and self-defining roles and occupations.[66] Faced with their mortality, clients may question beliefs, the purpose of life, and the reason for suffering and loss.[79] Clinicians need to determine the client's values, supporting beliefs, and what is meaningful in their lives to help them reframe perceptions, accommodate illness, and experience self-worth in the face of decline and functional loss.

Kay highly valued self-sufficiency. As a child, she was frequently sick and unable to help out with household duties like her siblings. Her mother often called her "a weak child." Although she regained full health in her adolescence, she continued to see herself as "weak" and overcompensated with self-reliance. Now, unable to fully care for herself, she felt worthless and a burden to her children. Countering these self-labels, however, is Kay's belief that God knows her and has a plan for "good" in her life. Can Tess help Kay draw upon her spiritual beliefs to help her find purpose, meaning, and inherent value despite functional dependence on her children?

Body structures and body functions.

Hospice and palliative care address an array of illnesses. Although cancer was the prevalent disease seen in hospice care in the 1970s, diagnoses other than cancer now make up 63.5% of the hospice admitting diagnoses, and cancer diagnoses account for 36.5%.[92] The top four noncancer diagnoses include dementia (15.2%), heart disease (13.4%), lung disease (9.9%), and unspecified debility (5.4%).[92] Smaller yet salient groups include stroke, kidney disease, liver disease, non-ALS motor neuron disorder, and human immunodeficiency virus infection/acquired immunodeficiency syndrome (HIV/AIDS).[92] Among **chronic illnesses**, the Centers for Disease Control and Prevention

(CDC) lists heart disease, cancer, chronic lower respiratory diseases, stroke, Alzheimer's disease, diabetes, and kidney disease as the leading causes of U.S. deaths, with heart disease and cancer comprising 48% of all deaths.[15,16] With such a range of illness in hospice and palliative care, this chapter is unable to address the full array of pathologic issues; however, four general guidelines may help the clinician consider how incurable illness affects body structures and function and, consequently, occupational engagement.

1. **Learn the pathology of the client's primary diagnosis.** Find out which structures are affected and how the disease compromises body function. Be aware of how the disease and symptoms change with disease progression. Consider how these changes will affect occupational engagement. In Kay's situation, pancreatic cancer will affect the function of the pancreas, which produces digestive enzymes and hormones to control blood glucose levels.[55] Pancreatic cancer is often undetected at early stages because there are no screening tests and symptoms are vague or nonexistent.[2,55] As the tumor grows, symptoms become more apparent. A tumor in the head of the pancreas may obstruct the bile duct, backing up bile into the liver and bloodstream and causing jaundice in the skin and eyes, darkened urine, and light-colored stools.[55] The tumor may block the digestive system, causing nausea and vomiting.[55] With continued growth, it may push against surrounding organs, resulting in abdominal pain and distention.[55] As cancer cells rob nutrients from normal cells in the advanced stages of the disease, the client will experience weakness, fatigue, and weight loss (cachexia).[2,55] Each sequential stage will pose increasing difficulties for Kay because digestive problems, pain, distention, and fatigue will progressively limit her function (see Chapter 45 for more details).

2. **Account for a secondary diagnosis or premorbid conditions.** These factors may complicate the primary disease process and have an exponential effect on body structures and function. Kay had a history of chronic obstructive pulmonary disease (COPD) and experienced dyspnea with moderate exertion. As her pancreatic cancer progresses, the abdominal pressure may cause shortness of breath and anxiety. Tess will need to address both her COPD and her cancer symptoms in treatment (see Chapter 44 for more details).

3. **See the body systems as integrated.** Impairment of one body structure can affect multiple body systems. Pancreatic cancer can spread into the lymphatic system, impairing drainage of lymph in the surrounding areas. Severe edema may develop in the abdomen and lower extremities, causing pain, immobility, and poor skin integrity.

4. **Be aware of the mind-body connection.** Clinicians need to consider the psychological implications of disease in order to holistically care for clients. At the early stages of her disease, Kay was dyspneic with moderate exertion. Although her symptoms were more related to her COPD at the time, she assumed her breathlessness was due to her growing tumor pushing onto her diaphragm. Kay would spiral into anxiety, feeling that she was about to suffocate and die. The context of living with a life-limiting illness may heighten emotional reactions and existential pain.[45] Somatic pains that seem excessive or not congruent with the identified organic pathology may be of psychogenic origins.[21] Also, physical changes to body structures due to surgical intervention (eg, amputation, mastectomy, or facial surgery) or disease progression may result in an altered body image, greatly affecting self-esteem, emotional well-being, spirituality, socialization, intimacy, sexuality, and function in daily activities.[105] The psychological impact of life-limiting disease can significantly affect occupational engagement.

Working with Kay, Tess will need to be aware of how cancer and COPD will affect multiple body functions and systems along the disease trajectory. With such knowledge, Tess will effectively address Kay's limitations and support her occupational engagement through the dying process.

Performance Skills and Patterns

Our values draw us to what we feel is important. To engage in these valued occupations, we rely on body structures and functions to support performance skills.[4] With practice and continued use of performance skills, we become proficient, develop habits, and blend habits into performance patterns.[4,64] These performance patterns structure our daily lives, define our roles in society, and provide purpose.[64]

Incurable disease can impair body functions and structures and limit performance skills. Loss of performance skills disrupts habits, dissolves routines, and collapses one's ability to uphold defining roles.[4,64] Although palliative medical interventions may stabilize symptoms and OT may help provide a window of improved functional performance, people with incurable illness continue to face decline. Inability to fulfill roles may rob a client of his or her self-identity, invalidate social membership, and erode the sense of self-worth.[64] A social death occurs long before the biologic death.[59]

When addressing performance skills and performance, consider what are the client's defining roles, habits, and routines.

- How has disease disrupted or limited these factors?
- Can these roles be modified or adapted to allow continued participation?
- Can the client's expectations of role requirements be reframed?
- Can the client participate in a role without performing a skill?
- Can new occupational roles be introduced and tried?
- Can the client be affirmed of inherent value, regardless of current role performance (Fig. 49.2)?

FIG 49.2 Illness can impact a client's ability to perform defining tasks, such as baking for the family.

Environments and Contexts

As Tess walked up the path to Liz's single-story home, she noted no steps or barriers to the front door. As a home hospice OT, Tess valued being able to visit Kay in her home environment. The OTPF-3 states that occupational engagement takes place "within the physical and social environment situated within context"[4] (OTPF-3, p. S8). Context describes the variety of interrelated conditions surrounding the client that are influential on occupational engagement, yet "less tangible than the physical and social environments"[4] (OTPF-3, pp. S8, S27). When working with clients with progressive disease and declining performance, OT practitioners may find that the environment and context are the only factors that can be modified and addressed to maximize occupational engagement.

Physical environment.

As disease affects performance, the *physical environment* may limit occupational engagement and compromise safety for both client and caregiver in the home, school, workplace, community, recreational facilities, and places of worship. Depending on the client's prognosis and available resources, remodeling may not be an option; however, providing durable medical equipment (eg, a wheelchair, ramps, shower chair, or raised toilet seat), rearranging furniture, moving items to more accessible locations, or installing additional supports (eg, grab bars, handrails, or bedrails) may enable partial or full engagement in choice occupations, increase safety, and decrease the burden on the caregiver.[82]

Tess looked forward to assessing whether she could help make Kay's environment more accessible. Because Kay had just moved in with Liz, perhaps she would need help building a personal and functional space to safely, efficiently, and privately access belongings and attend to her self-care. Tess's experience had taught her that simple changes could make a significant impact, such as clearing hallways to allow passage of a four-wheeled walker, raising the height of a favorite chair with a cushion for greater ease with standing, and moving a bed so that the client could turn to a less painful side while getting up. Other times Tess had used more involved interventions, such as setting up a tilt-in-space recliner wheelchair to enable a client confined to her bed to get outside or training another client to drive a scooter to attend a grandchild's baseball game at the far end of the park. Knowing that decline is inevitable with terminal illness, Tess continuously looks for ways to modify the environment to maximize occupational engagement.

Social environment.

The social environment is a critical and an essential source of support for the chronically and terminally ill. The *context of death and dying*, however, may hinder positive interaction between the client and the social environment. Family and friends may unintentionally isolate a loved one by avoiding conversations about dying and death.[26] Clients and caregivers may feel shunned by the lack of medical and social services for those with life-limiting illness in our cure-centric healthcare system. As the client physically declines, the caregiver's needs will increase, causing further stress and strain on the social environment. Bye[9] found that in the end of life, OTs' work with caregivers influenced OT outcomes more than did addressing the client's functional status. Clinicians may need to educate family, friends, and caregivers on positive communication strategies; the dying and grieving process; and available social and healthcare resources in the local area. To ease the burden of care, clinicians can train caregivers in safe body mechanics, the use of equipment, and techniques to enable occupational engagement.[82] To develop the client's locus of control, clinicians can coach clients in how to direct their own care.[9,25,97]

Kay's family seemed to be well connected with community and medical services, but it was less clear to Tess how they were coping with Kay's decline and impending death. Were they able to speak freely about their feelings, fears, grief, and concerns? Did engrained family dynamics support or isolate Kay? Tess recalled working with another client, Joe, and his family on new ways to communicate. As Joe's dementia progressed, his family struggled to visit because he repeated himself multiple times in the same conversation. Tess coached Joe's children on facilitating life review conversations, helping Joe to recall new details about the past. Tess also drew upon Joe's love of cooking by asking about family recipes and then working with him to make a dish with plenty of leftovers on Fridays. When his children visited on Saturdays, Joe would proudly serve them a meal. As they ate together, Joe and his children would talk about how Joe made the dish, reflect on their favorite dishes, and build new experiences together.

In addition to the context of death and dying, the *temporal context* in the social environment may complicate the grieving process. Chronic and terminal illness can occur at any stage of life. When expected temporal experiences are missed due to illness, there may be a great sense of loss. Parents of disabled children may repeatedly mourn each developmental milestone missed as their child ages.[6] The death of a child may trigger profound anguish over an unfulfilled life.[98] We are grieved by the deaths of a young mother of two toddlers, the 63-year-old who had only one year before retiring, the high school senior expecting to leave for college in the fall, and the 80-year-old hoping to hold her first great-grandchild. We expect people to be able to experience their lives fully and meet their personal goals (Fig. 49.3). Clinicians need to be mindful of the temporal contexts of people's lives; understand how illness is interrupting the presumed life plan; support the client and family through an ongoing grieving process; frame the value of one's life; assist in setting realistic new goals; and help clients leave a legacy by which to be remembered.[30,51,97]

FIG 49.3 High school graduation, as shown here, is an example of a temporal experience that can be disrupted by illness.

How would Tess be able to help Kay reconcile how cancer was disrupting her life plan? Could Tess help Kay build a legacy to leave for her great-grandchildren through which they could come to know their great-grandmother?

Although death, dying, and the temporal context may complicate living with life-threatening illness, the *virtual context* may support and enhance occupational engagement. Encapsulating interactions that are simulated, real-time, or near-time situations with no physical contact,[4] the virtual context may enable the client with limited accessibility to connect globally through texting, email, social media, video conferencing, and cell phones. The hospitalized client may be able to build a virtual shared space for social engagement and a sense of being at home while away from home.[103] One of Tess's OT colleagues had taught a client to use video calling to maintain his relationship with his grandchildren living out of state when he was no longer able to travel. Such interaction supported ongoing participation in his valued role as grandfather, hundreds of miles away.

Despite decline and loss of functional performance, the client may experience continued occupational engagement through attention to and modification of physical and social environments. Giving special consideration to the death and dying, temporal, and virtual contexts may help support the client and family through the grieving process, sustain participation in valued roles, and develop a new, virtual space in which to connect with others.

OTPF-3—Process

In the context of the grieving and dying process, providing hospice and palliative OT services involves evaluation, intervention, and targeting intervention outcomes to support occupational engagement throughout the life span.[3,4]

When Tess knocked on the front door of Liz's house, she heard shuffling steps approach the door. The deadbolt clicked, the doorknob turned, and Tess looked up to see Kay peering from behind the door. "Hi, I'm Tess … Mrs. Shimada?" Kay replied, "It's Kay. Come in."

Evaluation

The evaluation process seeks to find out what are the client's goals, needs, and functional baseline, in addition to supports and barriers to occupational engagement.[4] Through preparation, evaluation, and analysis, the OT develops an occupational profile and determines appropriate interventions.[4]

After the OT receives a consultation to evaluate and treat, *preparation* for the evaluation process begins with gathering data from a chart review, staff and caregiver reports, and clinical observation.[97] In addition to areas that may affect occupational engagement, special attention is given to the grieving and dying processes. Information may need to be verified by the client and/or family; however, preparation may prevent redundant questions, conserve the client's energy, build a foundation for an occupational profile, and provide segues for therapeutic interaction (Table 49.1).

TABLE 49.1

Preparation Guide for an OT Evaluation

Area of Concern	Subtopics	Sources of Information	Questions
Medical history	• Primary diagnosis (Dx) • Symptoms • Secondary Dx • Comorbidities • Prior medical issues • Mental health status	Physician, nursing, and mental health services notes Staff and family reports	• What were the events leading up to admission for the primary Dx? • How long since the initial Dx? • How is the client coping/grieving? • Do comorbidities complicate treatment (Tx)? • How do/will medical issues affect occupational engagement?
Medical orders	• Precautions • Contact isolation • Advance directive	Medical orders Physician, nursing notes	• Are there orders that should be in place that are not (eg, total hip precautions)? • Review advance directive. • Will precautions affect Tx?
Social history	• Age • Marital status • Work history • Education • Cultural background	Physician, nursing, social work, and mental health services notes Staff and family reports	• Do these client factors support or limit occupational engagement?
Areas of occupation	• Values • Leisure interests • Roles • Routines • Performance • Goals	Physician, nursing, social work, mental health services, physical therapy, or previous occupational therapy (OT) notes Staff and family reports Observation	• What is the client's previous level of occupational engagement/performance? • How much assistance was needed? • Any discharge needs? • Any end-of-life goals and wishes?
Environmental contexts	• Physical environment • Social environment	Home health services, physical therapy, social work, nursing, mental health services, and physician notes Staff and family reports	• See Discharge Planning Checklists (Table 49.3)

Building on the preparation process, *evaluation* begins by identifying the client's needs and goals and developing an occupational profile. The evaluation process may vary, depending on the client's physical, emotional, and cognitive stamina (Table 49.2). A palliative care client in the early stages of the disease process may have a relatively high activity tolerance and occupational performance capacity, despite living with a life-threatening disease. A more formal assessment may be indicated to determine more progressive interventions. For a hospice client with poor activity tolerance, a formal assessment process may be invasive and burdensome.[9,82,97] In a qualitative study of hospice occupational therapists, Bye[9] found that clinicians often used a "low-keyed" approach of observation and interview with the client, staff, and caregivers rather than exhausting clients with a formal assessment. Although administering an incomplete assessment may compromise validity and reliability, subsets of assessments may also address the client's particular need while accommodating the client's limited endurance.[5] For example, using only the grooming portion of the Functional Independence Measure (FIM),[40,63] rather than completing all areas of self-care, may provide evaluative data and conserve the client's energy to complete the single goal of brushing the teeth that day.

TABLE 49.2

Evaluation Strategies for the OTPF-3 Domains

Domains	Evaluation Strategies
Occupation	
ADLs IADLs Rest/Sleep Education Work Play Leisure Social Participation	• Chart review, interview, family reports • Focus on areas pertinent to client's goals and interests • Administer assessments only if data support client's goals; client is willing; and client has the emotional, cognitive, and physical stamina to participate. • Possible occupation-based assessments: • Occupational Circumstances Assessment Interview and Rating Scale (OCAIRS) (client report)[36] • Canadian Occupational Performance Measure (COPM) (client report)[74] • Functional Independence Measure (FIM) (subtests as indicated)[40,63]
Client Factors	
Values, Beliefs, Spirituality Body Functions Body Structures	• Chart review, interview, and family reports • Observation • OCAIRS[a] (values, beliefs, and spirituality) • Only assess body structures and functions that support client's goals and interests. For example, instead of doing comprehensive manual muscle testing, assess just hip and knee flexors and extensors to determine if at least grossly 3+/5 and safe to attempt functional transfer.
Performance Skills	
Motor Process Social Interaction	• Observation • FIM[a] (subtests as indicated) • OCAIRS[a] (client report) • COPM[a] (client report)
Performance Patterns	
Habits Routines Rituals Roles	• Chart review, interview, staff and family report • OCAIRS[a] (habits, routines, roles)
Context and Environments	
Cultural	• Chart review, interview, staff and family report

Personal Physical Social Temporal Virtual	• If client will be going home, see Table 49.3 (Discharge Planning Checklists) • OCAIRS[a]

[a]Administer assessments only if data support the client's goals, and the client is willing and has the emotional, cognitive, and physical stamina to participate.

ADLs, Activities of daily living; *IADLs*, instrumental activities of daily living.

Given the challenges of assessing people with life-threatening illness, are there accepted assessments for hospice and palliative care occupational therapy? Currently, there are no established hospice and palliative care OT outcome measures or assessment tools.[46,82] However, two occupation-based measures may be appropriate for use with hospice and palliative care clients: the Occupational Circumstances Assessment Interview and Rating Scale (OCAIRS)[36] and the Canadian Occupational Performance Measure (COPM).[74]

The OCAIRS is primarily a descriptive assessment of occupational engagement. Based on the Model of Human Occupation (MOHO),[65] the OCAIRS addresses all the domain areas of the OTPF-3 by evaluating volitional, habitual, and performance components in physical and social contexts. This 20- to 30-minute, standardized, semistructured interview is portable and flexible enough to accommodate the client's level of endurance. The OCAIRS has adequate reliability[42,43,57] and excellent to adequate validity.[8,71,117] The brief, MOHO-based interview format may enable the clinician to determine the client's goals and assess multiple domains quickly without excessively burdening the client. There are no studies on the use of the OCAIRS in hospice and palliative care. However, an unpublished quality improvement study found the OCAIRS an effective assessment tool for developing a rich narrative with hospice clients.[22]

Based on Canadian Model of Occupational Performance–Engagement (CMOP-E),[10] the Canadian Occupational Performance Measure (COPM)[74] is an extensively researched assessment tool with excellent reliability[27,95] and excellent validity.[11,13,29,81,100] This portable, 15- to 30-minute, semistructured interview is primarily an evaluation assessment that organizes occupational engagement under self-care, productivity, and leisure categories, with an emphasis on occupation performance.[74] The client identifies occupational performance issues and self-rates performance and satisfaction on a Likert scale.[74] The COPM was shown to be problematic for the terminally ill because the focus on occupational performance was psychologically distressing for clients confronting functional decline and disease progression.[94] However, as a client-centered and individualized measure with excellent psychometric strength, the COPM may be a good alternative to measures with preset performance levels[82] and appropriate for higher functioning palliative care clients.[94]

The OCAIRS and COPM are two possible hospice and palliative OT assessments. Both are brief, semistructured interviews that can accommodate low endurance. The OCAIRS accounts well for volitional and environmental components, which may be the only modifiable factors as the client loses functional performance.[9,97] Although better suited to higher functioning clients, the COPM offers excellent psychometric strength and clinical utility. Further research is needed to validate the appropriateness of the OCAIRS and COPM in hospice and palliative occupational therapy.

The evaluation process requires the clinician to assess the client's stamina and apply clinical reasoning to ascertain the appropriate approaches and assessment tools to use. After drawing from numerous sources, the clinician integrates and *analyzes* evaluation findings. Based on identified supports and limitations of occupational engagement, the clinician prepares to develop a treatment plan and implement intervention.

Kay's evaluation.

As Tess followed Kay into the living room, she observed Kay occasionally skimming the wall with her hand and leaning on the console *(movement function/gait pattern)* before sitting down on the couch *(motor skill–functional transfer)*. Kay pointed to the seat across from her for Tess. Liz came in, introduced herself, and asked if she could join the conversation. Tess said it would be fine with her if it were all right with Kay. Kay nodded in agreement.

Kay asked right away with a smile *(social interaction skills)*, “Are you here to give me a job?” Tess explained that her job was to help Kay be able to “do” what she felt was important, or her occupations. Although Kay's cancer will cause decline, Tess would try to help modify and accommodate everyday tasks, routines, and activities as much as possible. The reason for Tess's first visit is to get to know Kay better and define her goals and needs.

With Kay's permission, Tess initiated the OCAIRS interview. Folding questions from the OCAIRS into a casual conversation, Tess was able to find out that Kay's current *roles* are being a mother, grandmother, and friend. She enjoyed traveling, cooking, and going to church *(interests),* but her *routines* have slowly changed due to her fatigue, abdominal pain, and occasional shortness of breath *(body structures/function).* Kay used to attend different events three times a week for church or to meet friends but has attended church only twice in the last month *(routine, performance skills).* Although she is still able to get to the toilet independently, she needs minimal assistance from her daughters for bathing and dressing.

When asked what she *values* most, Kay replied God, her family, and being independent. Liz added that her mother worked hard to send all four kids to college and taught them to be self-sufficient. Kay said she is most proud of *(personal causation)* her children and grandchildren, adding, "They are all good people who get along with each other. I can't ask for more." She reflected that her life had been tough at times, but she felt that "God made me a better person through it all *(spirituality).*" Tess asked how she got through tough times in the past *(interpretation of past experiences).* Kay explained her *belief* that God had a purpose for her and her kids, which kept her going *(spirituality)*. Tess asked how she was doing getting through this challenging time. Kay paused and said, "I regret not being able to see my great-granddaughter, expected in 6 months, but I have to believe that God is somehow using me now *(grieving–acceptance, spirituality).*" Kay added, however, that she feels like a burden on her children and grandchildren because they are all taking turns from their jobs and schoolwork to help her out *(social environment, belief).* Liz tried to reassure Kay that she was not a burden, but Kay just looked down.

Tess then asked Kay, "If there were two things that you could do with greater ease, what would they be *(goals)*?" Kay looked up and said without hesitation, "Getting dressed and taking a shower by myself without being so tired." Tess asked if doing things differently or making changes was difficult for her *(readiness for change).* Kay said, "Sometimes. Especially if it means that things will never be the same."

Kay began to fatigue from the interview *(motor skill-endurance).* To allow her to rest, Tess asked her if it would be okay for Liz to show her Kay's bedroom, the bathroom, and places she likes to spend time *(physical environment).* Kay agreed and remained in the living room. While Liz showed Tess the main living areas and Kay's bedroom and bathroom, she mentioned that Kay was "still getting around, but is getting weaker." Tess asked Liz how she was doing. Liz replied that her mom's illness had been so sudden, and the whole family was struggling with watching their feisty mother and grandmother wither. "She's the glue of our family. I don't know what I'm going to do without her. My sister thinks she should get more chemo and go to rehab *(grieving–denial vs. bargaining),* but I know that's not going to help her *(grieving–acceptance)*." Tess listened intently and then remarked on how Liz and her family seemed to be working well together. Liz laughed, "What do you mean? We don't agree on things." Tess replied, "Maybe, but you talk with each other. Many families don't." Liz paused. "I guess we do," she said.

Tess and Liz returned to the living room to find Kay asleep on the couch *(motor skill–endurance)*. Not wanting to tire Kay further, Tess asked Liz if she could come back the next morning to discuss possible ways to make it safer for Kay to do her self-care and get around the house. Liz readily agreed.

Although Tess would have liked to spend more time with her client, Kay was obviously too fatigued. However, based on her OCAIRS and home assessment findings, Tess was able to determine Kay's goals, which were to be as independent as possible in dressing and bathing. Kay is limited by fatigue, abdominal pain, and shortness of breath, but she continues to have fair motor strength, fair to good balance, resilience, and strong social support. Perhaps with additional equipment, modification of her routine, and the use of energy conservation principles (also referred to as fatigue management), Kay might be able to become more independent with her self-care and get out into the community for a bit longer. Tess also thought about that great-grandchild coming and wondered if Kay would want to somehow share a part of herself with the baby.

Intervention

Using analysis of the evaluation data, the clinician collaborates with the client to develop a plan, implements intervention, and continually reevaluates treatment effectiveness.[4] Like the evaluation process, intervention remains focused on the client's goals and considers the changing needs of the dying and grieving process. The context of dying shapes the selection of occupations and interventions.

The **intervention plan** is the map to care. Taking the client's goals, the clinician translates them into treatment goals. In hospice and palliative care, the client's goal may not be realistic (eg, “I want to get better”). The clinician may have to dig deeper to understand if there are other ways to feel “better,” such as participating in a beloved hobby or spending time with family. The clinician and client collaborate to develop the optimal plan and desired outcomes.

Another frequently mentioned goal is “to return home.” In the context of dying, the wish to return home may be even stronger. Similar to other areas of care, clinicians need to access the physical and social environments and determine if discharge home is feasible and safe. Table 49.3 presents discharge planning checklists.

TABLE 49.3

Discharge Planning Checklists

Physical Environment Checklist	
Entrances	• Accessible entrances? (Primary and secondary entrances) • Door wide enough for wheelchair or scooter? • Accommodation for turning radius? • Ramp or railing needed? • Access to driveway or car drop off? • Will client be able to safely access home at current level of function and expected level of function? Will ambulance/gurney services be needed at discharge?
Bathroom	• Accessible entrance with room for turning radius? • Tub/shower accessible? Modifications needed? • Shower chair, grab bars, and shower hose? • Bedside commode, raised toilet seat or toilet frame needed? • Is it possible to provide safe care in this area at client's current and expected level of function?
Bedroom	• Accessible entrance with room for turning radius? • Clear pathways and access to belongings? • Bed: • Height too high/low for transfers? • Bed rail needed? • Hospital bed needed? • Room for hospital bed? • Bedside commode needed? Space available? • Room for mechanical lift if needed? • Is it possible to provide safe care in this area at client's current and expected level of function?
Living space, outdoor areas, community areas	• Accessible entrance/area for wheelchair or walker? • Accessible sitting areas? • Modifications needed to enable occupational engagement?
Caregiver's area	• Living space for caregiver that allows for sleep, self-care, respite, and privacy?
Social Environment Checklist	
Caregiver stamina	• Does the caregiver have the emotional, spiritual, and physical stamina to provide the care needed? • What are the caregiver's coping strategies? • Does the caregiver have a support system? • Are there multiple caregivers to allow for respite?
Caregiver education and training	• Knowledgeable about: • Dying and grieving process? • Proper body mechanics? • Caregiver techniques? • Use of equipment (eg, lift, hospital bed)? • Community supports?
Dying and death context	• Does the client feel supported or isolated? • Does the client have support to speak about dying and death?

Tess discussed with Kay her goals of dressing and bathing with less assistance. Kay was open to working with Tess on changing her routine and trying out adaptive equipment. Tess used Goal Attainment Scaling (GAS)[67] to develop treatment goals and to later serve as an outcome measure of treatment efficacy. GAS (Table 49.4) was initially developed for mental health services. It is based on the premise that goals are best defined by the client's challenges[52]; it provides a means to detect meaningful change relevant to clients and their families that may be difficult to capture on standardized measures[37,80,112]; and it can be administered in a time-effective manner.[37] Goals are rated on a 5-point scale, ranging from −2 to +2; −2 is a “much less than expected” outcome, 0 is an “expected” outcome, and +2 is a “much more than expected” outcome.[67,80] Preintervention and postintervention scores can be converted to a standardized score to show outcome changes.[112] Tables are available for easy conversion of outcome scores to T-scores.[68] There is insufficient evidence to determine test-retest reliability.[33,52] Concurrent validity is fair to poor.[33,52] Congruent validity is fair.[52] Despite its low to moderate psychometric strength, GAS is still widely used based on its clinical utility[33] and provides an individualized, client-centered outcome measure when standardized tests are not available.[80] (Box 49.1 presents Kay's GAS goals.)

TABLE 49.4

Goal Attainment Scaling (GAS)

Rating	Level Description
−2	Much less than expected outcome
−1	Somewhat less than expected outcome
0	Expected outcome
+1	Somewhat more than expected outcome

+2	Much more than expected outcome

From Kiresuk T, Sherman R: Goal Attainment Scaling: a general method of evaluating comprehensive mental health programmes, *Community Ment Health J* 4:443–453, 1968; and Mailloux Z, et al: The issue is—Goal Attainment Scaling as a measure of meaningful outcomes for children with sensory integration disorders, *Am J Occup Ther* 61:254–259, 2007.

Box 49.1

Kay's Treatment Goals

Goal 1: Using energy conservation principles and adaptive equipment, Kay will be able to complete her bathing routine independently.

−2: Kay will be able to complete her bathing routine with min A.

−1: Kay will be able to complete her bathing routine with CGA.

0: Kay will be able to complete her bathing routine with SBA/set up.

+1: Kay will be able to complete her bathing routine with set up.

+2: Kay will be able to complete her bathing routine with modified I.

Today's score: −2

Goal 2: Using energy conservation principles and adaptive equipment, Kay will be able to dress herself independently.

−2: Kay will be able to dress herself with min A.

−1: Kay will be able to dress herself with CGA.

0: Kay will be able to dress herself with SBA/set up

+1: Kay will be able to dress herself with set up.

+2: Kay will be able to dress herself with modified I.

Today's score: −2

Cumulative raw score for 2 goals: −4

Standardized score: +25

min A, Minimal assistance; *CGA,* contact guard assist; *SBA,* stand-by assist; *modified I,* modified independence.

When the intervention plan has been established, **intervention implementation** begins. Interventions used in hospice and palliative care include pain and symptom control,[3,46,82] occupational modification,[3,60,82] and training of both the client and caregiver.[9,97] (Table 49.5 presents symptom control strategies, and Table 49.6 lists examples of interventions.) Although these interventions seem similar to those used in other areas of care, qualitative studies of hospice OTs have found that the OT practitioners uniquely balance maximizing occupational engagement for today with preparing clients for death through occupations that promote closure during the intervention process.[9,46,53]

TABLE 49.5

Symptom Control Strategies[a]

Symptoms	Control Strategies
Pain, dyspnea, anxiety	• Work with team on use and timing of medications with daily routines. • Understand source of symptoms (physical, psychological, or both). • Identify triggers of symptoms. • Identify any positions that exacerbate symptoms.

	• Provide means for better positioning and body mechanics that reduce symptoms. • *Dyspnea:* Side-lying sleeping; avoid compressing abdominal/chest area. • *Pain:* Good body mechanics with daily tasks. • *Anxiety:* Note posturing that may cause muscle tension. • Assess and address quality of sleep and sleep hygiene. • Relaxation techniques • Stress management • Mindfulness training • Adaptive breathing techniques (eg, pursed-lipped breathing) • Make referrals as indicated to other disciplines (eg, massage and physical therapies, psychology, chaplain, social work).
Nausea, vomiting	• Identify triggers. • Work with team (speech and physical therapy, nursing) on positioning to avoid dysphagia. • Coach on positioning that reduces symptoms while performing daily tasks. • Relaxation techniques • Mindfulness training
Fatigue	• Identify and address psychological stressors that may exacerbate fatigue. • Assess and address sleep hygiene. • Analyze daily tasks; coach on simplifying and/or modifying tasks. • Instruct in energy conservation principles (ie, pacing, prioritizing, delegating, sitting with tasks).

[a]For additional resources and information, please refer to Chapter 7 (Teaching Activities in Occupational Therapy), section 2 (Therapeutic Use of Self: Embodying Mindfulness in OT); Chapter 13 (Sleep and Rest); Chapter 27 (Eating and Swallowing); Chapter 28 (Evaluation and Pain Management); Chapter 33 (Cerebrovascular Accident [Stroke]), Chapter 38 (Arthritis); Chapter 41 (Low Back Pain); and Chapter 44 (Cardiac and Pulmonary Diseases).

From Cooper J: Occupation therapy approach in symptom control. In Cooper J, editor: *Occupational therapy in oncology and palliative care,* ed 2, West Sussex, England, 2006, Whurr Publishers, pp 27–39; Miller J, Cooper J: The contribution of occupational therapy to palliative medicine. In Hanks G, et al, editors: *Oxford textbook of palliative medicine,* New York, 2011, Oxford University Press, pp 206–213; and Thompson B: Mindfulness-based stress reduction for people with chronic conditions, *Br J Occup Ther* 72:405–410, 2009.

TABLE 49.6

Examples of Interventions

Types of Interventions	Examples
Occupations	• Completes a morning routine with adaptive equipment. • Prepares own breakfast using energy conservation principles. • Does grocery shopping with use of a scooter. • Writes a legacy letter expressing hopes, dreams, and values to children. • Makes amends with estranged sibling. • Gives possessions away to desired loved ones. • Sits outside on porch to have a cup of coffee with a friend.
Activities	• Practices getting into and out of shower using grab bar. • Develops a list of affairs that need to be attended to. • Decides whom to give belongings to. • Participates in life review about raising children.
Preparatory methods	• Floats heels off pillow to prevent skin breakdown. • Provides retrograde massage to reduce upper extremity (UE) edema. • Provides a shower chair and shower hose. • Determines appropriate wheelchair and seat positioning. • Recommends installation of equipment (eg, grab bars, ramp, lift). • Provides long-handled equipment for dressing and bathing tasks.
Preparatory tasks	• Hand-strengthening program with putty or exercise hand ball • UE range of motion (ROM) program • Practices how to ask caregiver for help. • Practices how to do pursed-lipped breathing to control shortness of breath (SOB).
Education	• Caregiver instruction in ROM, edema control, positioning, and body mechanics • Instruction in use of adaptive equipment with bathing and dressing • Instruction in use of energy conservation strategies • Instruction in use of power wheelchair
Training	• Caregiver training in ROM, edema control, and positioning • Caregiver training in use of mechanical lift and body mechanics • Caregiver training in how to fold up wheelchair and stow it in car • Training in use of power chair • Training in manual wheelchair mobility • Training in pursed-lipped breathing to reduce SOB with ADLs
Advocacy	• Therapist advocates for client's interests in team meeting. • Therapist explains to family that client does not want to continue with aggressive rehabilitation anymore.
Self-advocacy	• Client directs own care. • Client makes a request for palliative treatments.
Groups	• Day hospice program • Group to discover new occupations, such as drawing or computer use • Legacy writing group • Support group

For additional resources and intervention strategies, please refer to Chapter 10 (Activities of Daily Living [ADLs]); Chapter 11 (Mobility), section 1 (Functional Ambulation) and section 2 (Wheelchair Assessment and Transfers); Chapter 13 (Sleep and Rest); Chapter 16 (Leisure Occupations); Chapter 17 (Assistive Technology); Chapter 33 (Cerebrovascular Accident [Stroke]), Chapter 38 (Arthritis); Chapter 41 (Low Back Pain); and Chapter 44 (Cardiac and Pulmonary Diseases).

To help Kay increase her safety and independence in bathing, Tess suggested equipment for the bathroom, such as grab bars, a shower chair, and a nonskid mat. Kay practiced transferring into and out of the shower using the shower chair. Liz said she would have someone install the grab bars at the shower entrance, in the stall, and by the toilet. Kay felt that she would be more stable getting in and out by herself with the grab bars, but reassured Tess that she would have her daughters stand by. To reduce Kay's fatigue, Tess instructed her in energy conservation principles, coaching Kay on pacing, prioritizing tasks, sitting with activity, and using long-handled equipment. They discussed situations and thoughts that might trigger Kay's dyspnea and practiced pursed-lipped breathing and mindfulness techniques to help her center herself. Tess gave Kay permission to not take a shower every day and to delegate other tasks so she could focus on what was important to her. She also showed Kay how to utilize a four-wheeled walker not only for stability, but to carry her things and allow her to take a break on the walker seat. At first Kay seemed hesitant, but when Tess mentioned she would probably be more independent with the walker, she decided to try it.

Although it was not specifically a part of Kay's treatment plan, Tess integrated a *therapeutic use of self-strategy* in order to connect with Kay and bring out Kay's previous occupational roles. At the end of one session, Tess noticed a picture of Kay's children by her bedside and commented, “I have two kids I'm raising on my own. Any parental advice?”[111]

Kay paused. “I never thought I'd have to raise four kids by myself,” she said.

Tess asked, “How did you do it?”

“Forgiveness,” Kay replied softly.

“Forgiveness?”

“I wasted a lot of energy being angry at my ex-husband. When I hit a wall, I realized I needed to make a change for the better. I had to choose to forgive him and not wait until I felt like I could forgive. When I finally did, a big weight lifted, and I was freed up to live my life and be there for my kids.”

“Did he ask for forgiveness?” Tess asked.

“Are you kidding? Of course not … have you ever tried oregano tea?

Surprised by the sudden change of subject, Tess replied, “No, never heard of it.”

“My neighbor told me it's a good household remedy for a nagging cough. I thought it was the strangest idea. But once, when I couldn't get over my cold, I decided to steep some. Terribly bitter, but surprisingly soothing. Sometimes you have to try something totally different for a change for the better.”[a]

Kay smiled, and Tess suddenly realized that their roles had been reversed. Kay was the OT for the day. Although weak and tired, in that moment, Kay was the strong, vibrant, self-reliant mother teaching Tess.

Tess returned the next week. Kay was able to bathe herself after Liz set things up. With Kay using the grab bars and sitting while she completed her bathing routine, Liz felt more comfortable leaving for periods of time and providing Kay privacy. By implementing the energy conservation suggestions of pacing, putting out her clothes the day before, carrying things with the four-wheeled walker, sitting down, and using long-handled equipment, Kay was able to get dressed with modified independence and without shortness of breath. She had a brighter affect than the previous week and seemed pleased with her progress.

At the end of the session, Tess did an **intervention review** of Kay's treatment plan (Box 49.2). Kay had made great progress over the past week. Although her progress may be momentary, it was evident that having more independence and privacy was priceless to Kay.

Box 49.2

Review of Kay's Treatment Goals

Goal 1: Using energy conservation principles and adaptive equipment, Kay will be able to complete her bathing routine independently.

−2: Kay will be able to complete her bathing routine with min A.

−1: Kay will be able to complete her bathing routine with CGA.

0: Kay will be able to complete her bathing routine with SBA/set up.

+1: Kay will be able to complete her bathing routine with set up.

+2: Kay will be able to complete her bathing routine with modified I.

Baseline's score: −2

Highest score achieved to date: +1

Goal 2: Using energy conservation principles and adaptive equipment, Kay will be able to dress herself independently.

−2: Kay will be able to dress herself with min A.

−1: Kay will be able to dress herself with CGA.

0: Kay will be able to dress herself with SBA/set up.

+1: Kay will be able to dress herself with set up.

+2: Kay will be able to dress herself with modified I.

Baseline score: −2

Highest score achieved to date: +2

Cumulative baseline raw score for 2 goals: −4

Cumulative raw score after second session: +3

Baseline standardized score: 25

Second session standardized score: 69

Outcome change: +44

min A, Minimal assistance; *CGA,* contact guard assist; *SBA,* stand-by assist; *modified I,* modified independence.

With Kay meeting her goals, Tess considered discharging her, but then asked her if she would like to work on a legacy project—creating something that would enable her family to remember her and the things she valued. Kay was a bit taken aback. Tess asked, “With your great-granddaughter coming, would you like to leave her a message or tell her something about yourself? Or your children and grandchildren?” Tess went on, “Recently, I read about people writing letters to their children, sometimes just a couple of sentences, expressing their feelings and hopes for their future.” Kay said, “My parents never ‘talked.’ I guess they just assumed that as long as I was fed, I knew they cared for me.” Tess asked, “Did you ever wish that they had said, ‘I love you?’” Kay paused. Tess broke the silence. “How about writing a couple of letters to your family?” she asked.

Tess and Kay worked out a goal for the next 3 weeks (Box 49.3). Kay did not know if she would have the time and energy to write everyone a letter, so she decided to write a letter to each of her children first. Then, if she were able, she would write one letter to all her grandchildren and one letter to her great-grandchild. Over the next couple of weeks, Tess gave Kay prompts, such as, “How would you describe your son?” or “What do you admire most about your daughter?” to help her put her thoughts into words. By the end of 3 weeks, Kay had completed her letters and put them in a large envelope to be opened after she passed away.

Box 49.3

Kay's Revised Treatment Goals

Goal: Kay will write legacy letters to her family.

−2: Kay will decide whom she will write letters to.

−1: Kay will finish writing 1 or 2 letters.

0: Kay will finish writing 3 or 4 letters.

+1: Kay will finish letters to her children and 1 letter to her grandchildren.

+2: Kay will write letters to her children, grandchildren, and great-grandchild.

Baseline score: −2

Highest score achieved to date: +2

Baseline standardized score: 30

Three-week reevaluation score: 70

Change in outcome score: +40

min A, Minimal assistance; *CGA,* contact guard assist; *SBA,* stand-by assist; *modified I,* modified independence.

Upon completion of her letters, Kay felt that she had met her goals. She continued to dress and bathe relatively independently and expressed feeling at peace. Tess also thought that there were no other OT issues to address at the moment, but she urged Kay and her family to ask for OT again "when things change." Tess then discharged Kay from OT services.

About 1 month after Tess had discharged Kay, she received another consultation to train the family in body mechanics with caregiving. Tess knew that Kay was declining quickly and that it would be a few weeks to perhaps a month before Kay would pass away. She worked with designated family members who would be providing care and ordered additional equipment, such as a bedside commode, so Kay could toilet with assistance bedside instead of using diapers. She also ordered a wheelchair with a pressure-relieving cushion so that Kay could be taken outside. Kay was sleeping a lot more, but when Tess visited, she awoke, smiled, and asked Tess how her daughters were doing.

Tess subsequently made one more visit to check in with the family, to see if the equipment was sufficient and to offer support. The family was able to safely provide care for Kay without cueing. Because the family's goals had been met with positive outcomes (Box 49.4) and there were no other OT issues, Tess again discharged Kay from OT services.

Box 49.4

Family Goals

Goal: Family will safely and independently assist Kay with care.

−2: Family will verbalize understanding of good body mechanics.

−1: Family will demonstrate good body mechanics with 3 or 4 verbal cues during care.

0: Family will demonstrate good body mechanics with 1 or 2 verbal cues during care.

+1: Family will demonstrate good body mechanics with 1 verbal cue during care.

+2: Family will demonstrate good body mechanics with no cueing during care.

Baseline score: −2

Highest score after 2 sessions: +2

Baseline standardized score: 30

Standardized score after 2 sessions: 70

Change in outcome scores: +40

Targeting Intervention Outcomes

Outcomes determine whether OT intervention is effective. Important questions are:

- What are the recommended OT outcome measures in hospice and palliative care?
- What constructs do we measure with a population living with a life-threatening illness?
- How do we determine if our intervention has been effective with clients who are declining?

There is currently no accepted hospice and palliative care outcome measure that distinguishes OT-specific outcomes.[34,46,82] However, to accommodate the probable functional decline of hospice and palliative care clients, the literature suggests using reliable, valid, and individualized measures rather than one with preset performance levels on a traditional standardized measure.[73,82,112] Such client-centered measures may be more sensitive to subtle changes and more effective in capturing personal and meaningful outcomes.[112] For example, upon admission, a hospice client confined to bed with severe pain and inability to tolerate transfer to a wheelchair would be rated on the Functional Independent Measure (FIM) scale as 1, or dependent. The client's goal may be just to be able to tolerate being lifted into a chair and escorted outside. On the GAS, the client tolerating a lift transfer and getting outside may progress three levels, from −2 (much less than expected outcome) to 0 (expected outcome). Although the client would accomplish a major personal goal, the FIM is not sensitive enough to show this progress because the performance level for functional transfers remains 1 (dependent).

In the previously mentioned example, the GAS is measuring occupational engagement, whereas the FIM is measuring performance. This raises the question of what constructs we should measure to capture positive outcomes with clients who are functionally declining. With Kay, Tess measured occupational performance changes resulting from adaptations and modifications. **Occupational performance** (or functional performance) is often used in healthcare to determine efficacy[34]; however, with life-limiting disease, a focus on occupational performance does not accommodate functional decline and may cause emotional distress over limited functional improvement as the client's disease progresses.[34,94] As Kay became more debilitated, using an occupational performance outcome measure would be less ineffective. **Occupational engagement** outcomes strike a balance; change in participation in meaningful occupations is detected without focusing on performance outcomes. Occupational engagement is the involvement and interaction in a life situation[4] and does not necessarily require occupational performance.[123]

The purpose of hospice and palliative care is commonly said to be to increase **quality of life** (QOL). With medical advances, people are living longer but with chronic and incurable diseases.[32] Longevity cannot be assumed to correlate with wellness; consequently, the concept of quality of life arose to determine if treatments improve life rather than just prolonging it.[75] Quality of life shifts the focus on functional performance to the value of life and is conceptually aligned with the philosophies of occupational therapy.[75,96] However, the use of QOL as an outcome measure can be problematic with terminally ill clients because there is no universal definition of QOL; outcomes can be affected by subjective experience; and it may be impossible to ascertain QOL outcomes due to OT intervention versus the cumulative team effect.[34,75,96]

Environmental factors are not specifically cited in the literature as a hospice outcome measure; however, the environment can affect OT outcomes and must be addressed in hospice care.[9,97] In the end-stages of life, attention and modification of the environment may lessen the burden of functional problems, may affect OT outcomes more than functional status, and may be the only elements that can be varied as the client's status declines.[9,82,97] The context of dying can transform mundane occupations to highly significant life moments,[53] whereas cultural and personal contexts may conjure up taboos, fears, and inhibitions that isolate the client.[26] Focus on the physical environment may maximize a client's engagement in occupations and the caregiver's ability to provide safe and effective care.[9,97] Focus on the social environment can facilitate social engagement, enhance social support, connect the client and family to essential community and medical resources, and help facilitate closure in the end of life.[9,26,53,82,97]

Overall there is no consensus on what constructs we should measure with hospice and palliative care clients to capture positive OT outcomes. Selection of constructs relies on the clinician's clinical reasoning to discern outcomes appropriate to the client's status and stage in the dying process and whether chosen constructs will effectively distinguish OT outcomes from other disciplinary interventions.

In the end, a reliable and valid client-centered measure that has an appropriately chosen construct may determine whether OT intervention has been effective. Clinicians can use client-centered measures (eg, GAS and COPM) if they are conducive to the selected construct. For Kay, Tess was able to quantifiably capture Kay's improved occupational engagement and her family's occupational performance in caregiving with GAS. Further research, however, is needed to validate whether these measures effectively and accurately capture OT outcomes in hospice and palliative care.

The role of hospice and palliative occupational therapy is to promote occupational engagement throughout the lifespan. The clinician integrates knowledge of the dying and grieving process into the OTPF-3 domain and process to meet the unique needs of people living with life-threatening illness. While focused on the client's goals, the clinician draws upon clinical reasoning to adjust and accommodate evaluation, intervention, and selection of outcomes to the changing needs of the dying process. *This method serves the needs of the client, but how do clinicians take care of themselves to sustain ongoing quality care?*

Clinician Self-Care

Within 2 weeks of her last visit, Tess got a call from the case manager, who said that Kay had died peacefully with all her children at her bedside. People often asked Tess how she could work in hospice and palliative care, with constant loss, death, and sadness. Hospice and palliative care clinicians are at high risk of burnout, given the stress of working with dying clients and being constantly confronted with their own mortality.[115] Other contributing factors may include high workloads, lack of financial compensation, or lack of administrative support of palliative care programs.[41,115] To cope and sustain quality care, **clinician self-care** is essential. Research has found that setting strong work-home boundaries; spending time with loved ones; focusing on the satisfying aspects of one's job; maintaining self-awareness and good physical care; practicing a daily spiritual or meditative routine; having a personal philosophy about illness and death; and knowing one's role in life may provide healthy coping strategies and decrease the risk of burn-out.[41,115] For Tess, after that call, she took a moment to remember Kay's glow when she was able to “do what was important” and the privilege of working with such a vibrant person. How could she not do this job?

Summary

Regardless of the diagnosis or prognosis, people with a life-threatening illness need opportunities and support for occupational engagement to experience normalcy, purpose, well-being, and connectedness into the end of life. The hospice team appropriately consulted occupational therapy to enable Kay to “do what is important” within her limited life expectancy. Although Kay had ample help, attending to her own self-care was critical to her values and self-identity of self-sufficiency. With modifications, compensatory strategies, and adaptive equipment, Tess helped Kay maximize her occupational engagement in self-care for a finite but meaningful period of time. Tess also helped Kay remain active in her role as mother and grandmother, sharing words of wisdom in letters to her family and in her interactions with Tess. As Kay declined, Tess continued to work with her family and provided additional equipment, modifying Kay's environment to support her occupational engagement through the dying process. Using a client-centered outcome measure, Tess was able to quantifiably determine positive OT outcomes of occupational engagement until the end of life. However, seeing the sense of satisfaction on Kay's face truly confirmed to Tess that treatment was effective and worthwhile.

Epilogue

A month after Kay's death, Tess received a card from Liz. “I know you worked with Mom on writing letters to us all,” Liz wrote. “Per her wishes, I opened up mine the night she died. Mom wrote, ‘You have become what I always wanted to be. I love you.’ She had never told me that before … Thank you. The enclosed letter is for you from Mom.”

Tess slowly opened the letter and chuckled as she read, “Drink a cup of oregano tea. Thank you for everything. Kay”

Review Questions

1. How are hospice and palliative care interconnected yet differentiated?
2. What are five therapeutic benefits of occupational engagement for a person living with a life-threatening illness?
3. What are common grief reactions we may see in clients, families, and ourselves?
4. Identify four dying trajectories.
5. What occupations has research identified as common in the end of life?
6. How can the loss of role engagement affect quality of life, and how can roles be modified and adapted to sustain participation despite disease and decline?
7. If disease limits a client's occupational performance of a valued task, how can this limitation affect the client's self-esteem, and how can the OT validate the client beyond performance?
8. How can the OT help a client mourn loss if illness interrupts his or her life plan, and how can the OT help someone set new, meaningful, and realistic goals?
9. How does the context of incurable disease and dying affect the domain areas of OT?
10. How can the evaluation process accommodate a declining and dying client?
11. How can the intervention process foster occupational engagement in declining and dying clients?
12. Identify three possible hospice and palliative OT outcome measures.
13. Identify five coping strategies for preventing burnout.

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[a]The author does not endorse the use of oregano tea and recommends consulting one's healthcare provider to inquire whether it is appropriate for personal use.

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