Received: 9 February 2020 | Revised: 15 May 2020 | Accepted: 16 May 2020

DOI: 10.1002/msc.1492

CLINICAL UPDATE

WILEY

A clinical practice guideline for physical therapy in patients with hip or knee osteoarthritis

Mitchell C.M. van Doormaal[1] | **Guus A. Meerhoff**[1,2] | **Thea P.M. Vliet Vlieland**[3] | **Wilfred F. Peter**[3,5]

[1]Royal Dutch Society for Physical Therapy (KNGF), Amersfoort, The Netherlands

[2]Radboud Institute for Health Sciences, IQ healthcare, Radboud University Medical Center, Nijmegen, The Netherlands

[3]Department of Orthopaedics, Leiden University Medical Center (LUMC), Leiden, The Netherlands

[5]Amsterdam Rehabilitation Research Center, Amsterdam, The Netherlands

Correspondence
Mitchell C. M. van Doormaal, Royal Dutch Society for Physical Therapy (KNGF), Stadsring 159B, Amersfoort 3817 BA, The Netherlands.
Email: m.vandoormaal@kngf.nl

Funding information
Royal Dutch Society for Physical Therapy (KNGF)

Abstract

Objective: The purpose of this paper is to revise the 2010 Dutch guideline for physical therapy (PT) in patients with hip or knee osteoarthritis (OA), issued by the Royal Dutch Society for Physical Therapy (KNGF).

Method: This revised guideline was developed according to the Appraisal of Guidelines for Research and Evaluation (AGREE) and Guidelines International Network (G-I-N) standards. A multidisciplinary guideline panel formulated clinical questions based on perceived barriers to current care. A narrative or systematic literature review was undertaken in response to each clinical question. The panel formulated recommendations based on evidence and additional considerations, as described in the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) Evidence-to-Decision framework.

Results: A comprehensive assessment should be based on the International Classification of Functioning Disability and Health (ICF) core set for OA, including the identification of OA-related red flags. Based on the assessment, four treatment profiles were distinguished: (1) education and instructions for unsupervised exercises, (2) education and short-term supervised exercise therapy, (3) education and longer term supervised exercise therapy, and (4) education and exercise therapy before and/or after total hip or knee surgery. Education included individualized information, advice, instructions, and self-management support. Exercise programs were tailored to individual OA-related issues, were adequately dosed, and were in line with public health recommendations for physical activity. Recommended measurement instruments included the Patient-Specific Complaints Instrument, the Numeric Pain Rating Scale, the Hip Disability and Osteoarthritis Outcome Score/the Knee Injury Osteoarthritis Outcome Score, and the Six Minute Walk Test.

Conclusion: An evidence-based PT guideline for the management of patients with hip or knee OA was developed. To improve quality of care for these patients, an extensive implementation strategy is necessary.

KEYWORDS

clinical practice guideline, exercise therapy, hip osteoarthritis, knee osteoarthritis, physical therapy, total hip arthroplasty, total knee arthroplasty

1 | INTRODUCTION

Osteoarthritis (OA) is the most common disorder of the musculoskeletal system, with hip and knee joints being among the most frequent localizations (Hunter & Bierma-Zeinstra, 2019). In 2010, of 291 conditions, hip and knee OAs were ranked as the 11th highest contributors to global disability in the Global Burden of Disease Study (Cross et al., 2014). The prevalence of OA is expected to rise in the future because of demographic developments and the increase in the occurrence of (serious) obesity and joint injuries (Cross et al., 2014; Hunter & Bierma-Zeinstra, 2019).

Primary care physical therapy (PT) is one of the cornerstones for the conservative management of hip or knee OA (Fernandes et al., 2013; Hochberg et al., 2012; McAlindon et al., 2014). The clinical effect of PT on pain and disability in hip or knee OA is substantial (Fransen et al., 2015; Fransen, McConnell, Hernandez-Molina, & Reichenbach, 2014), while its associated costs are low. In the Netherlands, costs related to primary care for hip or knee OA constitute 6% of the total costs for this condition (National Institute for Public Health and the Environment, 2017). Given its beneficial effects, PT has been advocated in multiple national and international guidelines and in recommendations for the management of hip or knee OA (Fernandes et al., 2013; Hochberg et al., 2012; McAlindon et al., 2014; National Health Care Institute, 2014; Peter et al., 2011).

A prerequisite for effective PT in hip or knee OA is appropriate delivery. Clinical practice guidelines (CPGs) can help to improve and sustain the quality of PT care. Since 1998, CPGs have been developed and implemented by the Royal Dutch Society for Physical Therapy (KNGF) (Hendriks et al., 2000). In 2016, the KNGF used a new methodology to develop their CPGs (Royal Dutch Society for Physical Therapy, 2019; Van der Wees & Irrgang, 2014) based on the AGREE II statement (Brouwers et al., 2010), the Guidelines International Network (G-I-N) standards (Qaseem et al., 2012), and the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) methodology (Guyatt et al., 2008) and emphasized the importance of multidisciplinary collaboration in the developmental process. The most recent update of the KNGF guideline for hip or knee OA was undertaken in 2010 (Peter et al., 2011). The evidence base for PT in patients with OA has expanded, and new insights into the optimization of its delivery have emerged; therefore, a revision of the KNGF guideline was deemed necessary. Moreover, more detailed practical recommendations were required concerning the actual delivery of exercise therapy and concerning physical therapeutic interventions before and after total hip or knee arthroplasties. The purpose of this paper is to describe the development of the revised KNGF guideline for hip or knee OA and the resulting recommendations on physical therapeutic assessment and treatment.

2 | METHOD FOR GUIDELINE DEVELOPMENT

The revision of the 2008 guideline was undertaken using the guideline methodology developed by the KNGF (Royal Dutch Society for Physical Therapy, 2019; Van der Wees & Irrgang, 2014). The methodology consisted of the following phases: (1) preparation, (2) development, (3) review and authorization, and (4) dissemination and implementation. This paper focuses on the first three phases, which were undertaken from June 2016 to March 2018.

2.1 | Phase 1: Preparation

Between June and September 2016, three groups were formed: an author group, a guideline panel, and a review panel. The author group consisted of guideline experts and policy advisors with expertise in the methodological field and with research experience, a postdoctoral researcher and a professor in the field of PT and OA. Both the guideline and the review panels composed of physical therapists with clinical and research experience concerning OA, patient representatives, and other stakeholders (e.g., general practitioners and orthopedic surgeons; see Appendix A for all stakeholders). An independent expert on the topic of OA was appointed as chair of both the guideline and the review panels.

The barriers to assessment, treatment, and evaluation of patients with OA were identified using focus groups comprised physical therapists (n = 19) and patients (n = 10) and during the first meetings of the guideline and the review panels. The guideline panel subsequently identified barriers that were then prioritized and translated into clinical questions (Appendix B).

2.2 | Phase 2: Development

The development process was based on the principles of evidence-based medicine through a description of the best available evidence combined with clinical expertise and patient preferences (Sackett, Rosenberg, Gray, Haynes, & Richardson, 1996). For this purpose, the clinical questions were first adapted to form research questions, which were subsequently answered by means of systematic literature reviews for questions regarding therapeutic interventions and narrative literature reviews for all other questions.

Regarding therapeutic interventions, a systematic literature search of the PubMed, Embase, Web of Science, Cochrane Library, Central, EMCARE, and CINAHL databases was conducted on December 19, 2016, for questions concerning exercise therapy and on August 14, 2017, for questions concerning nonexercise therapy (Appendix C). This study included randomized controlled trials (RCTs) involving adults diagnosed with OA according to the American College of Rheumatology classification criteria (Altman et al., 1991, 1986) that described the posttreatment effect of the intervention of interest compared with the usual care. All outcomes of interest were defined in advance by the guideline panel and rated as critical (in terms of physical functioning) or important (in terms of pain and quality of life), based on their importance for decision making. The evidence was synthesized through providing estimates of the effects and the quality of the evidence for each outcome. The methods described by the

TABLE 1 Recommendations for exercise therapy and nonexercise therapeutic interventions

Clinical question 1

Is exercise therapy recommended for people with hip osteoarthritis (OA)?

Conclusions from the literature study

- Directly after the intervention, exercise therapy has a moderate effect on physical functioning in people with hip OA, compared with no exercise therapy (SMD, 0.32; 95% CI, 0.13–0.52). The quality of the evidence is moderate.
- Six months after the intervention, there is a small effect (SMD, 0.28; 95% CI, 0.10–0.45). The quality of the evidence is high.

Evidence-to-Decision

Based on the likelihood of the effects, the limited side effects, the demonstrated cost-effectiveness, and a high acceptability of exercise therapy, the guideline panel is of the opinion that the intervention can be strongly recommended.

Recommendation

Offer exercise therapy to all patients with hip OA in the conservative treatment phase, and make use of the frequency, intensity, time, and type (FITT) principles.

Clinical question 2

Is exercise therapy recommended for people with knee OA?

Conclusion from the literature study[a]

- Directly after the intervention, exercise therapy has a moderate effect on physical functioning in people with knee OA, compared with no exercise therapy (SMD, 0.54; 95% CI, 0.36–0.72). The quality of the evidence is moderate.
- Six months after the intervention, there is a moderate effect (SMD, 0.30; 95% CI, 0.13–0.47). The quality of the evidence is high.

Evidence-to-Decision

Based on the likelihood of the effects, the limited side effects, the demonstrated cost-effectiveness, and a high acceptability of exercise therapy, the guideline panel is of the opinion that the intervention can be strongly recommended.

Recommendation

Offer exercise therapy to all patients with OA of the knee in the conservative treatment phase, and make use of the FITT principles.

Clinical question 3

Is exercise therapy recommended prior to joint replacement surgery for hip OA?

Conclusion from the literature study

Preoperative exercise therapy has a moderate effect on physical functioning in people after a total hip replacement, compared with no preoperative exercise therapy (SMD, 0.32; 95% CI, 0.06–0.57). The quality of the evidence is moderate.

Evidence-to-Decision

Based on the reasonable likelihood of the effects, the limited side effects, and the likely acceptability of exercise therapy, the guideline panel is of the opinion that the intervention can be considered for specific patients.

Recommendation

- Consider offering exercise therapy in the preoperative phase if the patient has an increased risk of delayed recovery following OA-related hip joint replacement. Make use of the FITT principles.
- Consider limiting exercise therapy in the preoperative phase, teaching the patient exercises that he/she can independently perform, and monitoring how the exercises are performed if the risk of delayed postoperative recovery is not increased. Teach all patients to use a walking aid that will be needed in the postoperative phase.

Clinical question 4

Is exercise therapy recommended prior to joint replacement surgery for knee OA?

Conclusion from the literature study

Preoperative exercise therapy has a moderate effect on physical functioning in people after a total knee replacement, compared with no preoperative exercise therapy (SMD, 0.4; 95% CI, 0.09–0.62). The quality of the evidence is low.

Evidence-to-Decision

Based on the reasonable likelihood of the effects, the limited side effects, and the likely acceptability of exercise therapy, the guideline panel is of the opinion that the intervention can be considered for specific patients.

Recommendation

- Consider offering exercise therapy in the preoperative phase if the patient has an increased risk of delayed recovery following OA-related knee joint replacement. Make use of the FITT principles.
- Consider limiting exercise therapy in the preoperative phase to teaching the patient exercises that he/she can independently perform and monitor how the exercises are performed if the risk of delayed postoperative recovery is not increased. Teach all patients to use a walking aid that will be needed in the postoperative phase.

Clinical question 5

Is exercise therapy recommended after joint replacement surgery for hip OA?

Conclusion from the literature study

Postoperative exercise therapy has a moderate effect on physical functioning in people after a total hip replacement, compared with no preoperative exercise therapy (SMD, 0.37; 95% CI, 0.17–0.56). The quality of the evidence is high.

Evidence-to-Decision

Based on the high probability of the effects, the limited side-effects, and the likely acceptability of exercise therapy, the guideline panel is of the opinion that a weak recommendation can be given in favor of the intervention.

Recommendation

- Preferably offer exercise therapy in the postoperative phase following OA-related hip joint replacement if the patient has an increased risk of delayed recovery and/or if complications occur. Make use of the FITT principles.

(Continues)

TABLE 1 (Continued)

- Consider limiting exercise therapy in the postoperative phase to teaching the patient exercises that he/she can independently perform and monitor how the exercises are performed, if the risk of delayed postoperative recovery is not elevated and there are no postoperative complications.

Clinical question 6

Is exercise therapy recommended after joint replacement surgery for knee OA?

Conclusion from the literature study

Postoperative exercise therapy has a minor effect on physical functioning in people after a total knee replacement, compared with no preoperative exercise therapy (SMD, 0.18; 95% CI, 0.03–0.33). The quality of the evidence is high.

Evidence-to-Decision

Based on the high probability of the minor effects, the limited side effects, and the likely acceptability of exercise therapy, the guideline panel is of the opinion that the intervention can be considered for specific patients.

Recommendation

- Consider exercise therapy in the postoperative phase following OA-related knee joint replacement if the patient has an increased risk of delayed recovery and/or if complications occur. Make use of the FITT principles.
- Consider limiting exercise therapy in the postoperative phase to teaching (and monitoring the execution of) exercises that the patient can independently perform, if the risk of delayed postoperative recovery is not increased and there are no postoperative complications.

Clinical question 7

Are the following nonexercise therapeutic interventions recommended for people with hip or knee OA: continuous passive motion (CPM; after joint replacement surgery), pulsed electromagnetic field therapy, low-level laser therapy, massage, passive mobilizations, shock wave therapy, taping, TENS, thermotherapy, and ultrasound therapy?

Conclusion from the literature study

- Massage therapy has a small effect on the physical functioning of people with knee OA, compared with no massage therapy. The quality of the evidence is very low. Massage therapy also appears to have an effect on pain. The effect of massage therapy on people with hip OA is unknown.
- TENS treatment has no effect on the physical functioning of patients with knee OA compared with no treatment using TENS. The quality of the evidence is very low. However, TENS treatment does appear to have an effect on pain in patients with knee OA. The effect of TENS treatment for patients with hip OA is unknown.
- There are small effects, no effects, or unknown effects of CPM (after joint replacement surgery), pulsed electromagnetic field therapy, LLLT, passive mobilizations, shock wave, taping, thermotherapy, and ultrasound in patients with hip or knee OA, compared with no nonexercise therapeutic intervention. The quality of the evidence (where available) is low to very low.

Evidence-to-Decision

- Based on the large uncertainty concerning the effect, the duration of massage therapy that was examined (30–60 min) and the expected negligible added value of the intervention compared with standard care (i.e., exercise therapy and education/advice) and the value that some patients may attach to this intervention and the potential effect on pain (thereby possibly supporting the exercise therapy), the *guideline panel* is of the opinion that the intervention should be conditionally discouraged for patients with hip or knee OA.
- Based on the large uncertainty concerning the effect and the expected negligible added value of TENS therapy compared with standard care (i.e., exercise therapy and education/advice) and the potential effect on pain (thereby possibly supporting exercise therapy), the guideline panel is of the opinion that the intervention should be conditionally discouraged for patients with hip or knee OA. In addition, the *guideline panel* is of the opinion that TENS therapy should only be considered as a brief intervention to support exercise therapy, if exercise therapy is being hampered due to severe pain symptoms.
- Based on the large uncertainty concerning the effect and the expected negligible added value of CPM (after total joint replacement surgery), pulsed electromagnetic field therapy, LLLT, passive mobilizations, shock wave therapy, taping, thermotherapy, and ultrasound therapy compared with standard care (i.e., exercise therapy and education/advice), the guideline panel is of the opinion that these interventions should be strongly discouraged for patients with hip or knee OA.

Recommendation

- It is not recommended to offer massage therapy to patients with hip or knee OA.
- Preferably do not offer treatment with TENS therapy to patients with hip or knee OA. Consider the use of TENS only as a brief intervention for pain reduction to support exercise therapy if exercise therapy is being hampered due to severe pain symptoms.
- Do not offer CPM (after total joint replacement surgery), pulsed electromagnetic field therapy, LLLT, passive mobilizations, shock wave therapy, taping, thermotherapy, or ultrasound therapy to patients with hip or knee OA.

[a]Analysis was restricted to studies of sufficient size and good quality to prevent downgrading because of low quality studies.

Abbreviations: CI, confidence interval; CPM, continuous passive motion; FITT principles, frequency, intensity, type of exercises, and time duration; LLLT, low-level laser therapy; SMD, standard mean difference; TENS, transcutaneous electrical nerve stimulation.

GRADE group were used to assess the quality of the evidence (Guyatt et al., 2008). The quality of the evidence was classified as high, in the case of RCTs, and was downgraded to moderate, low, or very low, based on the risk of bias (assessed in accordance with the Cochrane risk of bias tool) (Higgins et al., 2011), inconsistency of results (studies showing clinical or statistical heterogeneity), indirectness of the evidence (the study population differed from the target population of our guideline), imprecision (a low number of studies or included patients, e.g., <300 patients or events), and publication bias.

When it was not possible to answer a clinical question using a systematic literature review (e.g., because of a lack of suitability for a systematic literature review or due to an absence of literature), the question was answered through a search of landmark papers,

textbooks, and existing sets of guidelines, recommendations, or clinical protocols, as suggested by the experts.

In four face-to-face meetings of the guideline panel and in one face-to-face and three digital meetings of the review group over an 18-month period, the results of the (systematic/narrative) literature reviews were presented. For therapeutic interventions, the recommendations were formulated based on the GRADE Evidence-to-Decision framework (Alonso-Coello et al., 2016), including a discussion on the balance between benefits and harms, the quality of the evidence, the values and preferences of patients and clinicians, and feasibility, equity, and acceptability of the recommendations. Discussions were structured using an Evidence-to-Decision form (Appendix D), leading to strong or conditional recommendations in favor of or against the intervention or to a neutral recommendation (Alonso-Coello et al., 2016).

2.3 | Phase 3: Review and authorization

The recommendations and underlying descriptions formed the basis of a draft guideline, which was externally reviewed by seven physical therapists and 14 stakeholder organizations participating in the guideline or review panels (Appendix A). Based on their comments, revisions were made to the draft guideline, which then resulted in the final document. All participating stakeholders were then requested to authorize this final version of the guideline (Royal Dutch Society for Physical Therapy, 2018a; Royal Dutch Society for Physical Therapy, 2018b).

3 | RESULTS

The main recommendations for assessment and treatment resulting from the guideline development process are summarized in Table 1. These recommendations and a summary of additional recommendations and underlying descriptions, as included in the guideline, are presented below.

3.1 | Assessment

A narrative literature search was conducted regarding the comprehensive assessment of patients with hip or knee OA. This assessment is performed using history taking including the identification of red and yellow flags, physical examination, and the application of measurement instruments and analysis. A treatment profile is then selected that best suits the patient's health status, needs, and preferences. The recommended content of the assessment was based on the International Classification of Functioning Disability and Health (ICF) core set for OA (Bossmann, Kirchberger, Glaessel, Stucki, & Cieza, 2011) and included aspects most relevant specifically for people with hip or knee OA, in the following areas: body structures and function, activities, participation, environmental factors, and personal factors.

3.1.1 | History taking

The guideline panel concluded that, aside from a comprehensive inventory of the patient's health status and the effects of the disease on a patient's life, based on the ICF core set for OA (Bossmann et al., 2011), it is important to determine the course of the condition, previous and current medical and nonmedical assessments, and/or treatment. History taking provides a physical therapist with a wider understanding of the presence of comorbidity and other factors influencing the course of disability in OA. Relevant history taking questions are presented in Table 2.

3.1.2 | Red flags

Aside from general red flags, a number of OA-specific clinical signs and symptoms can indicate severe pathology. Based on expert opinion, the guideline panel formulated a list of specific red flags for patients with OA or after total joint replacement because of OA (Table 3).

3.1.3 | Physical examination

The guideline panel concluded that, similar to history taking, physical examination should be based on the ICF core set for OA. Relevant points of attention during the physical examination are presented in Table 4. These include the use of clinical classification criteria for hip or knee OA to determine a clinical diagnosis of OA (Table 5) (Altman et al., 1991, 1986).

3.1.4 | Measurement instruments

Based on the ICF core set for OA, a limited number of corresponding measurement instruments for initial assessment and subsequent evaluation were selected, conditional on their reliability, validity, and feasibility. The recommended measurement instruments selected were a Numeric Rating Scale for pain (Salaffi, Stancati, Silvestri, Ciapetti, & Grassi, 2004), the Patient-Specific Complaints Instrument (Horn et al., 2012), the Hip Disability and Osteoarthritis Outcome Score activities of daily living (ADL) subscale (De Groot et al., 2007), the Knee Injury Osteoarthritis Outcome Score ADL subscale (De Groot, Favejee, Reijman, Verhaar, & Terwee, 2008), and/or the Six Minute Walk Test (Kennedy, Stratford, Wessel, Gollish, & Penney, 2005) (Figure 1). It is recommended that both a questionnaire and a performance test be used to evaluate physical functioning.

3.1.5 | Treatment profiles

A literature research was conducted regarding specific indications for PT in patients with hip or knee OA. In the absence of literature to

TABLE 2 Relevant questions for history taking

Central
• What is the patient's request for help? • What are the patient's expectations regarding therapy? • What are the patient's expectations concerning the course of the symptoms?
Functional and anatomical characteristics
• Does the patient complain of intermittent or constant pain, pain on exertion, or night and/or rest pain? • Where is the pain located, and how long has the patient experienced this pain? • Is the patient suffering from (severe) pain and swelling at rest? (potential red flag) • Was the pain onset sudden? (potential red flag for joint replacement surgery) • Does the patient feel pain in the calf when raising the foot? (potential red flag for patients who have recently had knee joint replacement surgery) • Does the patient experience morning stiffness in the affected joint and/or start-up joint stiffness? If so, for how long? • Are the movements of the hip and/or knee restricted, and if so, in which direction? • Does the patient have reduced muscle strength in the legs? If so, with which activities? (risk factor for occurrence and course) • Does the patient have a fever? (specific red flag for joint replacement surgery) • Is wound healing progressing favorably and without complications? (point of interest in the case of joint replacement surgery) • Was the onset of symptoms sudden or gradual? • Does the knee appear to be swollen? (local/diffuse; left/right comparison) (potential red flag, depending on severity and in combination with an increased skin temperature) • Is there an increased skin temperature? (potential red flag, depending on severity and combination with swelling) • In terms of hip joint problems, has the patient observed any groin swelling? (potential red flag) • Has the mobility of the joint changed?
Functional and anatomical characteristics
• Does the patient experience a sensation of “giving way” or instability? • Does the joint exhibit an abnormal position? (potential risk factor for occurrence) • Is there any history of surgery or trauma? (potential risk factor for occurrence) • Is the patient overweight/obese? (height/weight; a high BMI is a risk factor for occurrence and course) • Does the patient have any congenital abnormalities of the hip? (potential risk factor for occurrence) • Concerning the knee joint, does the patient experience locking symptoms? (potential red flag) • Are there any symptoms in other joints? (potential risk factor for occurrence and potential predictor of course) • Is the patient experiencing any sensory and/or motor loss of function? (potential nerve damage as a complication of joint replacement surgery)
Activities
• Does the patient experience limitations when performing the following activities: walking indoors and outdoors, walking up and down stairs, sitting down and getting up, bending, standing (for long periods), sitting (for long periods), getting (un)dressed, washing, lifting, using the toilet, or getting in and out of a car? (potential predictive factors for course) • Does the patient experience any restrictions when cycling, driving a car, or using public transport? • Are there any circumstances or activities that exacerbate or reduce the symptoms? • To what extent is the patient able to bear weight on the hip and/or knee during ADL? • Has the patient suffered any falls in the past year? If so, how often? • To what extent is the patient able to bear weight on the hip and/or knee during the day? (In the case of joint replacement surgery, the patient should be informed that a very active lifestyle could shorten the lifespan of the prosthesis)
Participation
• Does the patient experience challenges when engaging in work (paid or as a volunteer), sport, or other leisure activities? • Does the patient have a job or play a sport that places significant strain on the hip and/or knee? (including heavy lifting, crouching, and kneeling) • Has the patient performed heavy manual labor in the past? (potential risk factor for occurrence) • Does the patient experience problems with social contact due to hip or knee issues?
External factors
Is there a family history of OA? • How do the people surrounding the patient (partner, family, friends, and work colleagues) respond to the symptoms? • Does the patient use modifications, aids, or make provisions when undertaking ADL and household tasks, and during work, sport, or leisure activities? • What is the patient's living situation? Are there stairs at home, and is the patient able to walk up and down stairs? • Have (additional) medical diagnostic tests been conducted? (plain radiographs, blood tests, and collection of joint fluid). If yes, what were the results? • Has the patient undergone any previous therapeutic treatment? If yes, which treatment and what was the result? • Is a medical specialist or another healthcare provider involved? (related to hip and/or knee problems or comorbidities) • Does the patient use medication such as painkillers and/or anti-inflammatories, and what is the effect? • Does the patient use nutritional supplements? If so, what is the effect? • Does the patient use a walking aid (walking stick, Nordic walking sticks, a walker, and walking while holding their bicycle), electric bicycle, or cycle instead of walking? If so, what is the effect? • Does the patient use an aid to perform activities? (standing support, adapted chair, wheeled stool, and knee support) If so, what is the effect?

TABLE 2 (Continued)

- Has the patient suffered any traumatic injury in the past that has resulted in damage to the hip or knee joints? If so, how long did this take place and how did the recovery progress? (potential risk factor for occurrence)
- Has any relevant surgery been performed in the past (e.g., joint replacement surgery or meniscus surgery)? If so, how long did this take place and how did the recovery progress? (potential risk factor for occurrence)

- Personal factors

- Does the patient have any current comorbidity (such as diseases affecting the heart or lungs, diabetes mellitus, visual loss, hearing loss, lower back pain, and/or depression)? If so, have these comorbid conditions affected the patient's ability to function and to tolerate movement/exertion? (In terms of potential predictors for course/measurement, the use of the *Cumulative Illness Rating Scale* is optional to support an estimation of the effect of comorbidity on functioning.)
- Does the patient have a history of any nontraumatic hip or knee conditions (e.g., reactive, crystal, or septic arthritis), resulting in joint damage or faster progression? If so, how long ago did this take place and how did the recovery progress?
- To what extent does the patient rest when experiencing pain? Does the patient lead an active lifestyle?
- Are there any cognitive issues? (e.g., dementia)
- To what extent does the patient consider movement to be harmful?
- To what extent does the patient fear falling or moving?
- Is the patient motivated to start/continue moving?
- What measures has the patient undertaken to ameliorate his/her symptoms (e.g., rest/movement; use of medication, orthoses, and/or walking aids; discussing issues with their employer; and/or obtaining work-related assistance if there are any work-related challenges) and was this helpful?

Abbreviations: ADL, activities of daily living; BMI, body mass index; OA, osteoarthritis.

TABLE 3 Red flags for hip or knee osteoarthritis

- Warm and swollen (red) knee
- Inexplicable severe pain in the hip and/or knee
- Swelling in the groin
- Severe locking of the knee
- Pain (severe) at rest and swelling (with no history of trauma)

In the presence of one or more joint replacement prostheses (postoperative):

- Developing a fever of ≥38.5°C
- If the wound remains very swollen and red
- If the wound presents with excessive exudate or if the wound continues to exude fluid
- Sudden severe pain in the joint containing the prosthesis, with or without a preceding fall or other trauma
- Increased knee pain that has not responded to painkillers
- If the patient is no longer able to stand on the leg, whereas he/she had previously been able to do so
- Developing pain in the calf when dorsiflexing the toes
- Red discoloration and pain development in the lower leg

support this clinical question, the guideline panel first formulated criteria to decide if PT could be started. The guideline panel considered that PT treatment is indicated if a patient (i) has a need for support regarding his/her OA-related hip or knee condition due to limitations in daily activities and/or social participation and/or (ii) is unable to achieve or maintain an adequate level of independent physical functioning without the need for support (Health Council of the Netherlands, 2017; Rausch Osthoff et al., 2018).

The guideline panel concluded that, in specific situations, a physical therapist could consult a physician, for example, if he/she had identified reasons to suspect a diagnosis other than OA, when relevant information on the severity of the condition and/or comorbidity is lacking, when generic or specific red flags were identified, when absolute contraindications for exercise therapy are present, or when there is a justified expectation that PT could worsen the symptoms.

In terms of active PT delivery, four profiles were distinguished. These profiles provide direction in terms of the content and extent of the PT as provided by the physical therapist. No literature was found concerning treatment profiles; therefore, treatment profiles were based on expert opinion within the guideline and review panels. Based on an initial patient assessment, the following four treatment profiles can be considered:

1. A short period of education, advice, and exercise/movement instruction.
2. A short period of guidance and supervision where the patient's needs cannot be addressed through a short period of education, advice, and instruction only.
3. Longer term guidance and supervision, due to the presence of risk factors for delayed recovery (such as comorbidity or poor pain management) that could hinder exercise therapy.
4. Education, preoperative, and/or postoperative exercise therapy before or after OA-related hip or knee joint replacement surgery.

3.2 | Treatment

Clinical questions concerning patient education, exercise therapy, and nonexercise therapeutic interventions were formulated by the *guideline panel*, based on the barrier analysis during the preparation phase. Systematic literature reviews regarding exercise therapy and nonexercise therapeutic interventions were conducted to formulate the recommendations. Additional narrative reviews were conducted to describe the content of exercise therapy and patient education.

3.2.1 | Patient education

Patient education, tailored to individual patient needs, is an essential component of conservative treatment (Fernandes et al., 2013; French et al., 2015). Interpretation of the literature was hampered by the fact

TABLE 4 Relevant points of attention during the physical examination for patients with osteoarthritis of the hip and/or knee

Functional and anatomical characteristics
Inspection
• Where is the pain located? • Do you currently observe mild, moderate, or severe swelling? (knee) • If so, where is the swelling located? Is the swelling diffuse or localized? • Are there any changes in color? (knee) NB: A reddened lower leg observed following joint replacement surgery can be a red flag. • Are there any changes in position compared to the nonaffected side: - of the knee and/or hip joint? - of the pelvis or the spinal column? - of the lower leg compared with the upper leg (e.g., varus/valgus position) and/or the foot? - of the lower/upper leg? • Is there any difference in the circumference of the musculature compared with the other leg, in terms of calf, thigh, and/or buttock musculature? • How is wound healing progressing? (in the case of joint replacement surgery) NB: A wound that remains very swollen and reddened after joint replacement surgery could be a red flag.
Palpation
• Is there any swelling? (knee) • Is there any skin temperature increase at the joint? (knee) • Is there any synovial or osseous thickening (knee) around the joint space? Is palpation painful? (knee) • Is there any pain upon patellofemoral compression? (knee) • Is there any increase in muscle tone of the lumbar extensors, the hip adductors (for hip osteoarthritis), or in the tensor fasciae latae (for knee osteoarthritis)?
Functional examination
• Active range of motion tests, in which the following movements are evaluated: - Knee flexion/extension. - Hip flexion/extension, abduction/adduction, and external/internal rotation. - Ankle/foot dorsiflexion/plantarflexion and pronation/supination of the foot. • Passive examination of the knee and hip with evaluation of the total range of motion, including valgus/varus motion of the knee joint. NB: Caution is advised during passive examinations in the first 2 weeks following knee joint replacement surgery, because of the wound healing process. Following knee joint replacement surgery, if knee mobility and range of motion is <80°–90° during the recovery phase, contact should be made with the treating orthopedic surgeon following the patient consultation. No passive movement examinations should be performed following joint replacement surgery of the hip, due to the risk of dislocation in the first 6 weeks postoperatively. • Passive movement examination of the ankle/foot. • Evaluation of the end sensation and pain provocation of the hip/ankle/foot. • Evaluation of muscle strength/muscle stamina (including the quadriceps femoris and gluteal muscles), stability, muscle length of the affected and nonaffected leg, and proprioception. • Evaluation of balance (both static and dynamic). • Evaluation of aerobic capacity. • Evaluation of the mobility/load-bearing capability of the lumbar spine (mainly in patients with hip osteoarthritis). • Evaluation of joint function of the upper extremities and cervical spine (due to the potential use of walking aids). • The Six Minute Walking test is a supporting function test to estimate physical functioning and to use as a baseline measurement for treatment. • Optional measurement instruments can be used to support the movement examination.
Activities
Inspection
• Evaluation of standing, standing on one leg, walking (up/downstairs), standing up from a seated position/sitting down, and other ADL activities relevant to the patient. To what extent can the hip/knee be used? What is the patient's walking speed? NB: If the patient is in the rehabilitation phase after joint replacement surgery and is no longer able to stand on the leg, whereas he/she had been able to do so beforehand, then this could be a red flag. • Evaluation to determine whether certain movements are being avoided or compensated for with other movements. • Evaluation of balance reactions compared with those of the nonaffected side when standing and walking. • Evaluation of the quality of movement during functional activities, such as sitting down and getting up again, bending, transfers, getting (un)dressed, and walking up/downstairs. • Evaluation of specific activities that are restricted during work, sports, or other leisure activities. • Evaluation of the use of aids. • Evaluation of performing other specific activities where symptoms are reported.

Abbreviation: ADL, activities of daily living.

TABLE 5 The American College of Rheumatology clinical classification criteria for hip and knee osteoarthritis used to support a clinical diagnosis of hip or knee osteoarthritis

Hip	Knee
Hip pain in combination with: - Internal rotation ≤15° - Flexion ≤115° Or Pain in the hip in combination with: - Age > 50 years - ≤60 min of morning stiffness - Pain on internal rotation - Internal rotation ≥15°	Knee pain and at least three of the following: - Age >50 years - >30 min of morning stiffness - Crepitus - Bony tenderness - Bony enlargement - No palpable warmth

that the provision of education and exercise therapy is usually inseparable in practice. The face-to-face provision of education should in all cases be supplemented with written or online information in the form of leaflets, handbooks, websites, or videos of proven quality. Based on international guidelines, the following topics are recommended for discussion with a patient with hip or knee OA: (i) the condition and the possible consequences, (ii) the importance of exercise and a healthy lifestyle, and (iii) treatment options (Fernandes et al., 2013, French et al., 2015). With regard to total hip or knee arthroplasty, patient information and advice should be adapted to the situation of the individual patient but should minimally include the following topics: (i) the surgery, the subsequent rehabilitation period, and the possible use of assistive devices and/or help from others; (ii) the importance of (maintaining) sufficient muscle strength and overall fitness prior to surgery and other factors involved in postoperative recovery; and (iii) the lifestyle restrictions and precautions involved during the first postoperative phase, where indicated by the orthopedic surgeon.

3.2.2 | Exercise therapy

Clinical questions regarding exercise therapy for patients with hip or knee OA were addressed using evidence from high quality systematic reviews (Fransen et al., 2015, 2014). For hip OA, the recommendation was based on a systematic review including 15 RCTs. It was concluded that exercise therapy had a moderate effect on physical functioning (standardized mean difference [SMD], 0.32), with a moderate quality of evidence reported in relation to the immediate post-intervention period (Fransen et al., 2014). For knee OA, the recommendation was based on a systematic review including 52 RCTs. It was concluded that exercise therapy had a moderate effect on

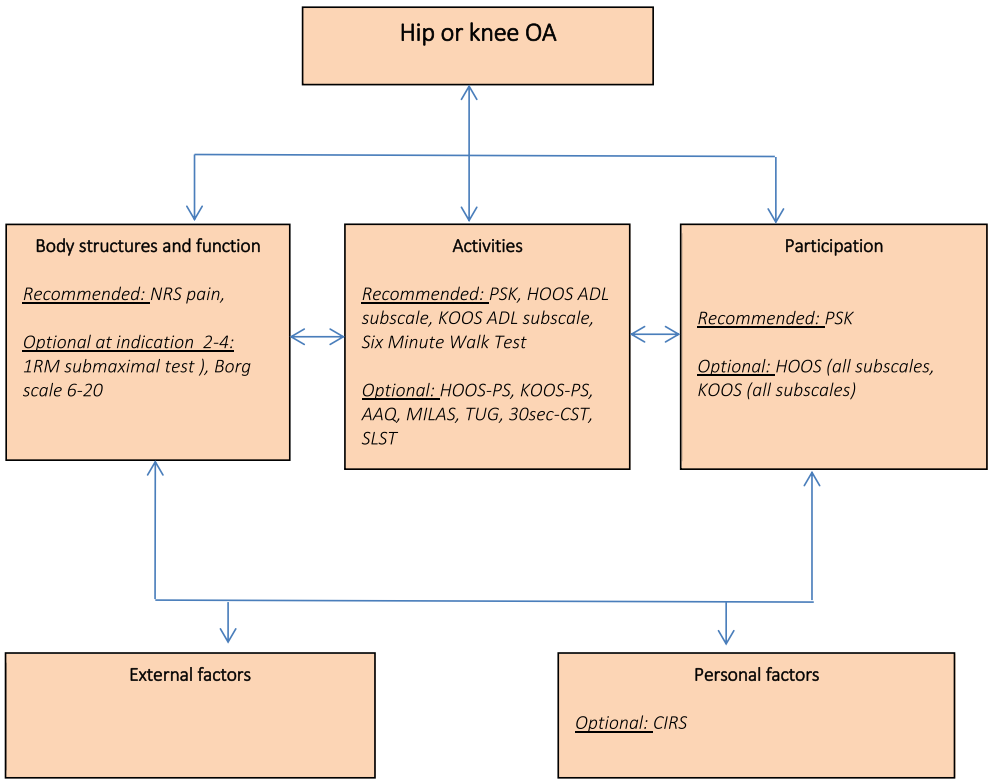

FIGURE 1 Recommended and optional measurement instruments for the treatment of patients with hip or knee osteoarthritis. 30-sec CST, 0-second Chair Stand Test; AAQ, Animated Activity Questionnaire; CIRS, Cumulative Illness Rating Scale; HOOS, Hip disability and Osteoarthritis Outcome Score; HOOS ADL subscale, HOOS subscale function, daily living; HOOS-PS, HOOS Physical function Short form; KOOS , Knee injury and Osteoarthritis Outcome Score; KOOS ADL subscale, KOOS subscale daily living; KOOS-PS, KOOS Physical function Short form; MILAS, Modified IOWA Level of Assistance Score; NRS, Numeric Rating Scale; PSK, Patient Specific Complaints instrument; SLST, Single Leg Stance Test; TUG, Timed Up and Go test

physical functioning (SMD, 0.54), with a moderate quality of evidence reported in relation to only high quality studies (Fransen et al., 2015). The positive effects of exercise therapy were consistent overall, but potentially undesirable effects, such as worsening of symptoms, were infrequently reported and appeared to be rare and not very severe. Therefore, the guideline panel was of the opinion that the positive effects outweighed the undesirable effects. Moreover, the guideline panel considered that most patients would be likely to have a positive attitude toward exercise therapy, given its beneficial effects on symptoms and daily functioning, and that it could be included in their daily routine. A cost-effectiveness analysis showed that exercise therapy performed in the conservative treatment phase resulted in a greater health gain per invested Euro than when exercise therapy was not offered (Cochrane, Davey, & Matthes Edwards, 2005; Hurley et al., 2007; Jessep, Walsh, Ratcliffe, & Hurley, 2009; Richardson et al., 2006; Sevick et al., 2000). For physical therapists, there are minimal costs associated with the provision of exercise therapy, assuming that the required practice area and exercise equipment are already present. Based on the evidence and mentioned considerations, the guideline panel formulated strong recommendations for exercise therapy in all patients with hip or knee OA.

Evidence concerning preoperative exercise therapy showed a moderate effect on physical functioning in patients after total hip replacement (SMD, 0.32) and total knee replacement (SMD, 0.40) (Beaupre, Lier, Davies, & Johnston, 2004; Bitterli, Sieben, Hartmann, & De Bruin, 2011; Calatayud et al., 2017; Ferrara et al., 2008; Lowe, Davies, Sackley, & Barker, 2015; Rooks et al., 2006; Silkman Baker & McKeon, 2012; Villadsen, Overgaard, Holsgaard-Larsen, Christensen, & Roos, 2014; Wallis & Taylor, 2011). For postoperative exercise therapy, evidence showed a moderate effect on physical functioning in patients after total hip replacement (SMD, 0.37) and a small effect after total knee replacement (SMD, 0.18) (Artz et al., 2017, 2015; Barker et al., 2013; Beaupre, Masson, Luckhurst, Arafah, & O'Connor, 2014; Bruun-Olsen, Heiberg, Wahl, & Mengshoel, 2013; French et al., 2015; Hepperger et al., 2017; Jakobsen, Kehlet, Husted, Petersen, & Bandholm, 2014; Liebs et al., 2010; Mitchell et al., 2005; Umpierres et al., 2014). Other considerations concerning exercise therapy in the preoperative and postoperative phase are similar to those of the conservative treatment phase. Based on the evidence and other considerations, the guideline panel formulated conditional recommendations for preoperative and postoperative exercise therapy in patients who undergo hip or knee replacement surgery for OA.

To formulate recommendations concerning the desired content of exercise therapy, exercise programs outlined in the RCTs and in the literature reviews were reviewed, as well as international guidelines and general studies on exercise therapy (American College of Sports Medicine, 2018; Foroughi, Smith, Lange, Singh, & Vanwanseele, 2011; Health Council of the Netherlands, 2017; Jan, Lin, Liau, Lin, & Lin, 2008; Juhl, Christensen, Roos, Zhang, & Lund, 2014; Regnaux et al., 2015; Westby, Marshall, & Jones, 2018), and recommendations using the FITT principles were then formulated (Table 6).

The guideline panel also concluded that joint-specific and general exercises should be combined in a personalized exercise and physical activity plan and be tailored to individual goals, needs, and preferences. The number and frequency of supervised and independently performed home exercises should be determined in consultation with the patient. Given the proven benefits of maintaining the positive effects of treatment, booster sessions planned after the initial treatment are recommended (Pisters et al., 2007).

Another clinical question addressed restrictions for exercise therapy for patients with hip or knee OA and the presence of comorbidity. A systematic review was conducted that aimed to determine the effect of exercise therapy in patients with hip or knee OA and comorbidity. Only one study included a protocol for patients with knee OA and different types of comorbidity (De Rooij et al., 2017). Therefore, for patients with comorbidity, no standardized treatment program is convenient, and exercise therapy should be adjusted accordingly.

The guideline panel addressed a clinical question concerning exercise therapy in patients with hip or knee OA in relation to poor pain management. A systematic review was conducted that aimed to establish the effects of exercise therapy in patients with hip or knee OA and who had poor pain management; however, no studies were identified. Two studies that were initially excluded because they did not specifically select patients with poor pain management did describe an intervention that included pain education and behavioral pain-coping skills (Hunt et al., 2013; Bennel et al., 2016). In these two studies, it was concluded that exercise therapy, according to a time-contingent approach (graded activity) combined with pain education and pain-coping skills training, could be effective. Therefore, the guideline panel recommended exercise therapy for patients with poor pain management.

Additionally, the guideline panel formulated a point of attention regarding the treatment of patients with OA and severe comorbidity or poor pain management, as follows. If a physical therapist's knowledge and skills regarding the management of patients with comorbidity or poor pain management is insufficient, the principle “those incompetent are unauthorized to act” applies, and referral to a competent colleague is required, or the physical therapist should cooperate with that competent colleague.

3.2.3 | Nonexercise therapeutic interventions

Systematic reviews were conducted to address clinical questions regarding the following nonexercise therapeutic interventions: massage therapy, transcutaneous electrical nerve stimulation (TENS) therapy, continuous passive motion (CPM), pulsed electromagnetic field therapy, low-level laser therapy (LLLT), passive mobilization, shockwave therapy, taping, ultrasound, and thermotherapy.

For all of these interventions, the quality of studies and level of evidence was low, with the effects on physical functioning in patients with hip or knee OA seldom reported. Massage therapy (Bervoets, Luijsterburg, Alessie, Buijs, & Verhagen, 2015; Perlman et al., 2012; Perlman, Sabina, Williams, Njike, & Katz, 2006) and TENS therapy (Law, Cheing, & Tsui, 2004; Palmer et al., 2014) should preferably not be offered to patients with hip and knee OA. However, the use of

TABLE 6 FITT factors for exercise therapy in people with hip and/or knee osteoarthritis (summarized)

Frequency
• Aim for the patient to preferably perform exercise therapy daily or at least 2 days a week (for muscle strengthening/functional exercises) or at least 5 days a week for 30 min at a time (for aerobic exercises) (which also complies with the new Movement Guidelines of the Health Council). • Start with one to two times weekly guided exercise therapy, supplemented with independently performed exercises and gradually reduce guidance during the treatment period.
Intensity
• Aim for the following minimum intensity for muscle strength and aerobic training: ◦ Muscle strength training: 60%–80% of 1 repetition maximum (1RM) (Borg score, 14–17) or 50%–60% of 1RM (Borg score, 12–13) for people not accustomed to strength training, with two to four sets of 8–15 repetitions with 30- to 60-s break between sets. ◦ Aerobic training: >60% of maximum heart rate (Borg score, 14–17) or 40%–60% of maximum heart rate (Borg score, 12–13) for people not used to aerobic training. • Ensure a gradual buildup in intensity during the program and follow the training principles.
Type
Offer a combination of: • Muscle strength training: ◦ Select exercises primarily aimed at the large muscle groups around the knee and the hip joints (especially knee extensors, hip abductors, and knee flexors). ◦ Perform these exercises in both legs (for hip or knee osteoarthritis, both for unilateral and bilateral osteoarthritis). ◦ Select functional exercises using the patient's own body weight and exercises using devices. Exercises with a high mechanical knee load (e.g., using a "leg extension device") should preferably be avoided in patients with knee osteoarthritis and after knee joint replacement surgery. • Aerobic training: ◦ Select activities with a relatively low joint load, such as walking, cycling, swimming, rowing, or using a cross-trainer. • Functional training: ◦ Select (parts of) activities that are hindered in the patient's daily life (e.g., walking, climbing stairs, sitting down, and rising from a chair). • Within one treatment session, focus primarily (at least 75% of the treatment time) on one type of training: muscle strength or aerobic training for optimal treatment results. Instruct the patient to independently perform a type of training that is not primarily targeted during the treatment session. • Consider offering specific balance and/or coordination/neuromuscular training in addition to exercise therapy if there are disturbances in balance and/or coordination/neuromuscular control that impede the patient's functioning. • Consider including (active) range of motion or muscle stretching exercises as a supplement to exercise therapy if there are muscle shortening and/or reversible joint mobility limitations that impede the patient's functioning.
Time
• Aim for a treatment period between 8 and 12 weeks, supplemented with one or more follow-up sessions after completion of this treatment period (e.g., 3 and 6 months after the end of the treatment period), to encourage adherence to therapy. • Encourage the patient to continue performing their exercises independently after the treatment period.
General points of attention
• Always offer exercise therapy regardless of patient characteristics such as age, symptom severity, and severity of joint damage. • Always offer exercise therapy in combination with information/advice and a movement plan (including short- and long-term goals for the [continued] execution of movement activities) that has been devised in consultation with the patient. • Always offer exercise therapy in the form of a combination of supervised exercise therapy and independently performed exercises. Determine together with the patient, partly based on the degree of independence/motivation, personal preferences, and practical considerations, the ratio of supervised and independently performed exercise therapy to be undertaken. • Consider using eHealth applications to support the patient in performing (continuing to perform) exercises independently and/or to reduce the level of supervision. • Consider offering group exercise therapy if little individual guidance is required. • Consider offering exercise hydrotherapy in the initial phase of treatment if there are serious pain symptoms during exercise that cannot be resolved in any other way.
Training principles for patients with hip and/or knee osteoarthritis
• Precede any workout with a warm-up session and finish with a cooling-down session. • Determine the starting intensity of strength training and monitor the intensity during treatment using the 1RM submaximal test. • Determine the starting intensity of aerobic training and monitor the intensity during treatment using heart rate and/or the Borg score. • Gradually increase the intensity of training (once a week) to the maximum level possible for the patient. • Reduce the intensity of the next workout if joint pain increases after a workout and persists for >2 h thereafter. • Start with a short period of 10 min (or less if necessary) of aerobic exercise, in patients who are untrained and/or limited due to joint pain and mobility. • Offer alternative exercises using the same muscle groups and energy systems if the exercise leads to an increase in joint pain. • When adjusting training intensity, use variation in sets and repetitions (in strength), intensity, duration of session or exercise, type of exercise, and rest breaks, and determine the adjustment in consultation with the patient.

Abbreviation: 1RM, 1 repetition maximum.

TENS therapy for patients with knee OA can be considered as a short-term intervention to support active exercise therapy if exercise therapy is impeded due to severe pain. CPM (Harvey, Brosseau, & Herbert, 2014; Lenssen et al., 2008; Maniar, Baviskar, Singhi, & Rathi, 2012), pulsed electromagnetic field therapy (Pipitone & Scott, 2001; Thamsborg et al., 2005; Li et al., 2013), LLLT (Alfredo et al., 2012; Huang et al., 2015; Kheshie, Alayat, & Ali, 2014; Tascioglu, Armagan, Tabak, Corapci, & Oner, 2004), passive mobilization (French et al., 2013; Wang et al., 2015), shockwave therapy (Cho, Yang, Yang, & Yang, 2016; Imamura et al., 2017; Zhao et al., 2013), taping (Hinman, Bennell, Crossley, & McConnell, 2003; Kocyiget et al., 2015; Wageck, Nunes, Bohlen, Santos, & De Noronha, 2016), ultrasound (Tascioglu, Kuzgun, Armagan, & Ogutler, 2010; Loyola-Sanchez et al., 2012; Ulus et al., 2012; Zhang et al., 2016), and thermotherapy (evidence absent) should not be offered.

4 | DISCUSSION

An evidence-based practice PT guideline for hip or knee OA was developed according to the AGREE II standard (Brouwers et al., 2010), the G-I-N standards (Qaseem et al., 2012), and the GRADE methodology (Guyatt et al., 2008). This guideline provides the physical therapist with practical information and tools for use in daily clinical practice. The physical therapist is guided through a process of clinical reasoning during the initial assessment, treatment, and evaluation stages, to provide the patient with the most optimal, evidence-based PT treatment available.

To our knowledge, recommendations for physical therapists with regard to initial assessment, treatment, and evaluation have not previously been described in a discipline-specific guideline other than the KNGF guideline (Peter et al., 2011). Recommendations for the general management of hip or knee OA have been made in current international guidelines; however, these recommendations do not comprise specific and concrete information for physical therapists (Hochberg et al., 2012; McAlindon et al., 2012; Fernandes et al., 2013). In view of continuous developments in the field of research and treatment for patients with hip or knee OA, regular updates to evidence-based guidelines are useful to continuously support daily practice in the application of evidence-based treatment.

Strengths related to the methodology of developing this guideline include the involvement of many stakeholders and the formulation of clinical questions derived from focus groups involving physical therapists and patients. Their questions are addressed in the guideline, which will likely facilitate implementation in PT practice. Moreover, along with evidence from the literature, important considerations from clinical practice and the opinions of experts and patients were taken into account when formulating the recommendations using Evidence-to-Decision forms (Bijlsma, Berenbaum, & Lafeber, 2011; Doherty, Hunter, Bijlsma, Arden, & Dalbeth, 2016). Finally, a field test was conducted among physical therapists from November 2017 to December 2017 to evaluate the applicability of the guideline, which contributes to guideline uptake in daily clinical practice.

One limitation regarding the methodology used in developing this guideline was that, concerning PT interventions, the literature search was limited to systematic reviews and RCTs. When these were unavailable, we undertook a narrative review involving textbooks, key articles, and current guidelines, as suggested by the panel experts. A more extensive literature search might have provided more information and evidence concerning initial assessment and evaluation of treatment. Another limitation was that we chose physical functioning, pain, and quality of life as the main outcome measures for the systematic literature reviews. However, in line with the ICF additional outcome measures covering other domains, such as participation in work or sports, these could also have been evaluated and considered.

In this CPG, recommendations on preoperative and postoperative PT have been added, which is a change from the 2010 CPG. This addition is relevant, given the increasing number of joint replacement surgeries and early discharge from hospital using fast track strategies. The recommended preoperative and postoperative interventions are in general similar to those described by Westby, Brittain, and Backman (2014), although they are described in less detail in the current guideline. Although the current guideline's focus is broader than preoperative and postoperative PT alone as described in the Canadian guideline, the difference between the guidelines can be explained through variations in the method of guideline development, with expert opinion playing a larger role in the Canadian guideline than in the present guideline.

A number of knowledge gaps remain concerning physical therapeutic treatment for hip or knee OA. Although the required frequency, intensity, type, and duration of exercises have been more clearly defined than in previous versions of the guideline, questions remain concerning the optimal composition, dosage, and mode of delivery. Literature concerning the mode of delivery, on which our recommendations were based, was relatively dated, with few studies using alternatives to face-to-face contact such as telephone guidance or eHealth. Another question remains as to how treatment should best be tailored to an individual patient. Moreover, there is considerably less evidence concerning exercise therapy with regard to hip OA compared with knee OA. Therefore, further studies are necessary concerning exercise therapy for hip OA and to determine whether the treatment of hip and knee OA requires different approaches.

Given scientific developments, maintaining an up-to-date guideline is important. Therefore, the author group will evaluate all recommendations annually and consider revisions, as required. The CPG was developed in a modular manner; therefore, revisions can be conducted efficiently in the future through updating a single clinical question.

Finally, implementation of the guideline in daily practice is important, and presentations and an E-learning module have been developed for this purpose. Information with regard to the guideline has been published on the KNGF website and in journals for professionals and patients.

Based on the guideline recommendations, quality indicators are currently being developed that can be used as a tool to evaluate and improve the quality of physical therapeutic care for patients with hip or knee OA.

In conclusion, an up-to-date evidence-based PT guideline for the management of patients with hip or knee OA has been developed. To improve the quality of care for these patients, adequate dissemination, implementation, and timely updates are needed.

ACKNOWLEDGMENT

The authors wish to acknowledge Caroline S. Kampshoff, PhD and Jesper Knoop, PhD for their support with the literature review and organization of guideline and review panel meetings; Els van den Ende, PhD for chairing the guideline panel meetings and review panel meetings; members of the guideline panel and review panel and participants in the focus groups for their active collaboration. Development of this CPG was funded by the Royal Dutch Society for Physical Therapy (KNGF).

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this article or the development of the CPG.

REFERENCES

Alfredo, P. P., Bjordal, J. M., Dreyer, S. H., Meneses, S. R., Zaguetti, G., Ovanessian, V., … Marques, A. P. (2012). Efficacy of low level laser therapy associated with exercises in knee osteoarthritis: A randomized double-blind study. *Clinical Rehabilitation*, *26*, 523–533. https://doi.org/10.1177/0269215511425962

Alonso-Coello, P., Schünemann, H. J., Moberg, J., Brignardello-Petersen, R., Akl, E. A., Davoli, M., … GRADE Working Group. (2016). GRADE Evidence to Decision (EtD) frameworks: A systematic and transparent approach to making well informed healthcare choices. 1: Introduction. *BMJ*, *28*, 353i2016. https://doi.org/10.1136/bmj.i2016

Altman, R., Alarcón, G., Appelrouth, D., Bloch, D., Borenstein, D., Brandt, K., … Wolfe, F. (1991). The American College of Rheumatology criteria for the classification and reporting of osteoarthritis of the hip. *Arthritis and Rheumatism*, *34*, 505–514. https://doi.org/10.1002/art.1780340502

Altman, R., Asch, E., Bloch, D., Bole, G., Borenstein, D., Brandt, K., et al. (1986). Development of criteria for the classification and reporting of osteoarthritis: Classification of osteoarthritis of the knee. *Arthritis and Rheumatism*, *29*, 1039–1049, Diagnostic and Therapeutic Criteria Committee of the American Rheumatism Association.

American College of Sports Medicine. (2018). *ACSM's guidelines for exercise testing and prescription* (10th ed.). Philadelphia (PA): Wolters Kluwer Health.

Artz, N., Dixon, S., Wylde, V., Marques, E., Beswick, A. D., Lenguerrand, E., … Gooberman-Hill, R. (2017). Comparison of group-based outpatient physiotherapy with usual care after total knee replacement: A feasibility study for a randomized controlled trial. *Clinical Rehabilitation*, *31*, 487–499. https://doi.org/10.1177/0269215516642503

Artz, N., Elvers, K. T., Lowe, C. M., Sackley, C., Jepson, P., & Beswick, A. D. (2015). Effectiveness of physiotherapy exercise following total knee replacement: Systematic review and meta-analysis. *BMC Musculoskeletal Disorders*, *7*(16), 15. https://doi.org/10.1186/s12891-015-0469-6

Barker, K. L., Newman, M. A., Hughes, T., Sackley, C., Pandit, H., Kiran, A., & Murray, D. W. (2013). Recovery of function following hip resurfacing arthroplasty: A randomized controlled trial comparing an accelerated versus standard physiotherapy rehabilitation programme. *Clinical Rehabilitation*, *27*, 771–784. https://doi.org/10.1177/0269215513478437

Beaupre, L. A., Lier, D., Davies, D. M., & Johnston, D. B. (2004). The effect of a preoperative exercise and education program on functional recovery, health related quality of life, and health service utilization following primary total knee arthroplasty. *The Journal of Rheumatology*, *31*, 1166–1173.

Beaupre, L. A., Masson, E. C., Luckhurst, B. J., Arafah, O., & O'Connor, G. J. (2014). A randomized pilot study of a comprehensive postoperative exercise program compared with usual care following primary total hip arthroplasty in subjects less than 65 years of age: Feasibility, selection of outcome measures and timing of assessment. *BMC Musculoskeletal Disorders*, *2*(15), 192. https://doi.org/10.1186/1471-2474-15-192

Bennell, K. L., Ahamed, Y., Jull, G., Bryant, C., Hunt, M. A., Forbes, A. B., … Keefe, F. J. (2016). Physical therapist-delivered pain coping skills training and exercise for knee osteoarthritis: Randomized controlled trial. *Arthritis Care Res (Hoboken).*, *68*, 590–602. https://doi.org/10.1002/acr.22744

Bervoets, D. C., Luijsterburg, P. A., Alessie, J. J., Buijs, M. J., & Verhagen, A. P. (2015). Massage therapy has short-term benefits for people with common musculoskeletal disorders compared to no treatment: A systematic review. *Journal of Physiotherapy*, *61*, 106–116. https://doi.org/10.1016/j.jphys.2015.05.018

Bijlsma, J. W., Berenbaum, F., & Lafeber, F. P. (2011). Osteoarthritis: An update with relevance for clinical practice. *Lancet*, *377*, 2115–2126. https://doi.org/10.1016/S0140-6736(11)60243-2 Review

Bitterli, R., Sieben, J. M., Hartmann, M., & De Bruin, E. D. (2011). Presurgical sensorimotor training for patients undergoing total hip replacement: A randomised controlled trial. *International Journal of Sports Medicine*, *32*, 725–732. https://doi.org/10.1055/s-0031-1271696

Bossmann, T., Kirchberger, I., Glaessel, A., Stucki, G., & Cieza, A. (2011). Validation of the comprehensive ICF core set for osteoarthritis: The perspective of physical therapists. *Physiotherapy*, *97*, 3–16. https://doi.org/10.1016/j.physio.2009.11.011

Brouwers, M. C., Kho, M. E., Browman, G. P., Burgers, J. S., Cluzeau, F., Feder, G., … AGREE Next Steps Consortium. (2010). AGREE II: Advancing guideline development, reporting, and evaluation in health care. *Preventive Medicine*, *51*, 421–424. https://doi.org/10.1016/j.ypmed.2010.08.005

Bruun-Olsen, V., Heiberg, K. E., Wahl, A. K., & Mengshoel, A. M. (2013). The immediate and long-term effects of a walking-skill program compared to usual physiotherapy care in patients who have undergone total knee arthroplasty (TKA): A randomized controlled trial. *Disability and Rehabilitation*, *35*, 2008–2015. https://doi.org/10.3109/09638288.2013.770084

Calatayud, J., Casaña, J., Ezzatvar, Y., Jakobsen, M. D., Sundstrup, E., & Andersen, L. L. (2017). High-intensity preoperative training improves physical and functional recovery in the early post-operative periods after total knee arthroplasty: A randomized controlled trial. *Knee Surgery, Sports Traumatology, Arthroscopy*, *25*, 2864–2872. https://doi.org/10.1007/s00167-016-3985-5

Cho, S. J., Yang, J. R., Yang, H. S., & Yang, H. E. (2016). Effects of extracorporeal shockwave therapy in chronic stroke patients with knee osteoarthritis: A pilot study. *Annals of Rehabilitation Medicine*, *40*, 862–870. https://doi.org/10.5535/arm.2016.40.5.862

Cochrane, T., Davey, R. C., & Matthes Edwards, S. M. (2005). Randomised controlled trial of the cost-effectiveness of water-based therapy for lower limb osteoarthritis. *Health Technology Assessment*, *9*iii-iv, ix-xi, 1–114.

Cross, M., Smith, E., Hoy, D., Nolte, S., Ackerman, I., Fransen, M., … March, L. (2014). The global burden of hip and knee osteoarthritis: Estimates from the global burden of disease 2010 study. *Annals of the Rheumatic Diseases*, *73*, 1323–1330. https://doi.org/10.1136/annrheumdis-2013-204763

De Groot, I. B., Favejee, M. M., Reijman, M., Verhaar, J. A., & Terwee, C. B. (2008). The Dutch version of the Knee Injury and Osteoarthritis Outcome Score: A validation study. *Health and Quality of Life Outcomes*, *26*(6), 16. https://doi.org/10.1186/1477-7525-6-16

De Groot, I. B., Reijman, M., Terwee, C. B., Bierma-Zeinstra, S. M., Favejee, M., Roos, E. M., & Verhaar, J. A. (2007). Validation of the Dutch version of the Hip disability and Osteoarthritis Outcome Score. *Osteoarthritis and Cartilage*, *15*, 104–109. https://doi.org/10.1016/j.joca.2006.06.014

De Rooij, M., Van der Leeden, M., Cheung, J., Van der Esch, M., Häkkinen, A., Haverkamp, D., … Dekker, J. (2017). Efficacy of tailored exercise therapy on physical functioning in patients with knee osteoarthritis and comorbidity: A randomized controlled trial. *Arthritis Care Res (Hoboken).*, *69*, 807–816. https://doi.org/10.1002/acr.23013

Doherty, M., Hunter, D. J., Bijlsma, H., Arden, N., & Dalbeth, N. (2016). *Oxford textbook of osteoarthritis and crystal arthropathy* (3th ed.). Oxford, United Kingdom: Oxford University Press.

Fernandes, L., Hagen, K. B., Bijlsma, J. W., Andreassen, O., Christensen, P., Conaghan, P. G., … European League Against Rheumatism (EULAR). (2013). EULAR recommendations for the non-pharmacological core management of hip and knee osteoarthritis. *Annals of the Rheumatic Diseases*, *72*, 1125–1135. https://doi.org/10.1136/annrheumdis-2012-202745

Ferrara, P. E., Rabini, A., Maggi, L., Piazzini, D. B., Logroscino, G., Magliocchetti, G., … Bertolini, C. (2008). Effect of pre-operative physiotherapy in patients with end-stage osteoarthritis undergoing hip arthroplasty. *Clinical Rehabilitation*, *22*, 977–986. https://doi.org/10.1177/0269215508094714

Foroughi, N., Smith, R. M., Lange, A. K., Singh, M. A., & Vanwanseele, B. (2011). Progressive resistance training and dynamic alignment in osteoarthritis: A single-blind randomised controlled trial. *Clinical Biomechanics (Bristol, Avon)*, *26*, 71–77. https://doi.org/10.1016/j.clinbiomech.2010.08.013

Fransen, M., McConnell, S., Harmer, A. R., Van der Esch, M., Simic, M., & Bennell, K. L. (2015). Exercise for osteoarthritis of the knee: A Cochrane systematic review. *British Journal of Sports Medicine*, *49*, 1554–1557. https://doi.org/10.1136/bjsports-2015-095424

Fransen, M., McConnell, S., Hernandez-Molina, G., & Reichenbach, S. (2014). Exercise for osteoarthritis of the hip. *Cochrane Database of Systematic Reviews*, *22*, CD007912. https://doi.org/10.1002/14651858.CD007912.pub2

French, H. P., Cusack, T., Brennan, A., Caffrey, A., Conroy, R., Cuddy, V., … McCarthy, G. M. (2013). Exercise and manual physiotherapy arthritis research trial (EMPART) for osteoarthritis of the hip: A multicenter randomized controlled trial. *Archives of Physical Medicine and Rehabilitation*, *94*, 302–314. https://doi.org/10.1016/j.apmr.2012.09.030

French, S. D., Bennell, K. L., Nicolson, P. J., Hodges, P. W., Dobson, F. L., & Hinman, R. S. (2015). What do people with knee or hip osteoarthritis need to know? An international consensus list of essential statements for osteoarthritis. *Arthritis Care Research (Hoboken).*, *67*, 809–816. https://doi.org/10.1002/acr.22518

Guyatt, G. H., Oxman, A. D., Vist, G. E., Kunz, R., Falck-Ytter, Y., Alonso-Coello, P., … GRADE Working Group. (2008). GRADE: An emerging consensus on rating quality of evidence and strength of recommendations. *BMJ*, *336*, 924–926. https://doi.org/10.1136/bmj.39489.470347.AD

Harvey, L. A., Brosseau, L., & Herbert, R. D. (2014). Continuous passive motion following total knee arthroplasty in people with arthritis. *Cochrane Database of Systematic Reviews*, *6*, CD004260. https://doi.org/10.1002/14651858.CD004260.pub3

Health Council of the Netherlands. (2017). Physical activity guidelines 2017. Retrieved from: https://www.healthcouncil.nl/documents/advisory-reports/2017/08/22/physical-activity-guidelines-2017.

Hendriks, H. J. M., Bekkering, G. E., Van Ettekoven, H., Brandsma, J. W., Van der Wees, P. J., & De Bie, R. A. (2000). Development and implementation of national practice guidelines: A prospect for continuous quality improvement in physiotherapy. *Physiotherapy*, *86*, 535–547. https://doi.org/10.1016/S0031-9406(05)60988-1

Hepperger, C., Gföller, P., Hoser, C., Ulmer, H., Fischer, F., Schobersberger, W., & Fink, C. (2017). The effects of a 3-month controlled hiking programme on the functional abilities of patients following total knee arthroplasty: A prospective, randomized trial. *Knee Surgery, Sports Traumatology, Arthroscopy*, *25*, 3387–3395. https://doi.org/10.1007/s00167-016-4299-3

Higgins, J. P., Altman, D. G., Gøtzsche, P. C., Jüni, P., Moher, D., Oxman, A. D., … Cochrane Statistical Methods Group. (2011). The Cochrane collaboration's tool for assessing risk of bias in randomised trials. *BMJ*, *18*(343), d5928. https://doi.org/10.1136/bmj.d5928

Hinman, R. S., Bennell, K. L., Crossley, K. M., & McConnell, J. (2003). Immediate effects of adhesive tape on pain and disability in individuals with knee osteoarthritis. *Rheumatology (Oxford, England)*, *42*, 865–869. https://doi.org/10.1093/rheumatology/keg233

Hochberg, M. C., Altman, R. D., April, K. T., Benkhalti, M., Guyatt, G., McGowan, J., … American College of Rheumatology. (2012). American College of Rheumatology 2012 recommendations for the use of nonpharmacologic and pharmacologic therapies in osteoarthritis of the hand, hip, and knee. *Arthritis Care Research (Hoboken).*, *64*, 465–474.

Horn, K. K., Jennings, S., Richardson, G., Vliet, D. V., Hefford, C., & Abbott, J. H. (2012). The patient-specific functional scale: Psychometrics, clinimetrics, and application as a clinical outcome measure. *The Journal of Orthopaedic and Sports Physical Therapy*, *42*, 30–42. https://doi.org/10.2519/jospt.2012.3727

Huang, Z., Chen, J., Ma, J., Shen, B., Pei, F., & Kraus, V. B. (2015). Effectiveness of low-level laser therapy in patients with knee osteoarthritis: A systematic review and meta-analysis. *Osteoarthritis and Cartilage*, *23*, 1437–1444. https://doi.org/10.1016/j.joca.2015.04.005

Hunt, M. A., Keefe, F. J., Bryant, C., Metcalf, B. R., Ahamed, Y., Nicholas, M. K., & Bennell, K. L. (2013). A physiotherapist-delivered, combined exercise and pain coping skills training intervention for individuals with knee osteoarthritis: A pilot study. *The Knee*, *20*, 106–112. https://doi.org/10.1016/j.knee.2012.07.008

Hunter, D. J., & Bierma-Zeinstra, S. (2019). Osteoarthritis. *Lancet*, *393*, 1745–1759. https://doi.org/10.1016/S0140-6736(19)30417-9

Hurley, M. V., Walsh, N. E., Mitchell, H. L., Pimm, T. J., Williamson, E., Jones, R. H., … Patel, A. (2007). Economic evaluation of a rehabilitation program integrating exercise, self-management, and active coping strategies for chronic knee pain. *Arthritis Rheumatology*, *57*, 1220–1229.

Imamura, M., Alamino, S., Hsing, W. T., Alfieri, F. M., Schmitz, C., & Battistella, L. R. (2017). Radial extracorporeal shock wave therapy for disabling pain due to severe primary knee osteoarthritis. *Journal of Rehabilitation Medicine*, *49*, 54–62. https://doi.org/10.2340/16501977-2148

Jakobsen, T. L., Kehlet, H., Husted, H., Petersen, J., & Bandholm, T. (2014). Early progressive strength training to enhance recovery after fast-track total knee arthroplasty: A randomized controlled trial. *Arthritis Care Res (Hoboken).*, *66*, 1856–1866. https://doi.org/10.1002/acr.22405

Jan, M. H., Lin, J. J., Liau, J. J., Lin, Y. F., & Lin, D. H. (2008). Investigation of clinical effects of high- and low-resistance training for patients with knee osteoarthritis: A randomized controlled trial. *Physical Therapy*, *88*, 427–436. https://doi.org/10.2522/ptj.20060300

Jessep, S. A., Walsh, N. E., Ratcliffe, J., & Hurley, M. V. (2009). Long-term clinical benefits and costs of an integrated rehabilitation programme compared with outpatient physiotherapy for chronic knee pain. *Physiotherapy*, *95*, 94–102. https://doi.org/10.1016/j.physio.2009.01.005

Juhl, C., Christensen, R., Roos, E. M., Zhang, W., & Lund, H. (2014). Impact of exercise type and dose on pain and disability in knee osteoarthritis: A systematic review and meta-regression analysis of randomized controlled trials. *Arthritis & Rhematology*, *66*, 622–636. https://doi.org/10.1002/art.38290

Kennedy, D. M., Stratford, P. W., Wessel, J., Gollish, J. D., & Penney, D. (2005). Assessing stability and change of four performance measures:

a longitudinal study evaluating outcome following total hip and knee arthroplasty. *BMC Musculoskelet Disord*, *28*(6), 3.

Kheshie, A. R., Alayat, M. S., & Ali, M. M. (2014). High-intensity versus low-level laser therapy in the treatment of patients with knee osteoarthritis: A randomized controlled trial. *Lasers in Medical Science*, *29*, 1371–1376. https://doi.org/10.1007/s10103-014-1529-0

Kocyigit, F., Turkmen, M. B., Acar, M., Guldane, N., Kose, T., Kuyucu, E., & Erdil, M. (2015). Kinesio taping or sham taping in knee osteoarthritis? A randomized, double-blind, sham-controlled trial. *Complementary Therapies in Clinical Practice*, *21*, 262–267. https://doi.org/10.1016/j.ctcp.2015.10.001

Law, P. P., Cheing, G. L., & Tsui, A. Y. (2004). Does transcutaneous electrical nerve stimulation improve the physical performance of people with knee osteoarthritis? *Journal of Clinical Rheumatology*, *10*, 295–299. https://doi.org/10.1097/01.rhu.0000147047.77460.b0

Lenssen, T. A., Van Steyn, M. J., Crijns, Y. H., Waltjé, E. M., Roox, G. M., Geesink, R. J., … De Bie, R. A. (2008). Effectiveness of prolonged use of continuous passive motion (CPM), as an adjunct to physiotherapy, after total knee arthroplasty. *BMC Musculoskelet Disord*, *29*(9), 60. https://doi.org/10.1186/1471-2474-9-60

Li, S., Yu, B., Zhou, D., He, C., Zhuo, Q., & Hulme, J. M. (2013). Electromagnetic fields for treating osteoarthritis. *Cochrane Database of Systematic Reviews*, *14*, CD003523. https://doi.org/10.1002/14651858.CD003523.pub2

Liebs, T. R., Herzberg, W., Rüther, W., Haasters, J., Russlies, M., & Hassenpflug, J. (2010). Ergometer cycling after hip or knee replacement surgery: A randomized controlled trial. *The Journal of Bone and Joint Surgery. American Volume*, *92*, 814–822. https://doi.org/10.2106/JBJS.H.01359

Lowe, C. J., Davies, L., Sackley, C. M., & Barker, K. L. (2015). Effectiveness of land-based physiotherapy exercise following hospital discharge following hip arthroplasty for osteoarthritis: An updated systematic review. *Physiotherapy*, *101*, 252–265. https://doi.org/10.1016/j.physio.2014.12.003

Loyola-Sánchez, A., Richardson, J., Beattie, K. A., Otero-Fuentes, C., Adachi, J. D., & MacIntyre, N. J. (2012). Effect of low-intensity pulsed ultrasound on the cartilage repair in people with mild to moderate knee osteoarthritis: A double-blinded, randomized, placebo-controlled pilot study. *Archives of Physical Medicine and Rehabilitation*, *93*, 35–42. https://doi.org/10.1016/j.apmr.2011.07.196

Maniar, R. N., Baviskar, J. V., Singhi, T., & Rathi, S. S. (2012). To use or not to use continuous passive motion post-total knee arthroplasty presenting functional assessment results in early recovery. *Journal of Arthroplasty*, *27*, 193–200.e1. https://doi.org/10.1016/j.arth.2011.04.009

McAlindon, T. E., Bannuru, R. R., Sullivan, M. C., Arden, N. K., Berenbaum, F., Bierma-Zeinstra, S. M., … Underwood, M. (2014). OARSI guidelines for the non-surgical management of knee osteoarthritis. *Osteoarthritis and Cartilage*, *22*, 363–388. https://doi.org/10.1016/j.joca.2014.01.003

Mitchell, C., Walker, J., Walters, S., Morgan, A. B., Binns, T., & Mathers, N. (2005). Costs and effectiveness of pre- and post-operative home physiotherapy for total knee replacement: Randomized controlled trial. *Journal of Evaluation in Clinical Practice*, *11*, 283–292. https://doi.org/10.1111/j.1365-2753.2005.00535.x

National Health Care Institute. (2014). Verbetersignalement zorg bij artrose van knie en heup. Retrieved from https://www.zorginstituutnederland.nl/werkagenda/publicaties/rapport/2014/06/30/zinnige-zorg-verbetersignalement-zorg-bij-artrose-van-knie-en-heup.

National Institute for Public Health and the Environment. (2017). Zorguitgaven artrose. Retrieved from https://www.volksgezondheidenzorg.info/onderwerp/artrose/kosten/zorguitgaven#node-zorguitgaven-artrose.

Palmer, S., Domaille, M., Cramp, F., Walsh, N., Pollock, J., Kirwan, J., & Johnson, M. I. (2014). Transcutaneous electrical nerve stimulation as an adjunct to education and exercise for knee osteoarthritis: A randomized controlled trial. *Arthritis Care Res (Hoboken).*, *66*, 387–394. https://doi.org/10.1002/acr.22147

Perlman, A. I., Ali, A., Njike, V. Y., Hom, D., Davidi, A., Gould-Fogerite, S., … Katz, D. L. (2012). Massage therapy for osteoarthritis of the knee: A randomized dose-finding trial. *PLoS ONE*, *7*, e30248. https://doi.org/10.1371/journal.pone.0030248

Perlman, A. I., Sabina, A., Williams, A. L., Njike, V. Y., & Katz, D. L. (2006). Massage therapy for osteoarthritis of the knee: A randomized controlled trial. *Archives of Internal Medicine*, *166*, 2533–2538. https://doi.org/10.1001/archinte.166.22.2533

Peter, W. F., Jansen, M. J., Hurkmans, E. J., Bloo, H., Dekker, J., Dilling, R. G., … Guideline Steering Committee - Hip and Knee Osteoarthritis. (2011). Physiotherapy in hip and knee osteoarthritis: Development of a practice guideline concerning initial assessment, treatment and evaluation. *Acta Reumatológica Portuguesa*, *36*, 268–281.

Pipitone, N., & Scott, D. L. (2001). Magnetic pulse treatment for knee osteoarthritis: A randomised, double-blind, placebo-controlled study. *Current Medical Research and Opinion*, *17*, 190–196. https://doi.org/10.1185/03007990152673828

Pisters, M. F., Veenhof, C., Van Meeteren, N. L., Ostelo, R. W., De Bakker, D. H., Schellevis, F. G., & Dekker, J. (2007). Long-term effectiveness of exercise therapy in patients with osteoarthritis of the hip or knee: A systematic review. *Arthritis and Rheumatism*, *57*, 1245–1253. https://doi.org/10.1002/art.23009

Qaseem, A., Forland, F., Macbeth, F., Ollenschläger, G., Phillips, S., Van der Wees, P., & Board of Trustees of the Guidelines International Network. (2012). Guidelines International Network: Toward international standards for clinical practice guidelines. *Annals of Internal Medicine*, *156*, 525–531. https://doi.org/10.7326/0003-4819-156-7-201204030-00009

Rausch Osthoff, A. K., Niedermann, K., Braun, J., Adams, J., Brodin, N., Dagfinrud, H., … Vliet Vlieland, T. P. M. (2018). 2018 EULAR recommendations for physical activity in people with inflammatory arthritis and osteoarthritis. *Annals of the Rheumatic Diseases*, *77*, 1251–1260. https://doi.org/10.1136/annrheumdis-2018-213585

Regnaux, J. P., Lefevre-Colau, M. M., Trinquart, L., Nguyen, C., Boutron, I., Brosseau, L., & Ravaud, P. (2015). High-intensity versus low-intensity physical activity or exercise in people with hip or knee osteoarthritis. *Cochrane Database of Systematic Reviews*, *29*, CD010203. https://doi.org/10.1002/14651858.CD010203.pub2

Richardson, G., Hawkins, N., McCarthy, C. J., Mills, P. M., Pullen, R., Roberts, C., … Oldham, J. A. (2006). Cost-effectiveness of a supplementary class-based exercise program in the treatment of knee osteoarthritis. *International Journal of Technology Assessment in Health Care*, *22*, 84–89. https://doi.org/10.1017/S0266462306050872

Rooks, D. S., Huang, J., Bierbaum, B. E., Bolus, S. A., Rubano, J., Connolly, C. E., … Katz, J. N. (2006). Effect of preoperative exercise on measures of functional status in men and women undergoing total hip and knee arthroplasty. *Arthritis and Rheumatism*, *55*, 700–708. https://doi.org/10.1002/art.22223

Royal Dutch Society for Physical Therapy. (2018a). KNGF guideline osteoarthritis of the hip and knee. Conservative, Pre-Operative and Post-Operative Treatment. Retrieved from https://www.kngf.nl/binaries/content/assets/kennisplatform/onbeveiligd/guidelines/artrose-heup-knie-2018-prl-en-toelichting-eng_def.pdf.

Royal Dutch Society for Physical Therapy. (2018b). KNGF guideline Osteoarthritis of the hip and knee. Conservative, pre-operative and post-operative treatment. Justification. Retrieved from https://www.kngf.nl/binaries/content/assets/kennisplatform/onbeveiligd/guidelines/artrose-heup-knie-2018-verantwoording-eng-def.pdf.

Royal Dutch Society for Physical Therapy. (2019). KNGF guideline methodology 2019. Development and implementation of KNGF guidelines. Retrieved from: https://www.kngf.nl/binaries/content/assets/

kennisplatform/onbeveiligd/guidelines/kngf-guideline-methodology-2019.pdf.

Sackett, D. L., Rosenberg, W. M., Gray, J. A., Haynes, R. B., & Richardson, W. S. (1996). Evidence based medicine: What it is and what it isn't. *BMJ*, *312*, 71–72. https://doi.org/10.1136/bmj.312.7023.71

Salaffi, F., Stancati, A., Silvestri, C. A., Ciapetti, A., & Grassi, W. (2004). Minimal clinically important changes in chronic musculoskeletal pain intensity measured on a numerical rating scale. *European Journal of Pain*, *8*, 283–291. https://doi.org/10.1016/j.ejpain.2003.09.004

Sevick, M. A., Bradham, D. D., Muender, M., Chen, G. J., Enarson, C., Dailey, M., & Ettinger, W. H. Jr. (2000). Cost-effectiveness of aerobic and resistance exercise in seniors with knee osteoarthritis. *Medicine and Science in Sports and Exercise*, *32*, 1534–1540.

Silkman Baker, C., & McKeon, J. M. (2012). Does preoperative rehabilitation improve patient-based outcomes in persons who have undergone total knee arthroplasty? *A Systematic Review. PM R.*, *4*, 756–767. https://doi.org/10.1016/j.pmrj.2012.06.005

Tascioglu, F., Armagan, O., Tabak, Y., Corapci, I., & Oner, C. (2004). Low power laser treatment in patients with knee osteoarthritis. *Swiss Medical Weekly*, *134*, 254–258. 4

Tascioglu, F., Kuzgun, S., Armagan, O., & Ogutler, G. (2010). Short-term effectiveness of ultrasound therapy in knee osteoarthritis. *The Journal of International Medical Research*, *38*, 1233–1242. https://doi.org/10.1177/147323001003800404

Thamsborg, G., Florescu, A., Oturai, P., Fallentin, E., Tritsaris, K., & Dissing, S. (2005). Treatment of knee osteoarthritis with pulsed electromagnetic fields: A randomized, double-blind, placebo-controlled study. *Osteoarthritis and Cartilage*, *13*, 575–581. https://doi.org/10.1016/j.joca.2005.02.012

Ulus, Y., Tander, B., Akyol, Y., Durmus, D., Buyukakıncak, O., Gul, U., … Kuru, O. (2012). Therapeutic ultrasound versus sham ultrasound for the management of patients with knee osteoarthritis: A randomized double-blind controlled clinical study. *International Journal of Rheumatic Diseases*, *15*, 197–206. https://doi.org/10.1111/j.1756-185X.2012.01709.x

Umpierres, C. S., Ribeiro, T. A., Marchisio, Â. E., Galvão, L., Borges, Í. N., Macedo, C. A., & Galia, C. R. (2014). Rehabilitation following total hip arthroplasty evaluation over short follow-up time: Randomized clinical trial. *Journal of Rehabilitation Research and Development*, *51*, 1567–1578. https://doi.org/10.1682/JRRD.2014.05.0132

Van der Wees, P., & Irrgang, J. J. (2014). Roadmap for publishing clinical practice guidelines in PTJ. *Physical Therapy*, *94*, 753–756. https://doi.org/10.2522/ptj.2014.94.6.753

Villadsen, A., Overgaard, S., Holsgaard-Larsen, A., Christensen, R., & Roos, E. M. (2014). Postoperative effects of neuromuscular exercise prior to hip or knee arthroplasty: A randomised controlled trial. *Annals of the Rheumatic Diseases*, *73*, 1130–1137. https://doi.org/10.1136/annrheumdis-2012-203135

Wageck, B., Nunes, G. S., Bohlen, N. B., Santos, G. M., & De Noronha, M. (2016). Kinesio taping does not improve the symptoms or function of older people with knee osteoarthritis: A randomised trial. *Journal of Physiotherapy*, *62*, 153–158. https://doi.org/10.1016/j.jphys.2016.05.012

Wallis, J. A., & Taylor, N. F. (2011). Pre-operative interventions (non-surgical and non-pharmacological) for patients with hip or knee osteoarthritis awaiting joint replacement surgery—A systematic review and meta-analysis. *Osteoarthritis and Cartilage*, *19*, 1381–1395. https://doi.org/10.1016/j.joca.2011.09.001

Wang, Q., Wang, T. T., Qi, X. F., Yao, M., Cui, X. J., Wang, Y. J., & Liang, Q. Q. (2015). Manual therapy for hip osteoarthritis: A systematic review and meta-analysis. *Pain Physician*, *18*, E1005–E1020.

Westby, M. D., Brittain, A., & Backman, C. L. (2014). Expert consensus on best practices for post-acute rehabilitation after total hip and knee arthroplasty: A Canada and United States Delphi study. *Arthritis Care Res (Hoboken).*, *66*, 411–423. https://doi.org/10.1002/acr.22164

Westby, M. D., Marshall, D. A., & Jones, C. A. (2018). Development of quality indicators for hip and knee arthroplasty rehabilitation. *Osteoarthritis and Cartilage*, *26*, 370–382. https://doi.org/10.1016/j.joca.2017.10.020

Zhang, C., Shi, J., Zhu, C., Xiang, T., Yi, Z., & Kong, Y. (2016). Effect of ultrasound therapy for knee osteoarthritis: A meta-analysis of randomized, double-blind, placebo-controlled clinical trials. *International Journal of Clinical and Experimental Medicine*, *9*, 20552–20561.

Zhao, Z., Jing, R., Shi, Z., Zhao, B., Ai, Q., & Xing, G. (2013). Efficacy of extracorporeal shockwave therapy for knee osteoarthritis: A randomized controlled trial. *The Journal of Surgical Research*, *185*, 661–666. https://doi.org/10.1016/j.jss.2013.07.004

How to cite this article: van Doormaal MCM, Meerhoff GA, Vliet Vlieland TPM, Peter WF. A clinical practice guideline for physical therapy in patients with hip or knee osteoarthritis. *Musculoskeletal Care*. 2020;18:575–595. https://doi.org/10.1002/msc.1492

APPENDIX A

TABLE A1 Stakeholders and their representing organizations

Stakeholders	Representing organization
Physical therapists	Royal Dutch Society for Physical Therapy (KNGF)
Exercise therapists	Association of Exercise Therapists Cesar and Mensendieck (VvOCM)
Patients	Dutch Arthritis Society (ReumaNederland), Arthritis Care Netherlands (RZN), Polyarthritis Companions (P-AL)
General practitioners	Dutch College of General Practitioners (NHG)
Orthopedic surgeons	Dutch Orthopaedic Association (NOV)
Rheumatologists	Dutch Society for Rheumatology (NVR)
Elderly care physicians and social geriatricians	Dutch Association of Elderly Care Physicians and Social Geriatricians (Verenso)
Clinical geriatricians	Dutch Society for Clinical Geriatric Medicine (NVKG)
Rehabilitation physicians	Dutch Society of Rehabilitation Physicians (VRA)
Nurses	Dutch Nurses' Association (V&VN)
Dieticians	Dutch Society of Dieticians
Podiatrists	Dutch Society of Podiatrists
Health insurers	Health Insurers Netherlands (ZN)
Government	National Healthcare Institute

APPENDIX B

TABLE B1 Clinical questions constituting the basis for a physical therapy guideline for patients with hip or knee osteoarthritis

Assessment
How is hip and knee osteoarthritis diagnosed by a physical therapist?
Which domains of the International Classification of Functioning Disability and Health (ICF) should be assessed during the diagnostic process?
Which measurement instruments are recommended during the diagnostic phase and for the evaluation of patients with osteoarthritis of the hip or knee?
What are the indications for physical therapy/exercise therapy in people with osteoarthritis of the hip and/or knee?
Treatment
What type of education and advice is recommended for patients with osteoarthritis of the hip or knee?
What type of education and advice is recommended at the time of total hip or knee arthroplasty?
Is exercise therapy recommended for people with hip or knee osteoarthritis?
Is exercise therapy recommended prior to total hip or knee arthroplasty?
Is exercise therapy recommended after total hip or knee arthroplasty?
Which exercise therapy is recommended in terms of frequency, intensity, type, and time duration for the treatment of patients with osteoarthritis of the hip or knee?
What modifications to exercise therapy are recommended for patients with hip or knee osteoarthritis if they also have one or more comorbidities affecting their physical functioning?
What modifications to exercise therapy are recommended for patients with hip or knee osteoarthritis if a patient is unable to cope with osteoarthritis-related pain?
Are nonexercise therapeutic interventions recommended for patients with osteoarthritis of the hip or knee?

APPENDIX C

TABLE C1 Search string exercise therapy

Search date	December 19, 2016
Consulted databases	PubMed, EMBASE, Web of Science, Cochrane Library, CENTRAL, EmCare, CINAHL.
General search terms[a]	(("hip osteoarthritis"[tw] OR "knee osteoarthritis"[tw] OR "Osteoarthritis, Knee" [MeSH] OR "Osteoarthritis, Hip"[mesh] OR (("Osteoarthritis"[Mesh] OR "osteoarthritis"[tw] OR osteoarthrit*[tw] OR "osteoarthrosis"[tw] OR osteoarthro* [tw] OR "degenerative arthritis"[tw] OR degenerative arthriti*[tw] OR "osteoarthrosis deformans"[tw]) AND ("Knee"[Mesh] OR "knee"[tw] OR "knees"[tw] OR "Knee Joint"[Mesh] OR "Hip"[Mesh] OR "hip"[tw] OR "hips"[tw] OR "Hip Joint"[Mesh] OR "menisci"[tw] OR "meniscus"[tw] OR menisc*[tw] OR "coxa"[tw] OR "coxas"[tw] OR "patellofemoral"[tw] OR "Patella"[Mesh] OR patella*[tw])) OR coxarthro*[tw] OR gonarthro*[tw]) AND (exercis*[tw] OR "stretching"[tw] OR "Exercise Therapy"[Mesh] OR "exercise therapy"[tw] OR exercise therap*[tw] OR "Continuous Passive Motion Therapy"[tw] OR "Continuous Passive Movement"[tw] OR "CPM Therapy"[tw] OR "Muscle Stretching Exercises"[tw] OR "Muscle Stretching Exercise"[tw] OR "Static Stretching"[tw] OR "Passive Stretching"[tw] OR "Static-Passive Stretching"[tw] OR "Static Passive Stretching"[tw] OR "Isometric Stretching"[tw] OR "Active Stretching" [tw] OR "Static-Active Stretching"[tw] OR "Static Active Stretching"[tw] OR "Ballistic Stretching"[tw] OR "Dynamic Stretching"[tw] OR "PNF Stretching"[tw] OR "Plyometric Exercise"[tw] OR "Plyometric Exercises"[tw] OR Plyometric Drill*[tw] OR "Plyometric Drills"[tw] OR "Plyometric Training"[tw] OR "Plyometric Trainings"[tw] OR "Stretch- Shortening Exercise"[tw] OR "Stretch Shortening Exercise"[tw] OR "Stretch- Shortening Exercises"[tw] OR "Stretch-Shortening"[tw] OR "Stretch Shortening"[tw] OR "Stretch-Shortening Drills"[tw] OR "Stretch-Shortening Cycle Exercise"[tw] OR "Stretch Shortening Cycle Exercise"[tw] OR "Stretch-Shortening Cycle Exercises"[tw] OR "Resistance Training"[tw] OR "Strength Training"[tw] OR "Weight-Lifting"[tw] OR "Weight Lifting"[tw] OR "Weight-Bearing"[tw] OR "Weight Bearing"[tw] OR "Exercise"[Mesh] OR "Exercise"[tw] OR "Exercises"[tw] OR "Physical Exercise"[tw] OR "Physical Exercises"[tw] OR "Isometric Exercises"[tw] OR "Isometric Exercise"[tw] OR "Aerobic Exercises"[tw] OR "Aerobic Exercise"[tw] OR "Circuit-Based Exercise"[tw] OR "Cool-Down Exercise"[tw] OR "Cool-Down Exercises"[tw] OR "Physical Conditioning" [tw] OR "Running"[tw] OR "Jogging"[tw] OR "Swimming"[tw] OR "Walking"[tw] OR "Warm-Up Exercise"[tw] OR "Warm-Up Exercises"[tw] OR "Physical Exertion"[Mesh] OR "Physical Exertion"[tw] OR "Physical Effort"[tw] OR "Physical Efforts"[tw] OR "Physical Fitness"[Mesh] OR "Physical Fitness"[tw] OR "Physical Endurance"[mesh] OR "Physical Endurance"[tw] OR "Anaerobic Threshold"[tw] OR "Exercise Tolerance" [tw] OR "Exercise Movement Techniques"[Mesh] OR "Exercise Movement"[tw] OR "Bicycling"[tw] OR "Walking"[tw] OR "Motor Activity"[Mesh] OR "Physical Activity" [tw] OR exertion*[tw] OR run*[tw] OR jog*[tw] OR treadmill*[tw] OR swim*[tw] OR bicycl*[tw] OR cycle*[tw] OR cycling[tw] OR walk*[tw] OR row[tw] OR rows[tw] OR rowing[tw] OR muscle strength*[tw]) NOT ("Animals"[mesh] NOT "Humans"[mesh]))

[a]For reasons of efficiency, the searches for hip and knee were conducted simultaneously and then completed separately.

TABLE C2 Selection criteria of systematic review to exercise therapy in conservative phase

Type of study	RCT's
Type of patient	Adults with a clinical diagnosis of hip or knee osteoarthritis[a]
Type of intervention	Any form of exercise therapy (irrespective of frequency, intensity, type, duration, and form)
Types of comparisons	No exercise therapy
Types of outcomes	Pain, physical functioning and quality of life (patient-reported outcomes).

[a]For reasons of efficiency, the searches for hip and knee were launched simultaneously and completed separately.
Abbreviation: RCT, randomized controlled trial.

TABLE C3 Selection criteria of systematic review to exercise therapy in preoperative phase

Type of study	RCT's
Type of patient	Adults with a clinical diagnosis of osteoarthritis who are eligible for joint replacement surgery of the hip or knee[a]
Type of intervention	Any form of preoperative exercise therapy (irrespective of frequency, intensity, type, duration, and form)
Types of comparisons	No exercise therapy
Types of outcomes	Physical functioning (patient-reported outcomes)

[a]For reasons of efficiency, the searches for hip and knee were launched simultaneously and completed separately.
Abbreviation: RCT, randomized controlled trial.

TABLE C4 Selection criteria of systematic review to exercise therapy in postoperative phase

Type of study	RCT's
Type of patient	Adults with a clinical diagnosis of osteoarthritis who are undergoing joint replacement surgery for hip or knee osteoarthritis[a]
Type of intervention	Any form of postoperative exercise therapy (irrespective of frequency, intensity, type, duration, and form)
Types of comparisons	No exercise therapy
Types of outcomes	Physical functioning (patient-reported outcomes)

[a]For reasons of efficiency, the searches for hip and knee were launched simultaneously and completed separately.
Abbreviation: RCT, randomized controlled trial.

TABLE C5 Selection criteria of systematic review to exercise therapy in patients with comorbidity

Type of study	SR and RCT
Type of patient	Adults with a clinical diagnosis of osteoarthritis of the hip or knee and comorbidity[a]
Type of intervention	Any form of exercise therapy (irrespective of frequency, intensity, type, duration, and form)
Types of comparisons	No exercise therapy
Types of outcomes	Physical functioning (patient-reported outcomes)

[a]For reasons of efficiency, the searches for hip and knee were launched simultaneously and completed separately.
Abbreviations: RCT, randomized controlled trial; SR, systematic review.

TABLE C6 Selection criteria of systematic review to exercise therapy in patients with inadequate pain coping

Type of study	SR and RCT
Type of patient	Adults with a clinical diagnosis of osteoarthritis of the hip or knee and inadequate pain coping[a]
Type of intervention	Any form of exercise therapy (irrespective of frequency, intensity, type, duration, and form) that specifically takes inadequate pain coping into consideration
Types of comparisons	No exercise therapy
Types of outcomes	Physical functioning (patient-reported outcomes)

[a]For reasons of efficiency, the searches for hip and knee were launched simultaneously and completed separately.
Abbreviations: RCT, randomized controlled trial; SR, systematic review.

TABLE C7 Search string nonexercise therapy

Search date	August 14, 2017
Consulted databases	PubMed, EMBASE, Web of Science, Cochrane Library, CENTRAL, EmCare, CINAHL.
General search terms[a]	((“hip osteoarthritis”[tw] OR “knee osteoarthritis”[tw] OR “Osteoarthritis, Knee”[MeSH] OR “Osteoarthritis, Hip”[mesh] OR (“Osteoarthritis”[Mesh] OR “osteoarthritis”[tw] OR osteoarthrit*[tw] OR “osteoarthrosis”[tw] OR osteoarthro*[tw] OR “degenerative arthritis”[tw] OR degenerative arthriti*[tw] OR “osteoarthrosis deformans”[tw]) AND (“Knee”[Mesh] OR “knee”[tw] OR “knees”[tw] OR “Knee Joint”[Mesh] OR “Hip”[Mesh] OR “hip”[tw] OR “hips”[tw] OR “Hip Joint”[Mesh] OR “menisci”[tw] OR “meniscus”[tw] OR menisc*[tw] OR “coxa”[tw] OR “coxas”[tw] OR “patellofemoral”[tw] OR “Patella”[Mesh] OR patella*[tw])) OR coxarthro*[tw] OR gonarthro*[tw]) AND (“Motion Therapy, Continuous Passive”[Mesh] OR “Continuous Passive Motion Therapy”[tw] OR “Continuous Passive Movement”[tw] OR “CPM Therapy”[tw] OR “Passive Stretching”[tw] OR “PNF Stretching”[tw] OR “musculoskeletal manipulations”[Mesh] OR “musculoskeletal manipulations”[tw] OR “Applied Kinesiology”[tw] OR “Chiropractic Manipulation”[tw] OR “Osteopathic Manipulation”[tw] OR “Soft Tissue Therapy”[tw] OR “Acupressure”[tw] OR “Massage” [Mesh] OR “massage”[tw] OR massag*[tw] OR “Zone Therapy”[tw] OR “Reflexology” [tw] OR “Rolfing”[tw] OR “Bodywork”[tw] OR Bodywork*[tw] OR “Electric stimulation therapy”[Mesh:NoExp] OR “electric stimulation therapy”[tw] OR “electrical stimulation therapy”[tw] OR “therapeutic electric stimulation”[tw] OR “therapeutic electrical stimulation”[tw] OR “electrotherapy”[tw] OR electrotherap*[tw] OR “interferential current electrotherapy”[tw] OR “electrical stimulation”[tw] OR “electrical nerve stimulation”[tw] OR “transcutaneous electric nerve stimulation” [Mesh:NoExp] OR “TENS”[tw] OR “transcutaneous electric nerve stimulation”[tw] OR “Ultrasonic Therapy”[Mesh] OR “therapeutic ultrasound”[tw] OR ultrasound therap*[tw] OR “ultrasonic therapy”[tw] OR “electromagnetic therapy”[tw] OR “Electromagnetic Radiation/therapeutic use”[Mesh] OR “Electromagnetic Phenomena/therapeutic use”[Mesh] OR “thermotherapy”[tw] OR “hot pack”[tw] OR “hot packs”[tw] OR hot pack*[tw] OR

(Continues)

TABLE C7 (Continued)

Search date	August 14, 2017
	hotpack*[tw] OR "cold pack"[tw] OR "cold packs"[tw] OR cold pack*[tw] OR coldpack*[tw] OR "cold treatment"[tw] OR "heat treatment"[tw] OR "Hyperthermia, Induced"[Mesh] OR fever therap*[tw] OR heat therap*[tw] OR "Induced Hyperthermia"[tw] OR Thermotherap*[tw] OR "Therapeutic Hyperthermia"[tw] OR "Local Hyperthermia"[tw] OR "Hot Temperature"[mesh] OR "Cold Temperature"[mesh] OR "Cryotherapy"[mesh] OR "Hypothermia, induced" [mesh] OR cold temperature*[tw] OR Cryotherap*[tw] OR "Induced Hypothermia"[tw] OR therapeutic hypotherm*[tw] OR "low level laser therapy"[tw] OR "low level laser treatment"[tw] OR "low intensity laser"[tw] OR "soft-laser therapy"[tw] OR "low energy laser therapy"[tw] OR "low-power laser therapy"[tw] OR "low level laser"[tw] OR "low level lasers"[tw] OR "low intensity lasers"[tw] OR "low energy laser"[tw] OR "low energy lasers"[tw] OR "low-power laser"[tw] OR "low- power lasers"[tw] OR "lllt"[tw] OR "Low-Level Light Therapy"[Mesh] OR "medical taping"[tw] OR "taping"[tw] OR "tape"[tw] OR "tapes"[tw] OR "taped"[tw] OR "kinesiotaping"[tw] OR "kinesio taping"[tw] OR kinesiotap*[tw] OR kinesio tap* [tw] OR "Bandages"[mesh] OR "Athletic Tape"[mesh] OR "Bandages"[tw] OR "Bandage"[tw] OR "Athletic Tape"[tw] OR "Athletic Tapes"[tw] OR "Hydrocolloid Bandages"[tw] OR "Biological Dressings"[tw] OR "Compression Bandages"[tw] OR "Compression Stockings"[tw] OR "Occlusive Dressings"[tw] OR "Hydrocolloid Bandage"[tw] OR "Biological Dressing"[tw] OR "Compression Bandage"[tw] OR "Compression Stocking"[tw] OR "Occlusive Dressing"[tw] OR "Dry needling"[tw] OR dry needl*[tw] OR "Acupuncture Therapy"[mesh] OR Acupunctur*[tw] OR Electroacupunctur*[tw] OR "Meridians"[tw] OR "Moxibustion"[tw] OR "Trigger Points"[tw] OR "Trigger Point"[tw] OR "Shockwave therapy"[tw] OR "Shock wave therapy"[tw] OR shockwav*[tw] OR shock wav*[tw] OR "High-Energy Shock Waves"[mesh] OR "HESW"[tw] OR "High Energy Shock Waves"[tw] OR "High-Energy Shock Wave"[tw] OR "Ultrasonic Shock Wave"[tw] OR "Ultrasonic Shock Waves"[tw] OR "Ultrasonic Shockwave"[tw] OR "Ultrasonic Shockwaves"[tw] OR "Ultrasonic Waves"[mesh] OR "Lithotripsy"[mesh] OR "Lithotripsy"[tw])) NOT ("Animals"[mesh] NOT "Humans"[mesh]))

[a]For reasons of efficiency, the searches for hip and knee were launched simultaneously and then completed separately.

TABLE C8 Selection criteria of systematic review to electromagnetic field, low level laser therapy, massage, passive mobilization, shockwave, taping, TENS, thermotherapy, and ultrasound

Type of study	SR and RCT
Type of patient	Adults with a clinical diagnosis of osteoarthritis of the hip or knee[a]
Type of intervention	Any form of treatment with an electromagnetic field
	Any form of treatment with low level laser therapy
	Any form of massage therapy
	Any form of treatment with passive mobilizations
	Any form of treatment with shockwave
	Any form of treatment with taping
	Any form of treatment with TENS
	Any form of thermotherapy
	Any form of treatment with ultrasound
Types of comparisons	No nonexercise therapeutic intervention
Types of outcomes	Physical functioning (patient-reported outcomes)

[a]For reasons of efficiency, the searches for hip and knee were launched simultaneously and completed separately.
Abbreviations: RCT, randomized controlled trial; SR, systematic review; TENS. transcutaneous electrical nerve stimulation.

TABLE C9 Selection criteria of systematic review to continuous passive motion therapy

Type of study	SR and RCT
Type of patient	Adults after or with an indication for a joint replacing prosthesis for osteoarthritis of the hip or knee[a]
Type of intervention	Any form of continuous passive motion therapy
Types of comparisons	No continuous passive motion therapy
Types of outcomes	Physical functioning (patient-reported outcomes)

[a]For reasons of efficiency, the searches for hip and knee were launched simultaneously and completed separately.
Abbreviations: RCT, randomized controlled trial; SR, systematic review.

APPENDIX D

TABLE D1 Evidence-to-Decision form

	Therapeutic intervention							
Desired effects	Very small	Small	Moderate	Large		Varies	No idea	Not measured
Undesirable effects	Large	Moderate	Small	Very small		Varies	No idea	Not measured
Quality of desired effects	Very low	Low	Reasonable	High		Varies	No idea	Not measured
Balance between desired and undesirable effects	The unfavorable effects definitely outweigh the favorable effects	The unfavorable effects probably outweigh the favorable effects	The favorable and unfavorable effects are equal	The favorable effects probably outweigh the unfavorable effects	The favorable effects definitely outweigh the unfavorable effects	Varies	No idea	No undesirable effects measured
Value of desired effects	Very low	Low	Reasonable	Large		No idea		
Variation in value of desired effects	Large variation	Moderate variation	Low variation	No variation		No idea		
Required resources (costs)	High costs	Moderate costs	Virtually no costs or savings	Moderate savings	High savings	Varies	No idea	
Variation in required resources (costs)	High	Moderate	Low	Very low		No idea		
Cost- effectiveness	Not cost-effective	Probably not cost- effective	Intervention and standard care are equal	Probably cost-effective	Cost- effective	Varies	No studies available	
Type of recommendation	Strong recommendation against intervention	Conditional recommendation against intervention	Conditional recommendation, neither in favor nor against the intervention	Conditional recommendation for intervention	Strong recommendation for intervention	Expert opinion		