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Case Study

Effects of daily living occupational therapy and resistance exercise on the activities of daily living and muscular fitness in Guillain-Barré syndrome: a case study

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Abstract. [Purpose] The study aimed to investigate the effects of daily living occupational therapy and resistance exercise on the performance of activities of daily living and muscular fitness in a patient with Guillain-Barré syndrome. [Subject and Methods] A 35-year-old man was diagnosed with Guillain-Barré syndrome. He was hospitalized at A Hospital for 3 years, and was discharged from the hospital after he became able to execute daily life activities. After discharge, he performed daily occupational therapy and resistance exercise twice a week for 70 minutes per session for 12 weeks. Performance in the activities of daily living was assessed using the modified Barthel index, and muscular fitness was measured in terms of isokinetic muscular function using the Biodes system. [Results] The subject's Barthel index score improved from 54 points before the intervention to 62 points after 4 weeks, 69 points after 8 weeks, and 79 points after 12 weeks. In addition, his shoulder flexion and extension, knee flexion and extension, and lumbar flexion and extension were improved. [Conclusion] The present study suggests that daily living occupational therapy and resistance exercise are effective in improving the activities of daily living and muscular fitness in a patient recovering from Guillain-Barré syndrome.

Key words: Resistance exercise, Guillain-Barré syndrome, Muscular fitness

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INTRODUCTION

Guillain-Barré syndrome (GBS) is an inflammatory peripheral polyneuropathy characterized by acute paralysis. GBS is uncommon, occurring in 1–2 per 100,000 individuals, and is proceeded in most cases by upper respiratory or gastrointestinal tract infections[1)]. The main symptom of GBS is sensory ataxia caused by demyelinating motor neurons or axonal lesions[2)]. The sensory ataxia is an ascending muscle weakness that progresses rapidly from the lower limbs to the upper limbs over a period of several days. Muscle weakness symptoms may deteriorate 2 to 4 weeks after the onset of GBS, and muscle strength is recovered in most cases. However, 10–20% of patients with GBS are reported to remain disabled due to muscle weakness caused by motor neuron defects, and, extremely rarely, death is reported to occur within one year after the onset of GBS[3)].

Treatment for GBS should be initiated immediately after its diagnosis is made because delayed treatment is associated with increased nerve damage; thus, recovery is delayed or is incomplete. Early treatments for GBS include plasma exchange, intravenous gamma globulin therapy, and immunosuppressive therapy based on immunopathology[4)]. After GBS treatment, many patients can recover to an extent such that independent walking is possible. However, some patients with GBS experience negative effects on the activities of daily living and impaired muscular function even at 3–6 years after the onset of

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Table 1. Resistance exercise program

Warm-up		Stretching (5 min)		
		1–4 week	5–8 week	9–12 week
Main exercise (30 min)	Upper limb exercises			
	Lowing	3 sets	3 sets	3 sets
	Pulling	15 repetitions	15 repetitions	15 repetitions
	Shoulder press	(R)	(R)	(G)
	Lower limb exercises			
	Squats	3 sets	3 sets	3 sets
	Leg curl	15 repetitions	15 repetitions	15 repetitions
	Leg extension	(R)	(G)	(G)
	Trunk exercises	3 sets	3 sets	3 sets
	Flexion	15 repetitions	15 repetitions	15 repetitions
	Extension	(R)	(G)	(G)
Cool-down		Stretching & breathing (5 min)		

R: red-colored thera-band; G: green-colored thera-band

GBS[5]. Therefore, it is important for patients with GBS to undergo rehabilitation treatment to increase the likelihood of achieving independence in the activities of daily living and to improve muscular fitness.

Herein, we examined the effect of 12 weeks of daily living occupational therapy and resistance exercise on the performance of the activities of daily living and muscular fitness in a patient with GBS who was discharged from the hospital after inpatient treatment for 3 years.

SUBJECT AND METHODS

A 35-year-old male complained of a sore throat accompanied by fever in May, 2011 and received pharmacological treatment for acute tonsillitis at 00 Hospital for 6 days. Starting on June 17, 2011, he had a tingling headache in the left temporal area, including the left orbital area. However, because the headache did not cause him to be uncomfortable in daily life, he did not take any medicine. On June 24, 2011, he had swelling in the left corner of his mouth and felt weakness in his left hand at 23:00 on that day. From June 25, 2011, around 17:00, symptoms of weakness occurred in his left leg, which he dragged when he walked. On June 26, 2011, after waking around 08:00 a.m., he developed symptoms such that his left side of the mouth did not turn well, his pronunciation became sloppy, and he felt that his right fist could not grip well. Accordingly, he visited the emergency room of 00 Hospital, was diagnosed with GBS, and was admitted to the Neurology Department. His muscle weakness corresponded to MRC (Medical Research Council) Grade 2 for both neck muscle flexion and extension, Grade 3 for deltoid muscles, and Grade 4 for lower arm and intrinsic hand muscles. His lower limb muscle strength was normal, and he had normal performance on the heel-knee-shin test. Tendon reflexes were decreased or non-existent in his upper limbs, but were normal in the lower limbs. No pathological reflex and no sensory abnormalities were observed, and he did not complain of any autonomic symptoms. He was hospitalized for 3 years at 00 Hospital, and discharged from the hospital in August, 2014, after he was able to walk independently. After discharge, he performed daily occupational therapy and resistance exercise for 12 weeks while receiving outpatient treatment, and returned to work at the end of December, 2014.

Performance in the activities of daily living and muscular fitness were measured every 4 weeks. The Korean version of the modified Barthel index was used to assess the activities of daily living performance[6]. The modified Barthel index consists of 10 specific activities of daily living with 7 items on self-care movements and 3 items on mobility. Detailed index items consist of personal hygiene, bathing, feeding, toileting, stair climbing, dressing, bowel control, bladder control, and ambulation/wheelchair and chair/bed transfers. Each item is scored with 5 grades and each item is weighted. The maximum total score is 100 points. In addition, a muscular fitness test was performed using the Biodex system and an isokinetic stenometer. In terms of angular velocity, measurements were made for shoulder flexion and extension at an angular velocity of 60°/sec, for knee flexion and extension at an angular velocity of 60°/sec and for lumbar flexion and extension at angular velocity of 30°/sec and 60°/sec.

The daily living occupational therapy and resistance exercise were performed twice a week for 12 weeks at 70 minutes per session. The daily living occupational therapy was performed for 30 minutes, and consisted of movements required for basic and functional daily life. The resistance exercise program was performed with 3 sets of muscle strength exercises for the upper body, lower body, and trunk for 30 minutes with 15 repetitions using elastic bands (thera-band, USA). A warm-up and cool-down were performed for 5 minutes each, before and after the main exercise, respectively. Exercise load was increased using different colored bands with different elastic resistances. Exercise intensity was performed in the range of 12–14° of the

Table 2. Change in modified Barthel index

	1st	2nd	3rd	4th	Δ%
Personal hygiene (score)	4	4	5	5	
Bathing (score)	3	3	3	4	
Feeding (score)	5	5	5	5	
Toilet (score)	2	2	5	8	
Stair climbing (score)	0	0	2	2	
Dressing (score)	5	5	5	8	
Bowel control (score)	10	10	10	10	
Bladder control (score)	10	10	10	10	
Ambulation (score)	3	8	8	12	
Chair/bed transfer (score)	12	15	15	15	
Total points (score)	54	62	68	79	46.29 (%)

Δ%=[(posttest − pretest)/pretest × 100]

Table 3. Change in muscular fitness

		1st	2nd	3rd	4th	Δ%
Shoulder	Right flexion (Nm)	23.9	31.7	45.3	43.1	80.33 (%)
(60°/sec)	Right extension (Nm)	72.3	79.3	89.9	107.2	48.27 (%)
	Left flexion (Nm)	28.4	32.8	37.3	53.6	88.73 (%)
	Left extension (Nm)	85.7	83.0	111.7	119.5	39.43 (%)
Knee	Right flexion (Nm)	23.4	25.6	35.7	33.7	44.01 (%)
(60°/sec)	Right extension (Nm)	10.9	15.1	23.7	28.9	165.13 (%)
	Left flexion (Nm)	19.0	25.1	28.2	33.3	75.26 (%)
	Left extension (Nm)	14.1	17.5	24.4	28.0	98.58 (%)
Lumbar	Extension (Nm)	124.5	135.7	166	175.6	41.04 (%)
(30°/sec)	Flexion (Nm)	47.9	59.7	58.9	67.5	40.91 (%)
	Extension (Nm)	128.5	130.7	145.5	168.0	30.73 (%)
	Flexion (Nm)	42.7	53.6	55.1	60.1	40.74 (%)

Δ%=[(posttest − pretest)/pretest × 100]

exercise angle (Table 1). The study purpose and methods were explained to the participant before his inclusion in the study, and he provided informed consent according to the principles of the Declaration of Helsinki.

RESULTS

The total scores on the modified Barthel Index improved from 54 points before the intervention to 62 points after 4 weeks, 68 points after 8 weeks, and 79 points after 12 weeks (Table 2). In terms of muscular fitness, shoulder flexion and extension, knee flexion and extension, and lumbar flexion and extension were improved after 4, 8, and 12 weeks, respectively (Table 3).

DISCUSSION

This case study demonstrates that 12 weeks of daily living occupational therapy and resistance exercise can improve performance in the activities of daily living and muscular fitness in a patient recovering from GBS. GBS causes symmetrical ascending motor paralysis, decreased or absent deep tendon reflexes, and respiratory muscle weakness in a short period of time[7, 8]. The treatment for GBS based on immunopathology is effective in delaying and recovering from GBS[9].

However, muscular weakness associated with GBS commonly proceeds to a peak within several days to several weeks after the appearance of the first GBS symptom and can remain in that state for several weeks or several months. Recovery from GBS often takes several weeks or several years, and although functional disability after treatment is a problem, its recurrence rate is extremely low (2–3%)[10]. In a study by Kim et al.[11], the duration of recovery (from the onset of GBS to independent walking) varied from 44 to 960 days, and the mean duration of recovery was 239 ± 169 days. With regard to the treatment of GBS, it is important to improve the physical function of patients, so that patients are able to regain their independent daily life as before the onset of GBS. To date, treatment for GBS has mainly focused on occupational therapy

after symptom relief[12]. Occupational therapy can help patients with GBS maintain a certain level of daily life; however, there may be some limitations in walking ability and performance of the activities of daily living. Therefore, resistance exercise is needed to improve the strength of the large muscles required for walking ability and daily life.

In the present study, 12 weeks of daily living occupational therapy and resistance exercise were performed by a patient diagnosed with GBS after his discharge from the hospital. As a result, his Barthel index score improved from 54 points before the intervention to 62 points after 4 weeks, 68 points after 8 weeks and 79 points after 12 weeks. In other words, the subject was in need of some help from others for walking and performing the activities of daily living at his discharge from the hospital. However, after 4 and 8 weeks of the intervention, he performed most of his daily activities himself and only intermittently needed help from others. After 12 weeks of the intervention, he performed his daily activities without help from others, but was not able to perform them perfectively. Thus, daily living occupational therapy and resistance exercise are effective in achieving functional recovery for the activities of daily living in patients with GBS.

In addition, the present study found that in terms of muscular fitness, shoulder flexion and extension, knee flexion and extension and lumbar flexion and extension were also improved by the daily living occupational therapy and resistance exercise program. Although GBS is associated with muscle weakness, it is thought that daily living occupational therapy and resistance exercise can help increase the level of muscular fitness. A systematic review by Simatos et al.,[13] also reported that exercise programs can improve muscle strength and the physical abilities needed to perform the activities of daily living, and reduce related fatigue, in patients with GBS. Therefore, patients with GBS need to be managed with resistance exercise and daily living occupational therapy after GBS symptoms have been alleviated.

In conclusion, the present study suggests that the combined daily living occupational therapy and resistance exercise program was effective in improving performance in the activities of daily living and muscular fitness. However, since GBS is a rare disease and the number of GBS cases is small, conducting large-scale studies is difficult. Therefore, it is necessary to establish therapeutic evidence related to daily living occupational therapy and resistance exercise through a continuous accumulation of data on GBS cases.

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