Original Article

The effects of patient-centered task-oriented training on balance activities of daily living and self-efficacy following stroke

Jin-Uk Choi, MS, PT[1], Soon-hee Kang, PT, PhD[2]*

[1] Department of Physical Therapy, Graduate School of Physical Therapy, Daegu University, Republic of Korea
[2] Department of Physical Therapy, Korea National University of Transportation: 61 Daehak-ro, Yonggang-ri, Jeungpyeong-eup, Jeungpyeong-gun, Chungcheongbuk-do, Republic of Korea

Abstract. [Purpose] This study aimed to determine whether a task-oriented training program improved balance, activities of daily living (ADL) performance, and self-efficacy in stroke patients. Twenty patients with stroke were recruited from a hospital in Cheongju, Korea. [Subjects] Ten of the subjects were assigned to an experimental group that participated in the task-oriented training program, and the other 10 were assigned to a control group that received traditional rehabilitation therapy. [Methods] In the two groups, balance was measured with the Berg Balance Scale (BBS), ADL performance with the Modified Barthel Index (MBI), and self-efficacy with the Self-Efficacy Scale (SES), before and after 4 weeks of training. [Results] Comparative analysis of the experimental group's pretest and post-test results showed statistically significant differences in the BBS, MBI, and SES scores. There were also significant between-group differences in the BBS, MBI, and SES scores. [Conclusion] The results suggest that a task-oriented training program can be an effective intervention to improve balance ability, ADL performance, and self-efficacy in stroke patients.
Key words: Stroke, Task-oriented training, Self-efficacy

INTRODUCTION

The goal of stroke rehabilitation is to maximize the ability to walk independently and improve activities of daily living (ADL)[1]. A reduction in balancing ability is one of the factors that adversely affect the ADL of stroke patients with hemiplegia. In these patients, the center of the body cannot move to the affected side, and tries to move to the unaffected side. As a result, patients with hemiplegia cannot shift body weight symmetrically in response to motion, thereby reducing balancing ability[2]. This leads to asymmetric physical balance, with walking and voluntary movement deficiencies. A previous study reported that task-oriented training significantly improved the balance and movement ability of chronic stroke patients, compared to a control group[3]. For hemiplegic stroke patients, the desire and motivation to participate in treatment programs are closely related to the restoration of exercise ability. Self-efficacy is an important precursor of health behavior. During the early hospitalization period after a stroke, enhancing self-efficacy is associated with restoring balance sense, exercise function, and walking ability[4]. Self-efficacy refers to a person's belief in their ability to overcome a crisis in life[5], and to perform a behavior or activity successfully. Task-oriented programs can be designed to enable people to accomplish specific tasks or acquire specific beliefs, such as in the ability to control one's disease[6], and are important factors in stroke rehabilitation. Such programs can improve the psychological and physical well-being of stroke patients.

The task-oriented approach used in the present study includes problem solving and functional tasks[7]. A number of recent studies have demonstrated the effects of task-oriented approaches[8–10]. However, only a few studies have applied a step-by-step task training program composed of ADL that the patient wants to accomplish.

In the present study, the patient rather than the therapist selected the tasks to be included in training. The tasks were important to the patients in their ADL, and would have a positive influence on the patient's sense of accomplishment or satisfaction. In addition, the exercise level in the step-by-step training program was tailored to the patient's ability, commencing with easy tasks and progressing to more difficult ones, according to the level of accomplishment. We examined the influence of this program on balance and self-efficacy in hemiplegic stroke patients.

*Corresponding author. Soon-hee Kang (E-mail: shkang@ut.ac.kr)

Table 1. Task-oriented training program

Task	Week	Program
Indoor walking	Step 1	Weight-support training on parallel bars
	Step 2	Weight-support training outside the parallel bars
	Step 3	Walking 10 m with the help of a therapist
	Step 4	Walking 10 m without the help of a therapist
Outdoor walking	Step 1	Walking on paved, level ground with a cane
	Step 2	Walking on unpaved ground with a cane
	Step 3	Walking on a slope (20°) while holding a cane and railing
	Step 4	Jumping over an obstacle using a cane (irregular paving)
Climbing the stairs	Step 1	Going up and down one low step (15 cm)
	Step 2	Going up and down 3 low steps (15 cm) while holding a handrail
	Step 3	Going up and down 5 low steps (15 cm) while holding a handrail
	Step 4	Going up and down 3 high steps (25 cm) while holding a handrail
Wearing clothes	Step 1	Monitoring the order and method of dressing, with maximum assistance of the therapist
	Step 2	Monitoring the order and method of dressing, with moderate assistance of the therapist
	Step 3	Monitoring the order and method of dressing, with minimum assistance of the therapist
	Step 4	Dressing by oneself
Catching things	Step 1	Catching a tennis ball with maximum assistance of a therapist (diameter 6.35 cm, weight 58.5 g)
	Step 2	Catching a tennis ball with minimum assistance of a therapist (diameter 6.35 cm, weight 58.5 g)
	Step 3	Catching an empty can
	Step 4	Catching an empty can and putting it on a 10 cm shelf

SUBJECTS AND METHODS

Subjects

The subjects in this study were 20 stroke patients who were hospitalized and receiving physical therapy from early July to the end of August 2013 at C hospital in Chungcheong-gbuk-do province. Ten of the subjects were allocated to a task-oriented training treatment group, and the other 10 to a general physical therapy control group. They were randomly and equally assigned to the experimental group (4 males, 6 females) or control group (4 males, 6 females). The mean ± standard deviation (SD) of the age, height, and weight of the experimental group were 61.5±7.2 years, 161±9.4 cm, and 59.6.1±14.3 kg. Four of the patients had right hemiplegia, and six had left hemiplegia. The Korean mini-mental state examination (K-MMSE)[11] score was 26.5±1.8. The mean ± SD of the age, height, and weight of the control group were 66.4±9.3 years, 160±7.2 cm, and 59.8±10.1 kg. Four of the patients had right hemiplegia, and six had left hemiplegia. The K-MMSE score was 26.0±1.4. The inclusion criteria for the study were as follows: a diagnosis of hemiplegia due to stroke, a morbidity period of 6 months or more, a score of 25 points or more on the K-MMSE, Stage 2 or lower on the Modified Ashworth Scale, an ability to understand the purpose of the study and follow instructions, and agreement to participate in the study. All subjects provided written informed consent prior to participation according to the ethical standards of the Declaration of Helsinki.

Methods

The Canadian Occupational Performance Measure (COPM) was used in the task selection. The COPM uses a 10-point scale to rate the importance of individual tasks.

Priority is placed on five tasks, with the greatest importance placed on the patient's evaluation of the outcomes of the training program[12, 13]. Following an interview with each subject by the researcher, five tasks were selected: indoor walking, outdoor walking, staircase climbing, wearing clothes, and picking up objects (Table 1). The selected tasks comprised four stages. If the patient was unable to complete the tasks in one week, they were repeated the following week. The participants practiced the tasks five times a week for 4 weeks. In each 30-min session, the tasks were performed three times for 10 min, with a 2-min break between each task. The control group received general physical therapy, including exercises aimed at improving gait ability and balance, for 4 weeks, five times a week, with each session lasting 30 min.

Balance ability was measured using the Berg Balance Scale (BBS)[14]. The BBS is used clinically for patients with elderly or hemiplegia resulting from a stroke to evaluate their balance ability during movement or in a standing position. It consists of 14 items, each scored from 0 to 4, giving a total maximum of 56.

The Modified Barthel Index (MBI) developed by Shah[15] was used to evaluate ADL. The ADL were divided into 10 detailed items, and were scored in each stage of the task according to the degree of assistance required. The total possible score was 100.

The self-efficacy of the subjects was assessed with a modified version of the general Self-Efficacy Scale (SES) developed by Sherer and Maddux[16] comprising 17 questions. Each question was assessed on a 5-point scale, with a higher score denoting greater self-efficacy. The reliability of this scale was Cronbach's $\alpha=0.86$[17].

All statistical analyses were performed using SPSS ver. 18.0 for Windows (SPSS, Chicago, IL, USA) was used to

analyze the collected data, and the statistical significance level was set at 0.05. To assess the homogeneity of the subjects, a χ^2 test and Mann-Whitney U test were used. A Wilcoxon signed-rank test and a Mann-Whitney U test were used to detect differences in the dependent variables of the experimental and control groups before and after training.

RESULTS

The results of the Wilcoxon signed-rank test of before-and-after changes in balancing ability, ADL, and self-efficacy showed that the BBS, MBI, and SES scores of both the experimental and control group increased significantly after training (p<0.05). The results of the Mann-Whitney U test also revealed significant differences in the BBS, MBI, and SES scores before and after training (p<0.01) (Table 2).

DISCUSSION

This study examined whether a 4-week task-oriented training program improved the balance, ADL, and self-efficacy of stroke patients. The task-oriented training program (experimental group) was more effective in improving the balance, ADL, and self-efficacy of hemiplegic stroke patients than the general physical therapy program (control group).

Comparison of the variation in the BBS scores of the experimental and control groups before and after training revealed a significant difference. The variation in the experimental group was greater than in the control group, with a measured difference of 1.8 points; however, this did not reach 4.66, which was the minimal detectable change (MDC), i.e., the minimum statistically significant variation[18]. The short duration of the training period may explain the findings, with 4 weeks possibly being insufficient to affect balancing ability. Bayouk[19] reported significant improvements in 10-m walking and balance (p<0.05) in chronic stroke patients who participated in an 8-week task-oriented training program, including sensory inputs. Ahn[20] reported that task-oriented training for chronic stroke patients increased BBS scores significantly, from 30.5±2.3 to 32.9.±1.7. Nichols[21] reported that balancing function was associated with ADL, such as walking, getting dressed, and movement, and that balancing function was necessary for the successful performance of these activities[22].

Comparison of the variation in the MBI before and after training revealed a score of 4.00±1.41 points for the experimental group and 2.00±1.41 for the control group, which was a significant difference (p<0.05). These results may be explained by the fact that task-oriented activities[23] replicating real-life situations were used. These promote brain reorganization and cerebral activation[24], and can maximize functional performance. In addition, these results may reflect the fact that the tasks are highly correlated[25] with balance and ADL in stroke patients.

Comparison of variation in the SES scores before and after training revealed a score of 6.20±2.90 for the experimental group and 2.20±1.55 for the control group, which was a significant difference (p<0.01). ADL and self-efficacy in stroke patients are highly correlated (r=0.698, p=0.000)[26], and

Table 2. Comparison of BBS, MBI, and SES scores between experimental and control groups

Variable		Pre Mean±SD	Post Mean±SD	Post-Pre Mean±SD
BBS	EG	35.0±5.8	36.8±5.6	1.8±0.4
	CG	33.3±4.4	34.1±4.3	0.8±0.6
				*
MBI	EG	58.4±11.5	62.4±11.0	4.0±1.4
	CG	50.5±10.1	52.5±10.4	2.0±1.4
				*
SES	EG	49.4±12.1	55.6±9.6	6.2±2.9
	CG	45.5±11.5	47.7±10.2	2.2±1.6
				*

EG: experimental group, CG: control group, BBS: Berg Balance Scale. *p<0.01.
MBI: Modified Barthel Index, SES: Self-Efficacy Scale

the improvement in self-efficacy in the present study may be associated with the improvement in ADL. The increase in self-efficacy may also be due to the motivational nature of the training, using patient-selected goal-setting and tasks. In addition, it is likely that by encouraging and praising the subjects as they progressed to high-level tasks, the physical therapist helped to improve self-efficacy.

The limitation of this study is the small sample number. Therefore, it is difficult to generalize the findings to other stroke patients. In addition, this study comprised tasks selected by the subjects, and this likely had a positive influence on self-efficacy. However, the study did not consider individual abilities, and potential compensatory patterns that may have developed during the training program could not be identified. To identify such patterns, future studies of programs comprising ADL tasks need to consider physical capabilities.

REFERENCES

1) Moreland JD, Goldsmith CH, Huijbregts MP, et al.: Progressive resistance strengthening exercises after stroke: a single-blind randomized controlled trial. Arch Phys Med Rehabil, 2003, 84: 1433–1440. [Medline] [CrossRef]
2) Dickstein R, Nissan M, Pillar T, et al.: Foot-ground pressure pattern of standing hemiplegic patients. Major characteristics and patterns of improvement. Phys Ther, 1984, 64: 19–23. [Medline]
3) Salbach NM, Mayo NE, Wood-Dauphinee S, et al.: A task-orientated intervention enhances walking distance and speed in the first year post stroke: a randomized controlled trial. Clin Rehabil, 2004, 18: 509–519. [Medline] [CrossRef]
4) Wee JS, Han JY, Lee SG: Brief cognitive and visuospatial assessment for patient with stroke and correlation of cognitive function and functional outcome. Ann Rehabil Med, 2002, 26: 237–242.
5) Bandura A: Self-efficacy: the exercise of control. New York: WH Freeman and Co., 1977.
6) Bandura A: Self-efficacy: Social foundation of thought & action, a social cognition theory. New Jersey: Prentice Hall, 1986.
7) Carr JH, Shepherd RB: Stroke rehabilitation, 1st ed. London: Helenemann, 2003.
8) Song CS: Effects of task-oriented approach on affected arm function in children with spastic hemiplegia due to cerebral palsy. J Phys Ther Sci, 2014, 26: 797–800. [Medline] [CrossRef]
9) Horak FB: Assumptions underlying motor control for neurologic rehabilitation. In: Lister MJ. (ed.), Contemporary Management of Moter Control Problems: Proceedings of II STEP conference. Alexandria: Foundation of

Physical Therapy, 1991, pp 11–27.

10) Kim BH, Lee SM, Bae YH: The effect of a task-oriented training on trunk control ability, balance, gait of stroke patients. J Phys Ther Sci, 2012, 24: 519–522. [CrossRef]

11) Kwon YC, Park JH: Korean Version of Mini-Mental State Examination (MMSE-K). Kor Neuropsychiat Assoc, 1989, 28: 125–135.

12) Carpenter L, Baker GA, Tyldesley B: The use of the Canadian occupational performance measure as an outcome of a pain management program. Can J Occup Ther, 2001, 68: 16–22. [Medline] [CrossRef]

13) Law M, Baptiste S, Carswell A, et al.: Canadian Occupational Performance Measure, 3rd ed. Ottawa: CAOT publication ACE, 1998.

14) Berg K, Wood-Dauphinee S, Williams JI: The Balance Scale: reliability assessment with elderly residents and patients with an acute stroke. Scand J Rehabil Med, 1995, 27: 27–36. [Medline]

15) Shah S, Vanclay F, Cooper B: Improving the sensitivity of the Barthel Index for stroke rehabilitation. J Clin Epidemiol, 1989, 42: 703–709. [Medline] [CrossRef]

16) Sherer M, Maddux JE: The self-efficacy scale: construction and validation. Psychol Rep, 1982, 51: 663–671. [CrossRef]

17) Lee S: The Correlation Study of Body Image, Self Efficacy and Self Care on Hemiplegia patients. The Graduate School of Sham Yook University, 1998.

18) Hiengkaew V, Jitaree K, Chaiyawat P: Minimal detectable changes of the Berg Balance Scale, Fugl-Meyer Assessment Scale, Timed "Up & Go" Test, gait speeds, and 2-minute walk test in individuals with chronic stroke with different degrees of ankle plantarflexor tone. Arch Phys Med Rehabil, 2012, 93: 1201–1208. [Medline] [CrossRef]

19) Bayouk JF, Boucher JP, Leroux A: Balance training following stroke: effects of task-oriented exercises with and without altered sensory input. Int J Rehabil Res, 2006, 29: 51–59. [Medline] [CrossRef]

20) Ahn MH, Ahn CS, Kim MC: Effect of selective-task vs set-task program on balance and weight bearing of stroke patient. J Phys Ther Sci, 2011, 23: 707–711. [CrossRef]

21) Nichols DS: Balance retraining after stroke using force platform biofeedback. Phys Ther, 1997, 77: 553–558. [Medline]

22) Perry J, Garrett M, Gronley JK, et al.: Classification of walking handicap in the stroke population. Stroke, 1995, 26: 982–989. [Medline] [CrossRef]

23) Carr JH, Sherpherd RB: A motor relearning programe for stroke, 2nd ed. Rockvill: Aspen, 1987.

24) Lee JH: The effect of task-oriented movement therapy on upper motor function, patterns and reorganization of motor network for stroke patients. The Graduate School of Daegu University, 2002.

25) Hsieh CL, Sheu CF, Hsueh IP, et al.: Trunk control as an early predictor of comprehensive activities of daily living function in stroke patients. Stroke, 2002, 33: 2626–2630. [Medline] [CrossRef]

26) Park SI, Jo BH: A study on the activities of daily living, self-efficacy, and the health promoting behavior in stroke patients. Kor J Rehabil Nurs, 2004, 7: 149–158.