



Original Article

Effects of individualized versus group task-oriented circuit training on balance ability and gait endurance in chronic stroke inpatients

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Abstract. [Purpose] The purpose of this study was to analyze the effects of task-oriented circuit training on the balance ability and gait endurance of chronic stroke inpatients. [Subjects and Methods] The participants were 30 patients who had stroke >6 months previously, resulting in a disability such as hemiparesis. The participants were randomly divided into the group task-oriented circuit training group and the individual task-oriented circuit-training group. They performed eight types of modified task-oriented training. Balance ability and gait endurance were measured by using the Berg balance scale questionnaire and the 6-min walk test, respectively, before and after the experiment. [Results] Significant differences were observed between before and after the intervention in all variables. There was a significant difference between groups in Berg balance scale scores; however, no significant differences were seen in the timed up and go test and the 6-min walk test. [Conclusion] The results of this study indicated that group exercise can better improve the balance ability of chronic stroke inpatients after stroke than can individualized exercise intervention.

Key words: Stroke inpatients, Task-oriented circuit training, Balance ability, Gait endurance

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INTRODUCTION

Stroke, a representative chronic neurological disease, is categorized according to the location of damage and causes different disabilities in patients, such as motor, perception, cognitive, and language disabilities¹⁾. Hemiparesis occurs in stroke inpatients and is a common disability that could restrict joint movement and reduce the ability of muscle contraction. In addition, motor disability can cause imbalance of the left and right sides of the body²⁾, reduce balance ability and gait endurance, and induce a fear of falling when performing physical activity³⁾.

Exercise therapy is gradually being recommended as a component of stroke rehabilitation programs for preventing adverse effects and improving function in patients. Several studies⁴⁻⁶⁾ have demonstrated the effects of training programs in preventing physical inactivity and improving gait ability in chronic stroke patients.

The task-oriented training designed by Shepherd and Carr in the 1980s is a kind of exercise therapy for stroke patients that is based on the motor learning theory, with emphasis on motor skill re-training. This method is a treatment that focuses on maximizing the effectiveness of the inner sense needed in task performance and then improves the adaptation ability⁷⁾.

In a previous study⁸⁾, it was shown that task-oriented training better improves functional ability than does traditional exercise intervention. In advanced studies⁹⁻¹³⁾ related to task-related training, it has been attempted to enhance the effects of

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intervention programs by controlling the parameters of stroke patients. Recently, group task-oriented intervention in circuit classes has been proposed as a method of improving the performance ability after stroke in task practice¹⁴). In another study, it was shown that group task-oriented intervention was as effective in improving gait ability as individual task-oriented circuit training¹⁵). Centered task-oriented training also can be an effective intervention to improve balance ability confirmed by using the Berg balance scale (BBS) in stroke inpatients¹⁶).

However, the effectiveness of task-oriented intervention between groups and individuals after stroke has not been investigated in recent studies. Therefore, the purpose of this study was to analyze the effect of task-oriented circuit training for comparing the differences between individualized and group-oriented interventions on the balance ability and gait endurance of stroke inpatients.

SUBJECTS AND METHODS

The subjects were 30 patients who developed hemiparesis at least 6 months previously, diagnosed at the Department of Neurosurgery of G hospital. They were randomly divided into the group task-oriented circuit training (GTCT) group (n=15; 8 males, 7 females; mean age, 50 ± 9.3 years) and the individual task-oriented circuit training (ITCT) group (n=15; 10 males, 5 females; mean age, 54 ± 7.1 years). Three subjects in the GTCT group and four subjects in the ITCT group were dropped from this study owing to personal reasons. Finally, 23 subjects were enrolled in the present study. This study was approved by the University of Sunmoon Research Ethics Review Committee (SM-201504-007-1; May 29, 2015), and the study protocol was conducted in strict accordance with the Declaration of Helsinki. Written informed consent was obtained from each subject. Patients were excluded if they had other neurological problems such as dependent gait, surgical lesions affecting walking, sight and vestibular lesions affecting balance, or a score of <23 on the Mini-Mental State Examination-Korea.

The program was carried out in the exercise therapy room of G hospital for a total of 18 times, 3 times a week for 6 weeks. Each group was composed of two or three patients, and each group was designated a partner to enhance optimal exercise performance through the subjects' motivation and enhanced competitive spirit. The task-oriented circuit training intervention program consisted of eight types of modified exercise including straight leg raise, kicking a ball toward the wall, sitting up and walking, obstacle walking, treadmill walking, maximal speed walking, sitting on a Swiss ball, and playing a video game for 50 min, and was conducted according to the type of circuit training. Warm-up and cool-down for 5 min were performed before and after exercise, respectively.

Dynamic balance was measured by using the BBS and timed up and go (TUG) test, and gait endurance was measured through the 6-min walk test (6MWT). The BBS is used to measure the static and dynamic balance ability of adult neurology inpatients, with 0 as the lowest point, 4 as the highest point, and 56 points as the perfect score (the higher the score, the better the balance). The TUG test was done with the subject first seated on a 50-cm-high chair with armrest; then, the time from standing up and walking up to 3 m to the time the patient returns to the chair was measured. The 6MWT was done on a 50-m rectangular track on which the participants were instructed to walk as fast as they can and sit thereafter. Balance and gait endurance were measured before and after the experiment.

The collected data were processed and analyzed by using the Windows SPSS/PV ver. 17.0 statistics program. For the participants' common characteristics, an independent t-test was used to determine the descriptive statistics and the differences between groups. To compare the groups before and after the training program, a paired t-test was used. The significance level was set at <0.05.

RESULTS

Table 1 shows the differences between the two groups in the BBS, TUG, and 6MWT scores of chronic stroke inpatients after 6 weeks of the task-oriented circuit training program. Significant differences were found between pre- and post-intervention in all variables ($p < 0.05$). In addition, a significant difference was seen between the two groups only for BBS ($p < 0.05$); no significant differences were found in TUG and 6MWT between the two groups.

DISCUSSION

The results in the BBS, TUG, and 6MWT in this study showed an increase in both groups, and only the BBS parameter showed a significant difference between the two groups. In addition, the variations in the TUG and 6MWT scores were more greatly increased in the GTCT group than in the ITCT group; however, the results did not show a significant difference between the two groups. In the study by English et al.¹⁰), the participants of a task-oriented circuit training program showed a significant increase in BBS scores. In Dean et al.'s study¹¹), it was also confirmed that a task-oriented circuit training program resulted in a significant decrease in the TUG score. In the present study, group training was shown to be more effective than individual therapy in improving balance ability and gait endurance. These results indicate that participants in the GTCT group (who exercised with other inpatients with hemiparesis) developed psychological stability owing to the encouragement they received from each other, conclusively increasing the effectiveness of the exercise.

However, in Salbach et al.'s study⁹), no significant difference was observed between pre- and post-evaluation in the BBS

Table 1. Difference of balance ability and gait endurance between interventions

		GTCT	ITCT
BBS score	Pre	44.5 ± 3.8	41.8 ± 3.8
	Post	52.1 ± 2.52	45.7 ± 6.3*#
TUG (s)	Pre	18.1 ± 6.5	18.7 ± 5.8
	Post	14.3 ± 6.1#	16.1 ± 4.7#
6MWT (m)	Pre	252.5 ± 94.0	256.2 ± 98.9
	Post	345.5 ± 131.4#	297.2 ± 81.3#

Values are means ± standard deviation. *Significant difference between groups ($p < 0.05$). #Significant difference between pre- and postintervention ($p < 0.05$). GTCT: group task-oriented circuit training; ITCT: individual task-oriented circuit training; BBS: Berg balance scale; TUG: timed up and go test; 6MWT: 6-min walking test

and TGU scores in 91 stroke patients who participated in a 10-cycle task-oriented circuit training program. Although the intervention method in the previous study was similar to that of the present study, the method of selecting the subjects was different. That is, the participants of this study were hospitalized during the experimental period, whereas the subjects in the previous study were outpatients. As inpatients require exercise more than outpatients, it was considered that exercise is more effective in inpatients.

In this study, the 6MWT was used to measure the effect of the applied intervention on gait endurance. In the study by Lord et al.¹⁷⁾, the 6MWT was found to be an effective measurement method for gait endurance. In previous studies^{8, 15, 18)} related to gait ability in stroke patients, circuit-based rehabilitation was shown to lead to improvements in gait endurance. In another study by Salbach et al.⁹⁾, the distance and speed of gait in chronic stroke patients were significantly increased after a task-oriented circuit program for 6 weeks. In the present study, the distance of the 6MWT was significantly increased after the applied intervention program for 6 weeks in both groups. The positive results of walking in this study were consistent with those of the study by Manning et al.¹²⁾ in which gait endurance and speed were improved through gradually increasing the speed of the treadmill.

In conclusion, the effectiveness of a task-oriented exercise intervention was shown through the application of group task- and individual task-intervention to chronic stroke inpatients. The results of this study indicate that group training is more effective in maintaining balance ability in stroke inpatients with hemiparesis than individualized training.

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