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The Effects of Task-Oriented Activities on Weight Support by the Paretic Side in Stroke Patients

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Abstract: The purpose of this study was to investigate what influence the task-oriented activities on weight support for the stroke patients with hemiplegia. A total of 30 patients with stroke patients participated. Subjects were randomly divided into 15 patients in a task-oriented activities group and 15 patients in a simple repetitive balance training group both therapy was applied for 30 min in a day and 3 times in a week for 4 weeks. The MTD balance system was used to evaluate weight support by paretic side in stroke patients. To compare the treatments we used paired t-test and independent sample t-test. The task-oriented activities group and simple repetitive balance activities group showed statically significant differences before and after all of the posture. The task-oriented activities group showed a more significant difference compared with the simple repetitive balance training group when standing up from a chair and stretching the impaired arm. The task-oriented activities on a paretic side for 4 weeks had an effect on weight support after stroke patients with hemiplegia.

Key words: Stroke, task oriented activities weight support, paretic side, hemiplegia, evaluate

INTRODUCTION

Stroke is caused by interruption of the cerebral blood supply or cerebral hemorrhage (Sims and Muyderman, 2010). According to Taub *et al*. (2002) movement function, sensory capacity and exercise ability on the paretic side deteriorate due to stroke, resulting in compensatory overuse of the non-paretic side. Falls in stroke patients due to impaired balance ability result in both physical injury and fear of recurrence and lead to self-limitation of physical activities (Watson *et al*., 2004; Park and Bae, 2012). Neurodevelopmental treatment, proprioceptive neuromuscular facilitation, constraint-induced exercise treatment and dynamic observation training have been used to enable recovery of balance ability and function in stroke patients.

This task-oriented approach involves actively challenging patients to learn problem-solving techniques based on functional tasks, rather than repetitive practice of normal movement patterns (Bang, 2007). In a study of stroke patients using this task-oriented approach, a stretching task resulted in improved balance ability (Dean *et al*., 2000; Kim, 2008) reported that task-oriented training showed statistically significant differences in trunk control capacity, balance and walking ability in stroke patients. Park and Bae reported that task-oriented activities significantly improved balance ability and occupational performance measures. However, prior reports are mostly single-case studies involving task oriented activities in a treatment room environment that patients are unlikely to encounter in real life. Therefore, the purpose of study provide activities related to common-life situations and to investigate the effect of weight support for the paretic side, also develop effective treatment to improve function in stroke patients.

Procedure for paper submission

Literature review: This study aims to investigate what influence the task-oriented activities on weight support by the paretic side in stroke patients. Carr and Spheherd reported that task-oriented activity is a more effective treatment for stroke as it offers a variety of functional activities to the patient and aids in the performance of real-life movements (Bang, 2007). The task-oriented training in this study did not use simple repetitive tasks as in previous studies but offered a selection of tasks that

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were closely related to real-life activities and the actual home environment so that the subjects could perform self-care when they returned to their home or society. The findings of this study are as follows.

First, there were significant differences in both control and experimental groups for all 4 activities used to measure body weight support before and after the study. The task-oriented activities group and simple repetitive balance activities group were both effective in increasing weight support on the hemiplegic side but the experimental group showed greater improvement than the control group, suggesting that task-oriented training is more effective. Gerardin *et al.* (2000) reported that performance of intervention methods appropriate for functional capability and applicable to real-life situations may aid concentration during the task and activate the cerebral cortex, thus motivating the patient (Taub *et al.*, 2002).

Second, the experimental group showed statistically significant improvement in weight support on the paretic side when standing up from a chair ($p<0.05$) and when stretching the impaired arm ($p<0.01$) compared with the control group. This result corresponds to previous reports that task-oriented programs had significant positive effects compared with treatments based on repetition of simple motions (Park and Bae, 2012). Moreover, standing up from the chair, filling the cup with water and hanging the washed laundry corresponded to previous reports involving standing up from a sitting, in which the hip and knee joint change from a bent to a resting position; in the stage shortly after standing, the extensor muscles of the hip and knee help maintain balance ability (Park *et al.*, 2013).

To summarize, task-oriented training applied to the experimental group included purposeful activities and showed improvements in weight support on the hemiplegic side for some motions, compared with the results for simple, repetitive balance activities.

MATERIALS AND METHODS

Experimental subjects: The experiment was conducted in B hospital of Gyeonggi Province, South Korea. Thirty patients diagnosed with stroke for at least 6 months were randomly allocated between 2 groups. The study was conducted from February to April 2015 with the following inclusion criteria:

- Diagnosed with cerebral hemorrhage or cerebral infarction for >6 months
- Score of at least 24 points on the Korean Mini-Mental State Examination (MMSE-K) with no difficulty comprehending instructions or communicating
- Capable of walking >10 m without supportive devices
- Without joint deformity, musculoskeletal pain, fractures or hemianopsia
- Patient (or guardian) fully comprehends the object of this study and agrees to participate

Evaluation tools

MTD balance system: The MTD balance system (Germany) was used to evaluate left and right balance ability. Static standing, 30 knee-bend posture, standing up from a chair and stretching the impaired arm were evaluated and weight support by the paretic side (%) during the 4 movements was measured. The system measures center of gravity calculated for the percentage body weight. The evaluation details are as follows:

- Measure left and right weight bearing in static standing position with eyes open for 10 sec
- Measure left and right weight bearing, maintained for 10 sec with knees bent at 30°
- Measure left and right weight bearing for 10 sec while the seated subject stands up from a chair
- Measure left and right weight bearing for 5 sec with the paretic arm stretched to the side

Intervention program: The patients were divided into control groups and experimental groups (15/group) the experiment was conducted 3 times weekly, 30 min/session for 4 weeks. The experimental group was given task-oriented activities and the control group a simple repetitive balance activity. The 5 task-oriented activities (Table 1) that were meaningful and possible were chosen for the experimental group based on meetings with subjects and selected from among standardized tasks suggested by the Assessment of Motor and Process Skills (AMPS) these activities are often encountered and applied in real-life situations. The activities were each performed for 5 min with a 1 min rest period between tasks. The tasks were initiated at the patient's discretion and the speed, intensity and difficulty were gradually increased with the patient's agreement over the 4 weeks of the experiment.

The control group performed simple repetitive balance activities with treatment tools including a balance board and trampoline. The intervention schedule was identical to that of the experimental group.

Statistical processing: The data were statistically processed using SPSS 18.0 for windows. Data analysis showed a normal distribution for all variables. The 4 weeks after the experiment, a t-test was performed

Table 1: Task-oriented training

Task	Training methods
Fill a cup with water from there frigerator	From a standing position 3 m away, go to the refrigerator and open it using the impaired and normal hand, take the water bottle in the refrigerator and walk 3 m to the table. Pour water into the cup and return the bottle to the refrigerator
Clean the window	In a standing position, use a prepared spray to clean an indicated mark on the window, holding a wipe with one or both hands. Move toward the side of impairment while cleaning the window
Hang the washed and dried laundry	From a standing position, go to the washing machine and bend down to take the laundry using the normal or impaired hand and hang the laundry on a drying rack 2 m away
Move an object while walking	Use both hands to hold a tray with a plastic cup on it and walk, being careful not to drop the tray. For a patient whose upper limb is rigid or otherwise difficult to use, the therapist may support the injured upper limb while the patient is walking
Go up and down the stairs	Go up and down stairs with steps 16 cm high, one by one. Patients with impaired balance may hold the rail. As the experiment proceeds, walk alternatingly up and down one step and hold the rail less frequently, if possible

to compare the balance ability of affected side and non-affected side and independent sample t-testing was performed to compare the difference between the control and experimental groups. For statistical significance, α was set to 0.05.

RESULTS AND DISCUSSION

General features of the task oriented activities group: The general features of the task oriented activities group are shown in Table 2. There was no statistical difference between the 2 groups ($p>0.05$).

Comparison of results before and after the experiments Comparison of results before and after the intervention in the task-oriented training group: In the experimental group, the weight support distribution in the static standing posture changed from 39.93±4.38% to 48.93±5.18% on the hemiplegic side ($p>0.001$) from 40.33±6.49 to 44.26±5.76% in the 30° knee-bend posture ($p>0.01$) from 38.20±5.60 to 43.46±4.42% when standing up from a chair ($p>0.01$) and from 57.93±4.44 to 62.73±4.78 when stretching the impaired arm ($p>0.001$). All of the postures displayed statistically significant differences for weight support on the hemiplegic sideas shown in Table 3.

Comparison of results before and after the experiments in the simple repetitive balance activities group: In the control group, the weight bearing distribution in the static standing posture changed from 42.86±4.29 to 45.60±4.45% on the hemiplegic side ($p>0.01$) from 41.40±5.91 to 44.06±6.35% in the 30° knee-bend posture ($p>0.05$) from 40.46±5.04 to 42.86±5.16% when standing up from a chair ($p>0.05$) and from 57.73±4.60 to 60.46±4.77 when stretching the impaired arm ($p>0.001$). All of the postures displayed statistically significant differences for weight support on the hemiplegic sideas shown in Table 3.

Table 2: General characteristics of subject

Variables	Division	Task-oriented training group (n = 15)	Simple repetitive balance activities group (n = 15)
Gender	Man	8 (53.3%)	10 (66.7%)
(persons)	Women	7 (46.7%)	5 (33.3%)
Brain injury	Hemorrhage	10 (66.7)	8 (53.3)
type	Infarction	5 (33.3)	7 (46.7)
Paretic side	Left	8 (55.3)	9 (60.0)
	Right	7 (46.7)	6 (40.0)
Average age		46.73±15.19	50.35±18.44
Average disease period (month)		30.53±20.84	32.68±19.72

Table 3: Comparison of results before and after the intervention

	Task-oriented training group		Simple repetitive balance activities group	
	Pre-test	Post-test	Pre-test	Post-test
Static standing posture	39.93 (4.63)	48.93 (5.18)***	42.86 (4.29)	45.60 (4.45)***
30° knee-bend posture	40.33 (6.49)	44.26 (5.76)**	41.40 (5.91)	44.06 (6.35)*
standing up from a chair	38.20 (5.60)	43.46 (4.42)***	40.46 (5.04)	42.86 (5.16)*
stretching the impaired arm	57.93 (4.44)	62.73 (4.78)***	57.73 (4.60)	60.46 (4.47)***

The values are mean (standard deviation), MTD (%), *p<0.05, **p<0.01, ***p<0.001 by paired t-test

Table 4: Comparison of results between the two groups

Variables	Task-oriented activities group (Mean±SD)	Simple repetitive balance activities group (Mean±SD)	t-values
Static standing posture	2.66±3.90	2.73±1.62	-0.610
30° knee-bend posture	4.06±6.77	2.66±3.90	0.693
Standing up from a chair	5.26±2.18	2.40±3.41	2.736*
Stretching the impaired arm	4.80±2.54	2.73±1.27	2.813**

The values are mean, MTD (%), *p<0.05, **p<0.01, ***p<0.001 by paired independent t-test

Comparison of results between the two groups: A comparison of control and experimental groups showed statistically significant differences for 2 activities; the experimental group increased 5.26±2.18% and the control group 2.40±3.41% when standing up from a chair ($p<0.05$) the experimental group also increased 4.80±2.54% and the control group 2.73±1.27 when stretching the impaired arm ($p<0.01$). However, there was no statistical difference for static standing posture and 3° knee-bend postureas shown in Table 4.

CONCLUSION

This study aims to investigate the influence of task-oriented activities on body weight support on the hemiplegic side by allocating stroke patients to a group performing task-oriented training and another group performing simple, repetitive balance activity.

From February to April of 2015, the experiment was conducted by dividing 30 subjects into two groups in B hospital in the Gyeonggi-do Province which the task-oriented activity, consisting total of 5 tasks was conducted 3 times weekly for 4 weeks. MTD balance system was used to measure weight support which static standing up, 30° knee bending posture, standing up from a chair and stretching the impaired arm was evaluated. The results are as follows.

First, the weight support on the hemiplegic side showed aimportant difference between control and experimental groups for all 4 activities. Second, the experimental group showed a more important difference compared with the control group when standing up from a chair and stretching the impaired arm.

The research suggested that task-oriented training in comparison with simple repetitive balance activity was more effective in improving weight support on the hemiplegic side for some stroke patients. Future studies require a greater number of experimental subjects to determine the mechanism of effect of task-oriented training as well as a longer duration for the experimental period to enable development of an effective treatment approach to improve function in stroke patients.

REFERENCES

Bang, Y.S., 2007. The effects of task-oriented activities on the cognitive function and performance of activities of daily living in stroke patients. J. Korean Acad. Occup. Ther., 15: 49-61.

Dean, C.M., C.L. Richards and F. Malouin, 2000. Task-related circuit training improves performance of locomotor tasks in chronic stroke: A randomized, controlled pilot trial. Arch. Phys. Med. Rehabil., 81: 409-417.

Gerardin, E., A. Sirigu, S. Lehericy, J.B. Poline and B. Gaymard *et al*., 2000. Partially overlapping neural networks for real and imagined hand movements. Cereb. Cortex, 10: 1093-1104.

Kim, B.H., 2008. The effect of a task-oriented training for trunk control ability, balance and gait after stroke. Master thesis, Graduate school, Sahmyook University, Seoul, South Korea.

Park, J., Y.K. Woo and S.Y. Park, 2013. Effects of sit-to-stand training on unstable surface on balance in subject with stroke. Phys. Ther. Korea, 20: 1-8.

Park, S.J. and S.Y. Bae, 2012. The effects of task-oriented activities on ADL performance, balance and satisfaction in chronic stroke patients. J. Korea Soc. Occup. Ther., 20: 1-11.

Sims, M.R. and H. Muyderman, 2010. Mitochondria, oxidative metabolism and cell death in stroke. Biochem. Biophys. Acta, 1802: 80-91.

Taub, E., G. Uswatte and T. Elbert, 2002. New treatments in neurorehabiliation founded on basic research. Nat. Rev. Neurosci., 3: 228-236.

Watson, S.C., L.S. Chipchase and S. Mackintosh, 2004. Balance, fear of falling, pain and gait aid use by low care older people: Pilot study. Australas. J. Ageing, 23: 77-81.