Original Investigation / Özgün Araştırma

Comparison of Effectiveness of Specific Balance Strategy Training Programme with General Balance Training Programme on Balance Performance in Chronic Stroke

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ABSTRACT

Objective: Balance impairment following stroke can lead to functional limitations. Balance training has shown positive results on balance abilities of the in stroke. The aim of this study is to compare the effects of specific balance strategy training programme with general balance training in individuals with chronic stroke.

Methods: The design was repeated measure experimental study carried out at Pt. DDU Institute for Handicapped and ISIC Institute of Rehabilitation Sciences, New Delhi, India with total duration of 2 weeks. 24 chronic stroke patients participated in the study. The participants were randomly assigned to one of the two groups. Group-1 (n=12) received specific balance strategy training and Group-2 (n=12) received general balance training for sixty minutes, five days per week.

Results: Balance performance of subjects was evaluated on Berg Balance Scale (BBS) and Timed Up and Go Test (TUGT). After two weeks of intervention period, there was no significant difference between the groups in improving balance in subjects with chronic stroke. But a within group analysis showed a significant improvement in both groups at p≤ 0.05. Both the interventions resulted in significant improvement in post intervention scores of BBS (group-1 t= 6.071, p= 0.001; group-2 t=6.514, p=0.00`) and TUGT (group-1 t=5.675; p=0.001; group-2 t=4.238, p= 0.001).

Conclusion: This study concludes that there is no significant difference between specific balance strategy training and general balance training in improving balance performance in chronic stroke.

Keywords: Balance, stroke, balance training

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Received/Geliş Tarihi: 28.06.2014
Accepted/Kabul Tarihi: 12.02.2015

Introduction

Stroke is one of the major cause of death and disabilities like physical dependence, cognitive decline, dementia, depression and seizures, which leads to high costs involved in providing care with negative social impact (1).

Postural control is fundamental to maintain balance. The important resources for postural control are movement strategies, biomechanical constraints, cognitive processing, perception of the verticality (visual and postural), sensory modalities (somatosensory, visual and vestibular) and the sensory reintegration and reweighting in central nervous system (CNS) , which can be impaired after a stroke (2). Patients with stroke exhibits increased sway during quiet standing, uneven weight distribution with increased weight bearing on the unaffected limb, decreased weight-shifting ability in stance, and abnormal postural responses (4-6).

Since balance is essential to all functional activities during sitting and standing, balance impairments following stroke thus lead to poor recovery of activities

of daily living (ADL) and mobility and an increased risk of falls which can be as high as five per year in the first year post-lesion (7,8). These falls can lead to pathological events (e.g. hip fractures), causing further declines in function and disability status (9). Therefore, balance training and optimization of function and mobility should be a major focus of rehabilitation programs. A task oriented approach to retraining balance and mobility has emerged as an effective model of intervention over the last decade. Nitz and Choy, in their study determined the effectiveness of specific balance strategy training programme for preventing falls among older adults (10).

There are various treatment approaches used for stroke based on neurophysiological, motor learning and orthopaedic principles but they do not specifically target balance and there is inconclusive evidence that one approach is effective than the other in the recovery of postural control.Evidences suggest that exercises can improve the balance abilities of the patients post stroke (11-14). Aerobic exercises and task oriented exercise programs showed convincing results for balance improvement in chronic stroke survivors (15-17). It is was suggested in a systematic review that balance and walking capacity can be improved with specific exercise modalities in stroke patients (14).

So this study aims to determine whether specific strategy balance training programme using workstation is superior to general balance exercises for improving balance in chronic stroke.

Materials and Methods

Subjects

A Sample of 24 chronic stroke with stroke were recruited from Pt. D.D.U. Institute for Handicapped and from ISIC Institute of Rehabilitation Sciences, New Delhi. The criteria for participant selection for the study were, that participant should be case of first stroke, duration since stroke more than 6 months, ability to follow verbal commands, MMSE (18) score > 24 and able to walk independently with or without assistive devices. Subjects were then randomly divided into 2 groups after getting the consent from the participants. The study was approved by research and ethical committee of ISIC institute of Rehabilitation Sciences, New Delhi, India.

Design and Setting

The design was repeated measure experimental study for five times a week for two weeks. Subjects of both groups were assessed before and after the training on the outcome measures i.e. Berg Balance scale and Timed Up and Go test. Subjects in the group 1 underwent specific balance strategy training programme while subjects group 2 underwent general balance exercise programme. The duration of each session was sixty minutes per session.

The exercise for group 1 was designed to focus on a specific task that addresses various aspects for balance including functional strength, flexibility, balance strategy practice, sensory integration and added attention demands during function and multitask practice. Various simple tasks are selected such as sit to stand and this task will be practiced using different heights of chairs, with or without upper limb assistance, balancing a cup with or without water on a saucer or while adding a cognitive task to the manual task. Each station task is graded to cater to various levels of ability so that participants can have the level of difficulty progressed to increase the challenges (10). The components of exercise in group 2 consisted of active stretching and strengthening of the upper and lower limb muscles, marching on spot, forwards, backwards and to the sides (19). This programme initially started with a low level of intensity (low frequency and repetitions) of individual exercises and was progressive over two weeks.

Outcome

The outcome measures used to assess the balance performance of subjects was on Berg Balance Scale (BBS) and Timed Up and Go Test (TUGT).The pre training evaluation was done on one day prior to beginning of the study and the post training evaluation was done next day after the completion of training. The demographic characteristic of subjects like age, height, weight and duration since stroke was also collected.

Berg Balance Scale (BBS)

The BBS is a 14-item scale that quantitatively assesses balance hrough direct observation of their performance. The scale required 10 to 20 minutes The items are scored from 0 to 4, with a score of 0 representing an inability to complete the task and a score of 4 representing independent item completion. A global score is calculated out of 56 possible points. Scores of 0 to 20 represent balance impairment, 21 to 40 represent acceptable balance, and 41 to 56 represent good balance. The scale was reported to be reliable and valid tool for measuring balance control in stroke patients (20,21). The scores obtained during the assessment were used in the data analysis.

Timed Up and Go Test

The Timed Up & Go (TUG) test is a simple and quick functional mobility test. This test measures the time it takes a subject to stand up from a chair, walk a distance of 3 m, turn, walk back to chair & sit down. TUGT was found to be an reliable and valid measure for assessing balance and mobility in these type population (22,23). The average of three trails was done and used for data analysis.

Data Analysis

Statistical analysis was done using SPSS version 17. Independent t test was used to analyze age, height, weight post stroke duration and MMSE scores between group-1 and group-2. Within group analysis between pre and post intervention scores of BBS and TUGT was performed using paired t-test.

Results

A total of 24 subjects participated in the study with 12 subjects in each group. Group 1 consisted of 10 males and 2 females (5 left and 7 right sided hemiplegia) while group 2 consisted of 9 males and 3 females (8 left and 4 right sided hemiplegia). All the subjects were community walkers without any assistive device for walking; in group 1, 8 were most limited community walker and 4 were least-limited community walker and in group 2 , 5 were most limited community walker and 7 were least-limited community walker (24). The mean + SD, of age, weight, MMSE score and duration of stroke is tabulated in Table 1.There was no significant difference between the groups for the demographic characteristics of subjects in the study. The mean + SD, of the pre and post training scores of BBS and TUGT for group 1 and 2 is given in Table 2.

Post intervention scores of Berg balance scale (BBS) between group 1 and group 2 showed no significant difference (t-value = 0.38, p-value = 0.70). Post intervention Timed Up and go test (TUGT) scores between group 1 and group 2 also showed no significant difference (t-value = 0.08, p-value = 0.93) (Table 3).

The pre and post intervention scores for Berg balance scale (BBS) of subjects in group1differed significantly as seen on paired t-test analysis (t-value = 6.07, p-value = 0.001).The pre and post intervention scores of Timed Up and Go Test (TUGT) also differed significantly (t-value = 5.67, p-value = 0.000).The pre and post intervention scores for Berg balance scale (BBS) of subject in group 2 differed significantly (t-value =6.51, p-value = 0.000) The pre and post intervention scores of Timed Up and Go Test (TUGT) also differed significantly (t-value = 4.23, p-value = 0.001).

Discussion

This study was done to compare the effectiveness of specific balance strategy training program versus general balance exercises in individuals with chronic stroke. The subjects in both groups were matched with respect to their age, height and weight. On comparison between

Table 1. Comparison of demographic characteristics between the groups.

Demographic characteristics	Group 1 (n=12;m=10,f=2) (mean± S.D)	Group 2 (n=12;m=9,f=3) (mean± S.D)	t	p
Age(years)	53.83 ± 10.73	56.75 ± 9.58	0.70	0.49
Height(cm)	167.85 ± 7.14	166.18 ± 8.84	0.50	0.61
Weight(kg)	64.92 ± 7.90	70.17 ± 9.65	1.45	0.15
Duration(months)	15.17 ± 6.96	23.42 ± 21.31	1.27	0.21
MMSE Score	24.83 ± 0.83	25 ± 0.74	-0.58	0.61

*significant at p≤0.05, **m:** male, **f:** female*

Table 2. Pre and post training, mean + S.D, Berg Balance Scale and Tied Up and Go Test.

Time of measurement	Balance scale	Group 1 (Mean ± SD)	Group 2 (Mean ± SD)
Pre training	Berg Balance scale	39.15 ± 7.16	41.50 ± 4.62
	Timed up and go test	33.44 ± 11.06	31.57 ± 10.23
Post training	Berg Balance scale	42.17 ± 6.01	43.00 ± 4.53
	Timed up and go test	29.80 ± 9.57	30.12 ± 10.09

the both groups, no statistically significant difference on pre intervention Berg balance scale (BBS) and Timed Up and Go Test (TUGT) scores was observed.

The post intervention scores of specific balance strategy training program group (Group 1) have shown statistically significant improvement as compared to their pre intervention scores. The pre and post intervention scores of general balance and mobility training group (Group 2) also differed significantly. This means that there was an improvement in balance performance of subjects of both the groups. Our results are consistent with the previous studies that examined the effects of physical therapy on balance performance in patients with stroke. Duncan et. al, studied the effects of a structured, progressive program of therapeutic exercise in chronic stroke and found gains in endurance, balance and mobility beyond those attributable to spontaneous recovery and usual care (25). Hammer et. al, also concluded that the balance ability of the patients post stroke can be improved by various physical therapy interventions. They also stated that individuals with stroke can regain their balance through exercises that target balance even in the sub acute and chronic stages post stroke (26).

The balance performance in subjects of group 1 improved after the period of two weeks of intervention. Factors that might have contributed to the improvement in balance of this group may be due the individual components of this intervention program which were within the context of everyday functional tasks. The activities challenged the limits of stability to maximum (10). Improvement in balance scores of participants in group 2 can be attributed to various factors such as gentle stretching to the upper and lower limb muscles, marching, alternate upper and lower limb movements. These exercises are part of various previous studies and have been used to improve balance performance of subjects with stroke (14,12).

In spite of the difference between the content of the two balance training interventions given to the two groups, there was no statistically significant difference between the balance performance of both the groups. These findings does not support the findings of the previous study done by Nitz and Cohy (10) in elderly population in which they concluded that the specific balance strategy training group showed better results. These may be due to small sample size, that may have contributed to a type – II statistical error, and further research with larger sample sizes can exclude that possibility. Although not evident statistically, clinical scores of BBS and TUGT in group 1 were comparatively better as compared to group 2.The percentage change in mean scores of BBS in group 1 was 7.1 % where as it was 3.6 % in group 2,in case of TUGT the reduction in score was -10.89% while it was only -4.5% in group 2 (Table 4).

Since falls are so common in stroke population, a major challenge is to reduce the number of falls and injuries without lowering the levels of activity (8). Addition of the balance training interventions to the conventional treatment can help improve the balance abilities of the patients with chronic stroke and thus reduce the incidence of falls and the related morbidity

Table 3. Comparison of pre and post training scores between group 1 & 2 with effect size.

Balance scale	Time of measurement	t	p	Effect size
Berg Balance scale	Pre training	0.43	0.67	----------
	Post training	0.38	0.70	0.013
Timed up and go test	Pre training	0.71	0.48	----------
	Post training	0.08	0.93	0.01

significant at p≤0.05

Table 4. Comparison of post training scores within groups with effect size and % change in scores.

Balance scale	Group	t	p	Effect size	% Change
Berg Balance scale	Group 1	6.071	0.001*	0.22	7.71
	Group 2	6.514	0.001*	0.16	3.6
Timed up and go test	Group 1	5.675	0.001*	0.17	-10.89
	Group 2	4.238	0.001*	0.07	-4..5

**significant at p≤0.05*

and mortality. The exercise program used in this study can easily be implemented due to the well described exercises and in addition all of the necessary equipments are portable; thus making it possible to exercise without transfer to a health care facility.

Future research can include acute or subacute cases of stroke. This may yield additional information with regard to the effectiveness of the balance training interventions used in the study for improving balance skills in groups of patients with at different stages of recovery following stroke. A follow up data of all the participants can also be obtained to check the long term benefits of the balance training interventions. The effectiveness and feasibility of these interventions can be studied further when the exercises are performed by the subjects at home in absence of any professional so as to establish these interventions as a part of home exercise program.

The sample size was too small, future researches with a larger sample size may help to establish the effectiveness of the balance training programmes. The inclusion criteria was specific and the sample was recruited from the Delhi region only. So the results may not be applicable to a larger or more diverse population of stroke. The duration of balance training, may not have been long enough to show significant changes and we haven't taken into consideration of the stage of recovery. Also, no follow-up measures were taken as a part of the study to assess the retention of balance improvement over a longer time span.

Conclusion

The results points to the fact that there is no difference between the training strategies on balance in chronic stroke, but this result should be read with caution as the sample size was too small.

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