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Orignal Article

Effectiveness of Balance Training and Postural Stability in Post Stroke Patients: Randomized Controlled Trial

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ABSTRACT

When balance impairment and functional disorientation emerge after a stroke, balance incoordination is one of the most common complications. The basic goal of stroke rehabilitation is to improve postural stability. Balance training combined with sensory integration appears to be beneficial. **Objective:** To assess the effects of task-oriented balance training with and without sensory input on postural stability and balance coordination in stroke patients. **Methods:** A total of 60 stroke patients participated in this randomized controlled experiment. Both genders, with a stroke, age of over 40 years, able to stand for at least 5 minutes without assistance, and patients with functional mobility grades of 2, 3, and 4 were included in the study. The BERG Balance Scale was utilized to assess each group, which had 40-minutes training sessions three times a week for six weeks. The baseline 3rd week and the last 6th week were used to evaluate the participants. **Results:** Both groups showed considerable improvement in the BERG Balance Scale after 6 weeks of treatment. The (p=0.004) in the control group, but (p=0.001) in the experimental group. BESS also demonstrated significant development in both the experimental and control groups, with p values (p0.001) for each group. **Conclusions:** In this study, task-oriented balance training with sensory input showed greater improvement in balance coordination and postural stability in stroke patients than task-oriented balance exercises without sensory integration.

INTRODUCTION

The mortality rate is higher in underdeveloped countries. In Pakistan, however, there is no specific stroke estimate. The annual occurrence rate is likely to be 250 per 100,000, with 350 expected in the near future [1]. The most well-known cause of death in the world is stroke. For the first time, Hippocrates (the father of medicine) coined the term 'apoplexia' to describe the sudden blackout and loss of function caused by a cerebrovascular accident [2]. Stroke has a negative influence on families due to poor dietary habits [3]. Imbalance is a significant aspect of stroke; this attribute demonstrates impairment in both fine and difficult activities; balance incoordination is the most accurate predictor of falls, which also causes panic in stroke patients. The risk of fall confines the patient from daily activities. That's why balance training needs to be done in post-stroke patients [4,5]. The benefits of training include developments in functional consequences such as activities of daily living and instrumental activities of daily living [6]. There are a lot of people who have had both acute and chronic strokes. If a person survives a stroke, he will

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develop other problems such as mental disorders and exhaustion [7,8]. Long-term disability and mobility limitations in the upper and lower limbs are common in stroke patients [8,9]. In 80% of stroke patients, limb function is impaired, resulting in limits in activities of daily living, imbalance, and ambulation, as well as poor quality of life [3,6]. Initially, a stroke causes a loss of motor and sensory function on the contralateral side of the body, which can affect half of the body, one arm, and one leg, making it difficult for the patient to move [10,11]. The basic goal of stroke recovery is balance re-education in order to regain stability. According to studies, if a stroke victim lives in society, there is a high risk of falling, thus it is critical to work on stability as soon as feasible. The literature has suggested a number of innovations, including the Nero-development weight shifting approach, gait and stability training, task-specific training, obstacle stepping, visual reality balance training, and task-oriented balance training [12,13]. The capacity to maintain one's body stable and coordinated in order to reduce the risk of falling is known as balance [14]. Though improving balance is the primary goal of stroke rehabilitation. The goal of this study is to see what effect combining task-oriented balance training with sensory assimilation has on stroke patients' stability and to provide early intervention for them.

METHODS

From August 2019 to January 2020, researchers at the Rafsan Neuro-rehabilitation Center conducted a randomized controlled trial with the clinical registration number NCT04468269. The current study used a non-probability, sealed envelope method sample approach. Using open EPI tools, the sample size was determined as 60 [15]. There were 30 people in each group. Both genders were included in the study if they experienced a stroke that lasted more than six months, were over 40 years old, oriented, and scored 2, 3, or 4 on the functional mobility scale. Participants with a loss of somatic sensation, hemiplegia, vestibular complaint, or orthopedic disease affecting the lower extremities, such as osteoarthritis, were excluded from the study. Participants in both groups got 40-minutes exercise sessions three times a week for six weeks. This includes 10 minutes of a conservative training, such as stretching exercises, and 30 minutes of balance coordination exercises, such as sitting without a backrest while feet are on the floor, sitting on a ball, semi-tandem stance, standing on one leg, walking forward and then continuing to walk, walking lateral and backward, and tandem walking. Patients in the control group did balance exercises under light conditions (eyes open and hard surface), while those in the experimental group did balance exercises under normal conditions (eyes open and hard surface) before receiving advanced training in the experimental group after two weeks. Participants were evaluated at the beginning, the third week, and the sixth week. The BERG balance scale, activity-specific balance confidence, and balance error rating system were used to evaluate the results and dynamic gait index. Data was analyzed through the statistical package of social sciences SPSS.22. Normality was assessed according to Shapiro Wilk.

RESULTS

A total of 60 patients with post-stroke were divided into two groups: control and experimental. Six people from the experimental group and four from the control group were eliminated. Both genders were included in the study; the control group had 67.7% males and 32.3 percent females, whereas the experimental group had 74.2 percent males and 27.6% females. The experimental group's mean age was 54.82 years with an SD of 5.04, while the control group's mean age was 54.12 years with an SD of 5.42. This study found that task-oriented balance training combined with sensory integration had significantly better effects in stroke patients than task-oriented balance training alone.

Variables	Demographics	Control group (%)	Experimental group (%)
Gender	Male	67.7	72.4
	Female	32.3	27.6
Side	Right	54.8	51.7
	Left	45.2	48.3
Type of stroke	MCA	83.9	86.2
	ACA	16.1	13.8

Table 1: Mann-Whitney u test between-group analyses

The P-value for the berg balance scale at baseline is (P=0.53), while the P-value for the 6th week is (P=0.46), indicating that there is no statistically significant difference between the baseline and 6th week.

Variable	Groups	Baseline		6 Weeks	
Berg Balance Scale	Control Group	Median (IQR)	P-value	Median	P-value
		2(0)	0.53	2(1)	0.46
	Experimental Group	2(0)		2(1)	

Table 2: P-value at Baseline and 6th week

At baseline, the p-value of the experimental and control groups is (p=0.04), while at 6 weeks, it is (p=0.01). In BESS, both levels of the assessment showed significant improvement, but the p-value at the 6th week was higher than at baseline.

Variable	Groups	Baseline	P-value	6 Weeks	P-value
BESS		Mean±SD		Mean±SD	
	Control Group	37.61±6.99	0.16	34.16±5.61	0.001**
	Experimental Group	37.65±3.67		32.13±3.04	

Table 3: Independent sample t-test between Group Analysis

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DISCUSSION

The findings of this study suggest that task-oriented balance training combined with sensory measures is more effective than task-oriented balance training alone. The experimental group improved their postural stability more than the control group in varied BBS, whereas both the control and experimental groups improved in BESS. Numerous studies' findings back up the findings of the current investigation. Previous research has shown that adding balance training to sensory assessments improved BBS scores, but there is no evidence that BESS scales can be used as final balance and stability measures. A study was undertaken, and the subjects' BBS scores were over 43, indicating a higher level of static balance, as well as a highly significant difference in timed-up scores between groups. In both groups, there was a significant improvement in all end measures (p 0.0001). Yelnik *et al.*, found that task-oriented training with various sensory integration had a positive impact on postural stability when compared to task-oriented workouts with no sensory input. The experimental group's post-session BBS score was significantly higher than the control groups, according to the current study [16]. Task-oriented training is highly important in the rehabilitation of patients with, when combined with changed sensory input, is difficult in nature and gradually persuades the patients to employ lower limb somatosensory signals to maintain balance, according to Kuberan P *et al.*, [17]. According to Jean P. Boucher, sensory input training increased the use of visual, somatosensory, and vestibular senses for conducting varied exercises in sensory disorders by reducing medial-lateral sway while standing position for condition management (eyes open, firm surface). This sensory reimbursement may have aided in the actuation and organization of motor processes by improving sensory and motor coordination of postural stability and functional control in the central nervous system [18]. After experiencing perception learning, the movements to identify the firmness of sponge rubber put under the soles of the feet, Morioka and Yagi observed that their participants' balance in the standing position improved [19]. Another study by Choi J *et al.*, compared Neuro-dynamic advance technique and multisensory inputs in post-stroke patients, with the value measured by BBS. They found no significance at the acute stage of stroke (p0.393), but there was an improvement in the outcome of the BBS (p0.052) in the multisensory integration group in chronic patients [20. The findings of this investigation back up the findings of the current study.

CONCLUSIONS

It is concluded that task-oriented balance training combined with sensory integration improves balance coordination and postural stability more effectively than task-oriented balance training alone.

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