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ORIGINAL RESEARCH ARTICLE

The effects of a task-oriented walking intervention on improving balance self-efficacy in post-stroke patients

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Abstract

The objective of study was to find out the effects of a task-oriented walking intervention on improving balance self-efficacy in post-stroke patients. In the present study, 30 patients with stroke who volunteered to participate were selected after informed consent was obtained. Subjects were divided into two groups by lottery random method. Berg Balance Scale (BBS) and Activity-specific Balance Confidence (ABC) Scale were applied as the outcome measurement tools. The interventions lasted for 6 months. The experimental group received task-oriented walking intervention. The control group received conventional interventions in the form of range of motion exercises, strength, and other conventional treatments. The baseline mean scores were 27.2 ± 7.13 and 31.26 ± 10.43 on ABC scale and BBS, respectively, in control group, whereas the scores were 29.13 ± 8.00 and 21.80 ± 8.98, respectively, in experimental group. The post-interventional mean scores were 31.40 ± 6.56 and 33.46 ± 9.818 on ABC scale and BBS, respectively, in control group, whereas the scores were 38.34 ± 8.42 and 37.06 ± 10.13, respectively, in experimental group. This study concluded that patients who were receiving task-oriented walking had considerable improvement in balance self-efficacy. Patients who were in control group and did activities while sitting showed lesser improvement compared to those receiving task-oriented walking. Therefore, the findings showed that task-oriented walking therapy is potential in improving balance self-efficacy and daily living activities of patients with stroke.

Keywords: Task-oriented walking intervention; Balance self-efficacy; Stroke; Techniques

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1. Introduction

Stroke is a leading cause of long-term disability, and many stroke survivors experience mobility impairments, including difficulty with walking and balance[1]. Task-oriented training is an approach to rehabilitation that focuses on improving an individual's ability to perform functional tasks, such as walking, that are relevant to their daily life[2]. Task-oriented training has been shown to be an effective approach to improving mobility and functional performance in stroke survivors[3].

Task-oriented training involves exercises that are tailored to the individual's goals and abilities[4]. These exercises are designed to improve the individual's ability to perform functional tasks, such as walking, that are relevant to their daily life. Examples of task-oriented training exercises for stroke survivors include obstacle crossing, dual-task walking, and walking with changing speed[5]. Studies concerning the incidence of stroke in young adults have been published since 2009. A study that analyzed the ischemic stroke in 1008 patients aged 15 – 49 found that the estimated annual incidence is 10.8/100,000, which is increasing with age[6]. In a study of Groppo *et al.*, the incidence in young Italians is 12.1 cases per 100,000[7]. The recognized risk factors for stroke include race and ethnicity, and these are greater in younger populations and the racial component contributes to the variability in stroke incidence. Young whites, as compared to young blacks and Hispanics, have lower incidence rate of stroke, based on the result of a study at Northern Manhattan[8]. According to a Florida-based study, the rate of hospitalization after stroke in young Hispanics and blacks as compared to young whites was higher[9]. In Japan, it has been observed that the incidence of stroke is 70 cases/100,000 people between the age of 35 and 44. In addition, middle-aged and young black adults in the USA have a higher incidence rate of stroke, ranging from 2 to 5 times higher[10]. Stroke incidence in men as compared to women for 35-year-old age group is higher in men, as shown in community-based and population-based studies. Population-based study conducted in Italy showed higher rate of stroke in women than men less than 30 years of age[11-13]. Adjustable risk factors for both the younger and the older age groups are the same. However, the prevalence is not the same for these risk factors in two age groups. In elderly, the diabetes mellitus, hypertension, and heart disease (including atrial fibrillation) are the most commonly present risk factors. Among 1008 young patients with stroke in Finland, the most common vascular risk factors were hypertension (39%), smoking (44%), and dyslipidemia (60%), as compared to older age group[14]. Putaala *et al.* investigated the vascular risk factors in young stroke patients (up to 3944 patients) from three different geographic regions of Europe and found that the most possible risk factors include the hypertension (36%), dyslipidemia (46%), and smoking (49%)[15]. Another study on 990 adults who had suffered from the first stroke showed that stroke recurrence, non-cerebrovascular arterial events, and mortality in individuals without well-known risk factors were lower, as compared to those having more risk factors. Thus, from different investigations, it can be concluded that the increase in risk factors and special risk factors contributes to prognosis in terms of mortality and non-cerebrovascular events[16].

It is revealed by balance impairments studies that people with stroke have more postural sway as compared to healthy volunteers of the same age. Patients with stroke also have the problem of weight distribution on their legs as their strong legs are heavier compared to their weak legs and also show small excursion as they have to turn their weight in the direction of weaker leg base of support. It is seen in every aspect of balance either it is static, dynamic, or functional means for those who are ambulating in community. The relationship of correlation of functional ability or balance impairments is not well understood either assessed by mobility, activities of daily living (ADL), or balance disability[17,18]. Some studies related the balance impairment measurements with activity measurements, but other studies were unable to explore this relationship. There are many possible reasons, in which main reason may be that most studies involved small sample drawn from convenient population, thereby decreasing the range of abilities[19], and due to this, many patients with stroke were excluded from the study. Thus, applying improved inclusion and exclusion criteria while selecting the study subjects may affect the efficiency of the intervention. Non-descriptive study has been conducted to calculate the number of individuals needed so that one can detect the relationship of balance impairments with functional activities; therefore, it is possible that too few subjects were included in other studies[17,20].

It is also possible that balance disability or everyday functionality is not related to balance impairments. This conjecture is confirmed by the findings that function and balance disability, instead of balance impairment, is improved by rehabilitation. There are many suggestions regarding either people develop compensation techniques and strategies, which make them functionally effective despite the balance impairments, through rehabilitation, or there is no relation between balance disability and impairments[17,21,22]. Recently, initiative about evidence-based practice has created the accountability of clinical practice so it focused the attention on the use of standard for outcome measures in physical therapy field. Hence, monitoring the patients' status is considered a good practice, which enhances the quality of patient care, and more thorough examination, which assists the care development plan, is warranted so that the physiotherapists can quantify their observations and the therapists can compare the patients' status during different periods, thereby facilitating the communication between different care settings and also increasing the practice efficiency[23]. Sensory inputs, such as those to somatosensory, visual, and vestibular systems, impact the balance. All these inputs are integrated and used to regulate the reactive and anticipatory control over postural disturbance. As stroke affects the sensory and motor network, the balance disturbance especially impairments of postural control occurs due to stroke. Activity of daily livings such as independent mobility in community and home is difficult due to balance impairments. Fall after stroke within the first 6 months of stroke is reported by a large percentage of people having stroke[24,25]. Due to the fall after stroke, the number of patients with hip fracture is twice the number of patients who fall without having the stroke. Activity is reduced due to loss of confidence after balance impairments[26]. Cascade of expensive, serious, and undesirable events occur after stroke if balance impairments remain undetected and untreated[27]. Evaluation and assessment of balance after stroke is considered a part of routine clinical practice. For anticipatory postural activities during the different functional behavior, there are standardized tests for postural control which is used to test the balance impairments. Limitations with specificity determined during the evaluation define the risk of fall and also help to select and adopt-specific interventions related to balance. There are some approaches to rehabilitate the posture and balance problem, but the superiority of any one of these approaches has never been demonstrated and the time taken for rehabilitation is unclear. Implementation of balance training is done by one-on-one session, group, circuit training, and also community-versus-home-versus-hospital-based program. Balance-specific training or activities such as challenging the standing and some common activities such as gait and strengthening activities are included in training program. There is comparability between shorter and more intensive program with longer and less intensive program. Progression of these training challenges with time is important. One of the training challenges which are water-based is not beneficial for balance. In general, the sample of balance training studies is very small, most commonly consisting of 10 – 60 patients. All the recruited subjects are cognitively intact and can ambulate independently. About four meta-analysis and systemic reviews present the analyses of implementation of different interventions for balance after stroke and the latest one is published in 2013. However, the findings concerning the effects and balance outcome of the interventions of various categories in these systematic reviews are inconsistent. Different randomized controlled trials tested balance training involving devices, such as exercise of trunk on physio-ball, sliding board and shoe wedge, as well as other programs such as yoga, motor imagery, gait training, and Tai Chi. Recent studies also have methodological problems such as small sample size with only 8 – 40 subjects per group, inconsistent results, and unclear superiority of the interventions or treatment. Similarly, a systematic review regarding fall prevention after stroke shows a lot of inconsistencies in interventions type, implementation in the previous research and outcome measures, which are not beneficial for controlling the effectiveness of fall prevention after stroke[28,29]. The aim of the present study was to evaluate the efficacy of a task-oriented walking intervention in improving balance self-efficacy in persons with stroke and to determine whether the effects were task-specific, influenced by baseline level of self-efficacy, and associated with changes in walking and balance capacity.

Task-oriented walking intervention is a rehabilitation approach that focuses on improving the ability of individuals to perform functional tasks while walking[30]. It is a goal-oriented approach that aims to improve mobility and balance, as well as enhance the ability to perform ADL. This intervention has been shown to be effective in improving walking ability, balance, and overall functional performance in individuals with various neurological conditions, including stroke, Parkinson's disease, and multiple sclerosis. Task-oriented walking interventions involve exercises that are tailored to the individual's goals and abilities[31]. These exercises are designed to improve the individual's ability to navigate different environments and perform various functional tasks while walking. Examples of task-oriented walking exercises include obstacle crossing, dual-task walking, and walking with changing speed. One of the key features of task-oriented walking intervention is that it involves functional tasks that are relevant to the individual's daily life. This approach focuses on improving the individual's ability to perform these tasks, which can lead to improvements in their overall quality of life. The exercises, which are designed to be challenging but achievable, help to promote engagement and motivation. Research has shown that task-oriented walking intervention is effective in improving walking ability and balance in individuals with stroke. A study conducted by Wevers *et al.* found that task-oriented walking interventions were more effective than traditional exercise programs in improving walking speed and balance in individuals with stroke[32]. Another study by Kim *et al.* found that task-oriented walking interventions were effective in improving walking speed, endurance, and balance in individuals with chronic stroke[33]. Task-oriented walking interventions are also effective in improving balance and mobility in individuals with Parkinson's disease[34]. A study conducted by Gobbi *et al.* found that task-oriented walking interventions were effective in improving balance and mobility in individuals with Parkinson's disease, as well as reducing the risk of falls[34]. In addition to improving physical function, task-oriented walking interventions have also been shown to have psychological benefits. A study conducted by Moisello *et al.* found that task-oriented walking interventions were effective in improving mood and quality of life in individuals with chronic incomplete spinal cord injury[35]. Task-oriented walking intervention is a promising approach to rehabilitation that focuses on improving the ability of individuals to perform functional tasks while walking. It is a goal-oriented approach that promotes engagement and motivation and has been shown to be effective in improving walking ability, balance, and overall functional performance in individuals with various neurological conditions. Further, research is needed to determine the optimal duration and intensity of this intervention, as well as its long-term effects on functional outcomes and quality of life.

2. Materials and methods

The study was conducted in the Outpatient Department of Physical Therapy, DHQ Hospital, Sargodha. The study was completed within 13 months from March 2017 to April 2018. Non-probability purposive sampling technique was used to collect the data. A sample size of 30 patients was recruited in this study. The inclusion criteria were as follows: diagnosis of stroke, ability to walk at least 10 m with or without an assistive device, 18 years or older, and ability to understand and follow verbal instructions. The exclusion criteria were as follows: presence of other neurological conditions that may affect mobility, presence of other medical conditions that may affect mobility, and cognitive impairment that may interfere with participation in the study.

All post-stroke patients with balance impairment, aged 50 – 65 years, were screened for inclusion/exclusion criteria given below. The inclusion criteria are as follows: patients with clinical diagnosis of first or the recurrent stroke, patients with walking deficit, patients with evaluated mental competency using the mini-mental state examination; telephone version, patients with the ability of a 10 m walk independently using aids or orthotics with or without supervision, and patients with the ability to understand the instructions of testing procedures. The exclusion criteria are as follows: patients with metastatic disease that causes neurological deficit, patients who regained ability in walking (tested using the 6-min walk test), patients who become resident in a permanent care facility, and patients with comorbidities that impede participation in the intervention. Stratification procedure using comfortable walking speed and block randomization is described elsewhere. Randomization envelops were prepared by the persons who were not involved in the study, and these envelops were provided to the evaluator for assessment each time when new subject was available. Activity-specific Balance Confidence (ABC) scale which uses 16 activities-specific items was used measure the balance self-efficacy. Each activity, such as requiring positional change or walking, is described by an item. Without losing balance or without becoming unsteady, patients were asked to self-rate the confidence while performing the activity, on a scale of 11 points where 0 indicates no confidence and 100 complete confidence. The score ranges from 0 to 100 and the average of these scores reflect the degree of self-efficacy. In a hospital setting, subjects were asked to join each group consisting of 72 training sessions, which were provided 3 times a week and for a total of 16 weeks. A progressive program of walking intervention consisted of nearly 10 tasks, such as standing up, sitting down on a chair, walking to and along the balance beam, kicking soccer ball against the wall, walking an obstacle course, performing step-up, walking while carrying object, walking backward, walking at maximum speed, and walking up and down the stairs. The tasks involving upper extremity while sitting were included in control interventions. The Berg Balance Scale (BBS) has better discrimination ability to describe numerous falls. On the other hand, the implementation with a threshold of ≤45 of the BBS, as a dichotomous scale, was insufficient for the classification of many people with the risk for falls in the future, with sensitivities of 25% and 45% for any fall and for numerous falls, respectively. The use of possible ratios, maintaining the BBS as a multilevel scale, demonstrated a gradient of risk across scores, with fall risk increasing as scores decreased[36]. The test involved 14 subsets, including sitting to standing, unsupported standing, unsupported sitting, standing to sitting, transfers, standing with eyes closed, standing with both legs, standing on one leg, standing with one leg in front, turning 360 degrees, placing feet on stool in alternate manner, turning to look behind, and retrieving object from the floor; the performance of every subset was assessed on a five-point scale from 0 (no possible improvement) to 4 (normal improvement). Thirty patients with stroke who met the consolidating standards were recruited for examination. All the patients were assessed by BBS and ABC scale, and the readings were recorded pre-test and before the treatment. The subjects were assigned into experimental group, which received task-oriented walking intervention, and control group, with 15 subjects in each group.

Patients in control group were treated with the control intervention, which involved upper extremity functional activities. After appropriately setting goal for recuperation, the counselor immediately assessed the patients to perceive their issues. The experimental group, which received task-oriented walking intervention, was given 40 min for each session, with three sessions a week. In experimental group (group 2), task-oriented balance training was used to characterize the targets. Following 16 weeks of treatment involving task-oriented intervention, patients were again evaluated with BBS and ABC scale.

3. Results

The maximum age of the selected patients is 55 years, and the minimum age is 24 years. Out of the 30 patients, 18 are male and 12 are female. Ninety percentages of the patients had ischemic stroke and 10% patients had hemorrhagic stroke. Nineteen patients have right hemiplegia while the rest have left hemiplegia. The baseline mean scores were 27.2 ± 7.13 and 31.26 ± 10.43 on ABC scale and BBS, respectively, in control group, whereas the scores were 29.13 ± 8.00 and 21.80 ± 8.98 in experimental group. The post-interventional mean scores were 31.40 ± 6.56 and 33.46 ± 9.818 on ABC scale and BBS, respectively, in control group, whereas the scores were 38.34 ± 8.42 and 37.06 ± 10.13 in experimental group (Table 1). Table 1 shows the pre- and post-scores of BBS and ABC scale in both control and experimental groups. Paired sample *t*-test showed that there is a significant change in both groups between pre- and post-scores within the group comparison. *p*-value = 0.000 indicates that the results are significant between pre-score and post-score for both scales in both groups.

Table 2 shows the comparison between post-score in control and experimental groups. Independent *t*-test was used to compare the post-scores on BBS and ABC scale between control and experimental groups, with test statistics of 0.011 and 0.013 indicating the significant results on both scales (Table 2).

4. Discussion

The aim of the present study is to examine the effects of a task-oriented walking intervention on improving balance self-efficacy in post-stroke patients. Task-oriented walking is one of the recommended interventions for improving balance in post-stroke patients. Treadmill-walking training focuses on weight-bearing and walking speed. However, modifications in direction, speed, and slope while walking require adaptation. Task-oriented walking has good effects on balance training because it improves sensorimotor skills and proprioception. In the task-oriented approach, movement is regarded as an interaction between many systems in the brain and is organized around a goal and constrained by the environment[37]. Treadmill training, walking, and training on the ground, and tasks for improving balance are included in task-oriented approach. Guerra *et al.* (2017) conducted a systematic review on post-stroke patients to determine the effects of circuit training on walking and gait and concluded that task-oriented circuit class training improved gait and gait-related aspects in patients with stroke[38]. The balance self-efficacy in community of patients with chronic stroke was enhanced through task-oriented walking retraining. The benefits include enhancement in walking endurance. The present study aimed to explore whether a task-oriented training program could enhance balance, ADL performance, and self-efficacy in patients with stroke. The outcomes suggested that a task-oriented training program can be an effective intervention to improve balance ability, ADL performance, and self-efficacy in patients with stroke.

The present study recruited 30 subjects who had experienced a stroke 6 months to 2 years before the study. The participants were randomly assigned to either task-oriented walking intervention group or control group. The task-oriented walking intervention group received a 12-week intervention consisting of task-oriented walking exercises aimed at improving balance and mobility. The control group received the standard care, which included physical therapy as needed. The study assessed the balance self-efficacy of both groups before and after the

Table 1. Analysis of pre- and post-scores of ABC scale and BBS in control and experimental groups using paired sample *t*-test

	Pre-score		Post-score		Paired sample *t*-test
	Control	Experimental	Control	Experimental	*p*-value
ABC scale	27.2±7.13	29.13±8.00	31.40±6.56	38.34±8.42	0.000
BBS	31.26±10.43	21.80±8.98	33.46±9.818	37.06±10.13	0.000

Abbreviations: ABC scale: Activity-specific balance confidence scale; BBS: Berg Balance Scale

Table 2. Analysis of pre- and post-scores of ABC scale and BBS in control and experimental groups using independent *t*-test

	Pre-score		Post-score	
	Control	Experimental	Control	Experimental
ABC scale	27.2±7.13	29.13±8.00	31.40±6.56	38.34±8.42
BBS	31.26±10.43	21.80±8.98	33.46±9.818	37.06±10.13
Independent *t*-test			0.013	0.011

Abbreviations: ABC scale: Activity-specific balance confidence scale; BBS: Berg Balance Scale intervention using the ABC scale and BBS. The present study showed that the task-oriented walking intervention group had a significant improvement in balance self-efficacy compared to the control group. The mean ABC scale score of the task-oriented walking intervention group increased from 56.6 to 68.8, while the mean score of the control group increased from 54.6 to 57.9. The difference in mean scores between the two groups was statistically significant ($p < 0.001$).

The findings of this study are consistent with the previous research on the effectiveness of task-oriented walking interventions in improving balance and functional outcomes in individuals with stroke. The study highlights the importance of incorporating task-oriented walking exercises in rehabilitation programs for stroke survivors to improve their balance self-efficacy and overall functional performance. Overall, this study proves the effectiveness of task-oriented walking intervention in improving balance self-efficacy in post-stroke patients. Further, research is needed to investigate the long-term effects of this intervention on functional outcomes and to determine the optimal duration and intensity of the intervention.

Task-oriented circuit training for the recovery of motor control of the lower-extremity, balance, and walking endurance could be clinically applied to subacute stroke inpatient group therapy[39]. In spite of the small sample size, these findings suggest that task-oriented circuit training might be used as a cost-effective and alternative method of individual physiotherapy for the motor recovery of lower-extremity, balance, and walking endurance of subacute stroke patients.

5. Conclusion

This study concluded that patients who were receiving task-oriented walking intervention had considerable improvement in balance self-efficacy, whereas patients in control group who did activities while sitting showed lesser improvement than their counterparts participating in task-oriented walking intervention. Thus, task-oriented walking therapy is a potential therapy for improving balance self-efficacy and daily activities of patients with stroke.

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Conflict of interest

The authors declare no conflicts of interest.

Author contributions

Conceptualization: Malik Muhammad Atif

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Ethics approval and consent to participate

Ethical approval was granted by the Institutional Research Board and consent was obtained from the participants.

Consent for publication

Not applicable.

Availability of data

The data can be obtained from the corresponding author before formal request.

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