



Original Article

Effectiveness of Motor Relearning Program on Balance And Upright Mobility in Sub-acute Stroke Patients: A Randomized Control Trial

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ABSTRACT

A stroke is characterized as a sudden disturbance in brain function as a result of vascular damage which lasts for one day or more. **Objective:** To determine the effectiveness of the motor relearning program along with routine physical therapy versus routine physical therapy alone on balance and upright mobility in sub-acute stroke patients. **Methods:** Patients who satisfied inclusion criteria were chosen and randomly allotted into experimental and control group, 34 patients in each. After baseline assessment first follow-up was recorded at fourth week. Patients were guided for home plan for further one month. Second follow-up data was taken at eight weeks. Experimental group were given motor relearning training along with routine physical therapy in sit to stand component by putting effected foot behind the sound one, forward movement of knees on chair and trunk in flexion. Gait training, balance training, stretching exercises and strengthening exercises were given to control group. The berg balance scale and time up and go test were used to measure the outcomes. **Results:** Statistically significant post-treatment p-value<0.05 was shown by both groups in all items of the BBS and time up and go test while doing the intragroup analysis after 8 weeks of intervention. Statistically significant results (P-value=0.000) was shown at 2nd follow up by the BBS score and TUG measure in intergroup analysis. **Conclusions:** Motor relearning program is demonstrated to have more measurably noteworthy and clinically compelling intervention while comparing to routine physiotherapy alone.

INTRODUCTION

A stroke is characterized as a sudden disturbance in brain function as a result of vascular damage which lasts for one day or more [1]. According to WHO 15 million individuals suffered from stroke around the world each year. Among them 5,000,000 individuals die and another 5,000,000 are left with post stroke disability. More than 12.7 million strokes are caused by hypertension worldwide [2]. Stroke is on rise in Asians. Annual rate of stroke in Asia is found between 116 and 483/100,000 [3]. After carcinomas and coronary heart disease stroke is the leading cause of mortality and morbidity in Pakistan. In Pakistan expected prevalence of stroke is near to 250 per 100,000 population and annually it affects around 350,000 people [4]. Balance is a more disabling consequence after stroke. In the balancing process, the upright position is controlled by postural alterations to deliberate movement and in

reaction to an outside insult. The rate of long-term mobility and balance disabilities are higher in stroke patients. Balance disturbance leads to functional impairments in stroke people which in turn may increase the fall risk [5]. As diminished mobility is one of the major concerns for stroke patients so it is one of the main objectives of patients experiencing recovery. The researchers propose that mobility-related result progresses after restoration treatment [6]. After stroke patients present with poor balance capacity, asymmetrical weight bearing and postural instability. Decreased functional independence and inadequately balance leads to frequent falls in stroke patients [7]. Rehabilitation goals include improving muscle strength, maximizing mobility, improving the patient's coordination, helping the patient to get recover to best of his physical ability, improving the stroke survivor's general

health, and prevention following stroke [8]. Motor control is trained by ongoing practice and anticipatory actions. The effective use of feedback and practice is focused in task-specific learning while performing motor relearning program (MRP). Many studies showed that MRP is compelling in improving motor function recovery of the effected limb [9]. One of essential movements of daily living is the sit-to-stand component. Stroke patients put more weight on the unaffected lower extremity than on the affected lower limb when they rise all of sudden from a chair i.e. there is asymmetrical weight bearing. A normal person perform sit to stand movement many times in a day whereas stroke patients experience severe difficulty in performing this action. A number of researches showed that motor relearning plays an important role in improving balance and mobility in stroke patients [10-12]. Application of motor relearning program while treating stroke patients includes three components during the training of 'standing up'. These three components include positioning of affected foot behind the unaffected one. Second is forward flexion of the trunk at the hip while keeping neck and spine straight and the third one is the forward movement of knees on the chair. In previous researches, researchers worked on only one component that was the positioning of affected foot behind whereas overlooked the other two components. However, in this study, all three components of motor relearning program will be addressed during the performance of sit to stand training for improvement of balance and upright mobility. The present study is a randomized control trial conducted to assess the effectiveness of motor relearning program along with routine physical therapy. MRP is proved to show significant effect in western countries but the evidence of this technique is deficient in Pakistan. Therefore, the purpose of this study was to examine the effectiveness of MRP along with routine physical therapy over routine physical therapy alone to improve balance and upright mobility in subacute stroke patients.

METHODS

68 patients of both genders having first attack of stroke included in this randomized control trial. Participants were capable of rising from a chair with or without the help of assistive devices. The subjects who were having age range between 20 to 50 years, diagnosed either with ischemic or hemorrhagic type of subacute strokes were included. All participants were referred by a neuro physician. However, patients having moderate to severe spasticity, suffering from other neurological/musculoskeletal disorders of lower extremities, having some other medical conditions, convulsions, and complete upper limb sensory loss were not included. Trial was conducted after taking the approval

from Institutional Review Board (IRB) of Faculty of Allied Health Sciences, The University of Lahore. The study duration was 9 months. Data were collected from neurology department of the Sheikh Zayed Hospital Lahore through non-probability purposive sampling technique. Informed consent was taken from study participants and then patients were randomly assigned to both experimental and control groups. Experimental group received MRP along with RPT while control group received RPT only. Total sample size was 64, 34 patients in each group. Number of dropout patients in both groups were 4. Assessment was taken at baseline, at 4 weeks and at 8 weeks on a Berg balance scale which is a standardized questionnaire to measure balance and Time Up and Go Test for upright mobility. Experimental group was given routine physiotherapy in combination with motor relearning training in sit to stand component. The paralytic foot was placed posterior to the sound foot and the distance between both feet was kept at 50% of the patient's foot length [13,14]. The ankle was in dorsiflexion at 15°. The patients were taught to move knees forward on the seat of chair while maintaining flexion at trunk. The sound foot was placed at front with knees at 90° flexion and 0° of dorsiflexion at ankle. Sitting to standing training consists of 100 repetitions i.e. 10 sets of 10 repetitions with rest intervals. This training continued for five days in a week for four weeks. The patients of Control group were given routine physiotherapy. The stretching exercises were given to avoid tightness of muscles and strengthening exercises were performed at both lower and upper extremities of hemiplegic side. The balance training with gait re-education was continued for five days in a week for four weeks. After the completion of four weeks, 1st follow-up data were taken. The home exercise plans were given to the participants of both groups to continue for five days in a week at home for further four weeks. Final assessment was taken at eighth week at the end of home treatment and recorded as 2nd follow up Shapiro-Wilk test was performed to check normality of data and the graph distribution showed that data was not normal so non parametric tests i.e. Friedman test and Mann Whitney U test were applied by using SPSS version 21.0. For quantitative data mean \pm standard deviation (S.D) were used to express statistical results. For intra-group analysis a non-parametric Friedman test was conducted and for inter-group analysis a non-parametric Mann Whitney U test was used. These tests were performed to record results at baseline, at fourth and then at eighth weeks.

RESULTS

A sample of 68 patients fulfilled the inclusion criteria and was recruited in the study. 68 patients were further divided

into experimental and control group (Figure 1). 34 patients in each group. Total dropout patients from both groups was 4 in number. There were 21 males (65.5%) and 11 females (34.4%) in the experimental group. In the control group, 23 were males (71.9%) and 9 were females (28.1%). Mean age of study participants was 43.64 years in experimental group and 40.51 years in control group. In the experimental group 29(90.6%) patients were suffering with ischemic stroke and 3(9.4%) were suffering with hemorrhagic stroke. However, in control group 30(93.8%) were having ischemic stroke and 2(6.3%) were having hemorrhagic stroke. To check the side effected by stroke we find that both groups were having the same results i.e. 17(53.1%) participants were right sided hemiplegic and 15(46.9%) were left sided hemiplegic. 7(21.9%) patients were using the assistive devices for ambulation while 25(78.1%) patients were not using any assistive device for mobility in the control group. However, in experimental group there were 2(37.5 %) stroke subjects using the assistive devices for mobility while 20(62.5%) subjects performed their activities without any assistive device. This showed that there were large numbers of participants not using ambulatory devices in both groups. After the completion of eight weeks of treatment there was a significant increase in mean scores of Berg Balance Scale and Time Up and Go measure in both groups. However, there was marked increase in mean value in the experimental group. In intergroup analysis scores of mean±SD on Berg Balance scale at baseline in control and experimental groups were 24.03±7.706 and 22.34±6.699 respectively with P= 0.353. Statistically this p-value was insignificant as it was greater than 0.05.

However, mean± SD at first follow up on BBS in control and experimental groups were 31.72±6.929 and 36.41±5.780 respectively with (p-value=0.05) showed statistically significant improvement from baseline to first follow up. Mean± S.D scores at second follow up on Berg Balance scale in control and experimental groups were 35.03±6.606 and 44.47±5.174 respectively with (p-value=0.000) which showed significant improvement from first follow up to second follow up (Table 1). In intergroup analysis scores of mean± SD in Time Up and Go Test at baseline in control and experimental groups were 40.31±8.161 and 42.12±8.431 respectively with P= 0.386. Statistically this p-value was insignificant as it was greater than 0.05. However, mean± SD at first follow up in Time Up and Go Test in control and experimental groups were 32.53±7.066 and 25.16±7.375 respectively with (p-value=0.000) showed statistically significant improvement from baseline to first follow up. Mean±S.D scores at second follow up in Time Up and Go Test in control and experimental groups were 28.41±6.085 and 17.91±3.495 respectively with (p-value=0.000) which showed significant improvement from first follow up to second follow up.(Table 1).

	Mean	SD	Mean	SD		
Berg Balance Scale Baseline Score	24.03	7.706	22.34	6.699	1.688	0.353
Berg Balance Scale 1 st Follow - up Score	31.72	6.929	36.41	5.780	-4.688	0.005*
Berg Balance Scale 2 nd Follow -up Score	35.03	6.606	44.47	5.174	-9.438	0.000*
TUG Baseline Time	40.31	8.161	42.12	8.431	-1.813	0.386
TUG 1 st Follow up Time	32.53	7.066	25.16	5.144	7.375	0.000*
TUG Post Treatment Time	28.41	6.085	17.91	3.495	10.500	0.000*

Table 1: Inter-Group Analysis for Berg Balance Scale and TUG Measures

Group	Measures	Pre-Treatment		Post-Treatment		Mean Difference	P-Value
		Mean	SD	Mean	SD		
Control Group	BBS Score	24.03	7.706	35.03	6.606	-11.00	.000*
	TUG Time	40.31	8.161	28.41	6.085	11.90	.000*
Experiment Group	BBS Score	22.34	6.699	44.47	5.174	-22.13	.000*
	TUG Time	42.13	8.431	17.91	3.495	24.21	.000*

Table 2: Intra Group Analysis for Pre-Treatment and Post-Treatment Berg Balance Scale and Time Up and Go Measures

DISCUSSION

This research was done to find out the effectiveness of motor relearning program on balance and upright mobility in subacute stroke patients. Results of this trial showed that motor relearning program with routine physiotherapy treatment is more significant in regaining balance and upright mobility in stroke patients rather than the routine physiotherapy alone. In present study subacute stroke patients are selected whom time period was 2 weeks to 3 months post stroke. MRP plus RPT initiated within 2 weeks of stroke onset proved to be effective rehabilitation strategy. In present study mean age of participants was 43.64 years in experimental group and 40.51 years in control group while in another study by Park JH (2015) mean age was 61.3 years in spontaneous group and 64.3 years in

CONSORT FLOW DIAGRAM

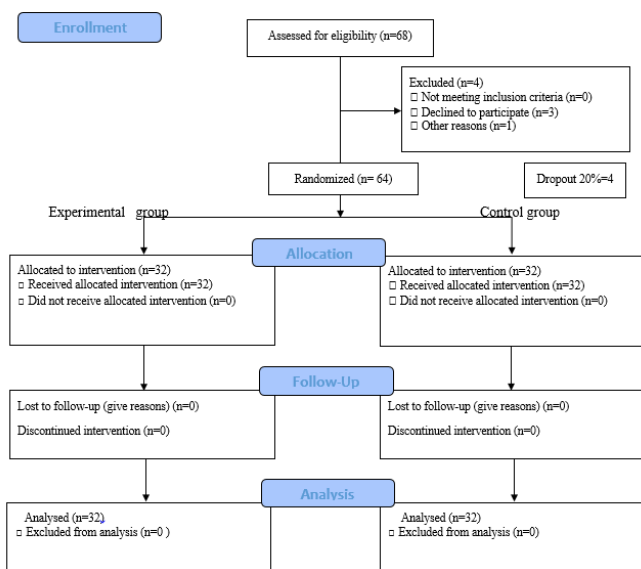


Figure 1: Consort Flow Diagram

asymmetrical group. In Khurana B (2019) study mean age was 65.46 years in group A and 65.69 years in group B. Results of the present study showed improvements in both groups but significantly more in experimental group. Difference in the results might be due to the reason that present study included younger age group patients. However, in other studies older stroke population was addressed [16,17]. This trial found that the experimental group appeared with marked improvement in balance and upright mobility as compared to the control group after sitting-to-standing coaching. This trial results are in agreement with Park JH study in which he assess the impacts of sitting-to-standing with a paralyzed side asymmetrical limb position on the balancing of chronic CVA patients. The outcome of the research was the same as the present one. JH Park's research time was one and half month whereas the current study was for 2 months [16]. Shears (2018) study finding also showed considerable improvement in balance, sit to stand symmetry, lower limb mobility progressed in general [18]. Practice the sitting-to-standing activity with the paralyzed limb set backward the sound limb is more compelling at retraining balancing and mobility than putting the limbs side-by-side. Liu M considered the impact of monotonous sitting to standing training with effected side deviated foot position on the balancing of chronic stroke subjects. The result of the research appeared that altered sitting-to-standing training makes balance better in hemiplegia [19]. A review was conducted by Amira Boukadida to check the sit to stand task in the individual having hemiparesis post-stroke [20]. In 2017 KS Jung conducted a study and found whenever MRP component sitting-to-standing combined with TENS it decreases the stiffness, and increased balancing and muscular quality [21]. These studies showed the same results as of present study. In the present study changes were made from the original protocol [14] by selecting patients of subacute stroke stage with wide range of age (30 years to 50 years). Time duration of treatment was 8 weeks and follow-up assessment was done in present study to evaluate long term effects. The foot placement was controlled in the present study, as the distance between feet was predefined and maintained during the training program. Within this trial, all three parts of sitting to standing of MRP are addressed. MRP is a compelling recovery strategy with routine physiotherapy treatment to treat stroke subjects for balancing and upright mobility. The study includes patients who were diagnosed as having the first stroke however the patients with a history of repeated strokes were not included in the study. The age group of patients is between 20 to 50 years it should also include patients of age above 50 years. Furthermore, this study is single-blinded it should be

double-blinded.

CONCLUSIONS

While concluding, both treatment groups appeared to have impressive advancement in balance and upright mobility in sub-acute stroke patients after a standardized 2 months Motor Relearning Program Plus Routine physiotherapy treatment (applied in the experimental group) and conventional physiotherapy treatment alone (applied in the control group). Motor Relearning Program Plus Routine physiotherapy treatment is demonstrated to be more effective and clinically viable intervention while comparing to routine physiotherapy for the stroke subjects aged between 20-50 years.

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