

Effectiveness of proprioceptive neuromuscular facilitation on balance in chronic stroke patients

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Objective: To find the effectiveness of proprioceptive neuromuscular facilitation in improving balance among chronic stroke individuals.

Methodology: It was a single blinded randomized controlled trial conducted at University Physical Therapy and Rehabilitation clinic, Lahore using non-probability convenient sampling. Sixty hemiplegic patients having single episode of hemorrhagic or ischemic stroke were randomly allocated into two groups. Experimental group (n=30) received proprioceptive neuromuscular facilitation (PNF) and routine physical therapy, while control group (n=30) received only routine physical therapy. Patients having orthopedic injury, visual and hearing problems were excluded

from the study. Berg Balance Scale (BBS) was used to access balance at baseline and at the end of six weeks. Data were analyzed by SPSS version 24.

Results: The comparison at the end of trial showed that BBS scores were significantly increased in PNF group as compared to group without PNF ($p < 0.05$).

Conclusion: Proprioceptive neuromuscular facilitation along with routine physical therapy was more effective in improving balance in stroke patients as compared to routine physical therapy alone. (Rawal Med J 202;46:212-215).

Keywords: Stroke, proprioceptive neuromuscular facilitation, physical therapy.

INTRODUCTION

Cerebrovascular accident (CVA), also known as stroke, is the sudden cessation of neurological system of body due to impairment in blood flow towards brain. It can be hemorrhagic or ischemic.¹ Around the world, stroke is the second common cause of death and disability, and in United States; it is third to fourth common cause of disablement and death.² In the developing countries like Pakistan, incidence of stroke is increasing.³ In Pakistan, during 2000 to 2016, there was a stroke occurrence rate of 95 per 100,000 persons per year, with the highest occurrence rate among the old aged individuals mostly between 75 to 85 years old.⁴ Approximately 90% of stroke survivors are left with disabilities that are the cause of compromised functions.⁵ Motor impairments are the most prevalent. Abnormal tone, weakness, and equilibrium loss on the paretic side are the causes of hindrance in maintaining posture and balance.⁶ Pusher syndrome is also a cause of balance impairment in stroke patients.⁷ Disturbance in bulb spinal pathways which contracts a number of

muscles at one time, hence preventing normal pattern of movement.⁶

To reduce disability and promoting independence, physical therapy rehabilitation has an important role.⁸ Irradiation, resistance, reinforcement, manual contact, proper mechanics of body and body positions, verbal commands, traction, vision and approximation, stretch, proper timings and pattern are basic procedures for facilitation used in proprioceptive neuromuscular facilitation (PNF).⁹ Several studies reported significant improvement in balancing capabilities and strength after the application of PNF approach.¹⁰⁻¹² The aim of this study was to determine effectiveness of PNF in improving balance among chronic stroke individuals.

METHODOLOGY

Data for this single blinded Randomized controlled trial was collected from University Physical Therapy and Rehabilitation Clinic (UPTRC), Lahore, Pakistan. The study was approved by University IRB (IRB#IRB-UOL-FAHS/718-

X/2020). An informed consent was signed by all participants. A sample size of 60 patients was calculated after adding 20% attrition rate with 30 patients in each group using WHO sample size calculator 2.0.1.¹³

$$n = \frac{2\delta^2 (Z_{1-\beta} + Z_{1-\alpha/2})^2}{(\mu_1 - \mu_2)^2}$$

Desired Power of the study = $\beta = 90\%$, Desired Level of Significance $\alpha = 95\%$, Expected Mean Difference in toxicity = $\mu_1 - \mu_2 = 12.6 - 14.41 = -2.32$, Standard Deviation of BBS score in Group 1 = $\delta_1 = 2.58$ and Standard Deviation of BBS in Group 2 = $\delta_2 = 2.41$

Non probability convenient sampling technique was used and lottery method of randomization was used for group allocation. Inclusion criteria were hemiplegic patients having single episode of ischemic or hemorrhagic stroke, patients of either gender, age between 35 to 85 years, duration of stroke more than 6 months, participants able to walk with or without support for 10 m and participants having Mini-Mental Status Examination [MMSE] ≥ 24 .¹⁴ Exclusion criteria were patients with recurrent stroke, patients having orthopedic injury that could interfere with walk, and patients having visual and auditory impairments.

A pre-test (t0) was performed on the eligible participants. To evaluate balance, Berg balance scale (BBS) was used. After baseline assessment, patients were randomly allocated into experimental group/group A (PNF and routine physical therapy) and control group/ group B (routine physical therapy).

In group A, routine physical therapy was performed for 40 minutes and PNF for 10 minutes (Total 50 minutes session) and in group B, routine physical therapy was performed for 50 minutes. Routine physical therapy involved muscle strengthening exercises, range of motion exercises and stretching exercises up to patient's tolerance.¹² Other exercises involved pelvic bridging, rolling, sitting and standing exercises, walking practice and balancing in parallel bars, wobble board exercises, and treadmill training up to patients tolerance. PNF exercises involved PNF pelvic patterns, PNF lower extremity D1 Flexion and PNF lower extremity D1 extension, each exercise was repeated 10 to 20 times

or up to patient's tolerance, progressed from rhythmic initiation to stabilizing reversals and then followed by dynamic reversals up to 4th week of therapy session.¹⁰

The treatment was provided 3 days per week on alternate basis, for 6 weeks (18 sessions). Participants were re-assessed on the outcome scale at end of 6 weeks. Researchers who assessed outcomes or involved in data analyses were masked to group allocation.

Statistical Analysis: Statistical analysis was performed using SPSS version 24. Test of normality was performed on BBS data and Mann-Whitney U test was used for analysis between experimental and control group. $p < 0.05$ was considered significant.

RESULTS

Table 1 shows descriptive statistics of age of participants, gender, time of onset of stroke, body mass index, Mini Mental Status Exam Score (MMSE) and type of stroke in two groups.

Table 1. Demographics and clinical characteristics of study participants.

Demographics	Experimental group PNF and RPT (n=30)	Control group RPT (n=30)
Age (years)	53.63 \pm 9.503	53.90 \pm 9.43.
Gender (M/F)	17/13	16/14
Stroke onset (months)	25.87 \pm 12.227	23.37 \pm 12.987
Body Mass Index	27.345 \pm 4.13	27.557 \pm 5.7956
MMSE score	27.53 \pm 1.074	27.23 \pm 0.898
Type of stroke (H/I)	16/14	17/13

MMSE Score- mini mental status examination score, PNF- proprioceptive neuromuscular facilitation, RPT-routine physical therapy

Table 2. Comparison of BBS scores before and after intervention in two groups.

	Group	Number	Mean	Std. Deviation	P value
BBS Pretest	Experimental	30	32.40	4.54	0.84
	Control	30	32.07	4.37	
BBS Post test	Experimental	30	40.57	3.83	0.04
	Control	30	38.37	4.03	

BBS- Berg balance scale

Mean of BBS score before treatment in experimental and control group was 32.40 \pm 4.54 and 32.07 \pm 4.37, respectively ($p = 0.84$), while after

treatment mean value of BBS score in experimental and control group was 40.57 ± 3.83 and 38.37 ± 4.03 ($p < 0.05$) (Table 2).

DISCUSSION

Findings of the study showed consistency with the published literature that PNF is an effective intervention in improving balance of stroke patients.¹⁵ One study showed more positive gains in stroke population when treadmill training was combined with PNF.¹⁶ Similar results were seen in a study in which PNF patterns of lower limb was applied under water.¹⁷ Berg balance scale scores showed a significant increase when routine physical therapy treatment was combined with PNF neck pattern exercises in chronic stroke individuals.¹⁸

Balancing ability is an important factor for decreasing risk of falls among elders. Results of a study showed that there was significant difference ($p < 0.05$) between pretest values and posttest values of BBS ($p < 0.01$), in which PNF technique was applied to study its effect on posture among post stroke individuals.¹¹ Another study showed significant increase in BBS score ($p < 0.05$) when PNF was applied along with conventional physical therapy as compared to other group without PNF.¹⁹ Balance improvements similar to this study ($p < 0.05$) can also be seen in published RCTs in which PNF based exercises were performed under water.²⁰ PNF along with full body vibrations proved to be effective in improving balance, strength and walking in individuals with stroke.²¹

The interventions used in this study are based on the concepts of motor development and neuroplasticity concepts, as per researchers knowledge, and the intensity and frequency of exercises were according to the published recommendations in order to improve balance of post stroke individuals.¹⁰ Also PNF increases brain derived neurotrophic factor (BDNF) levels, that repair brain tissues and enhances the functional capabilities of post stroke patients.²²

Hence the inclusion of PNF in routine treatment regime of post stroke individual must be supported in order to enhance their balancing capabilities. Strength of this study is the use of standardized measuring outcome. Weakness of this study is that

the data was collected from a specified clinic in one region of Lahore.

CONCLUSION

Proprioceptive neuromuscular facilitation along with routine physical therapy was more effective in improving static and dynamic balance in post stroke patients as compared to routine physical therapy alone.

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