



# **Effects of Proprioceptive Neuromuscular Facilitation (PNF) Techniques on Bed Mobility, Transfer and Early Trunk Control in Acute Stroke Patients**

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## **Authors' contributions**

*This work was carried out in collaboration among all authors. Author BA designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors TM and SM managed the literature searches. Authors AB, GAB and SNA managed the analyses of the study. All authors read and approved the final manuscript.*

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## **ABSTRACT**

**Aims:** The aim of this study was to observe the effects of Proprioceptive neuromuscular facilitation (PNF) Techniques to improve bed mobility, transfer and early trunk control in Stroke patients.

**Study Design:** Assessor blinded Randomized Control Trail.

**Place and Duration of the Study:** Physiotherapy department of Shalamar hospital Lahore, Pakistan from March 2019 to September 2020.

**Methodology:** A total of 50 acute stroke patients with severity level NIHSS>21 were recruited and randomly allocated into 2 groups (males: 29, females: 21; age range: 50 to 65) after obtaining written informed consent. Patients were assessed at baseline 0 week and after 6 week of post treatment on Trunk impairment scale (TIS) and ICU mobility scale.

**Results:** It showed that PNF base trunk control exercises exhibited significant improvement in

Trunk impairment scale(TIS) in Group A as compared with Group B at post-test,  $18.44 \pm 3.176$  vs  $16.12 \pm 2.35$  ( $p=0.004$ ) respectively. ICU Mobility scale significantly improves at post-test in Group A as compared to Group B,  $7.52 \pm 2.583$  vs  $5.84 \pm 1.434$  ( $p=0.007$ ) respectively.

**Conclusion:** This study concluded that PNF based trunk exercise showed more improvement in Group A (Trunk stability exercises using PNF techniques) when compared with conventional training.

**Keywords:** *Proprioceptive neuromuscular facilitation; bed mobility; transfer; in acute Stroke; trunk control.*

## 1. INTRODUCTION

Stroke is the neurological disorders and leading cause of disabilities and death. This has been noticed as the leading health related disorders which requires constant as well as the widespread rehabilitation [1]. The Common signs and symptoms of stroke are sudden numbness or weakness of the face, arm, or leg, especially on one side [2]; trouble speaking or sudden confusion ; sudden trouble seeing in one or both eyes; sudden trouble in walking, dizziness, or loss of balance; [3]Along with dysfunction of limb functions the stroke also affects the trunk function. The Clinical observation of ambulatory patients with chronic stroke shows atypical trunk movement and coordination, also experience difficulty from getting out of bed and standing up from a chair [4]. The current clinical trial study find out that weakness of trunk muscle in post stroke case is related to poor sit to stand ability [5]. So it is important to strengthen the trunk muscle which ultimately benefits the transfer and bed mobility of the stroke patient. Shim, Jaehong conducted a study in 2020 to identify the effects of EMG-triggered FES during trunk pattern in PNF on trunk balance, control and gait of stroke patients and found that trunk control of stroke patients are affected by PNF trunk pattern [2], and to improve balance and walking the increased trunk control ability was effective. Besides, it was found that the FES triggered EMG applied to the PNF trunk pattern which affected the trunk control [6].

Proprioceptive neuromuscular facilitation (PNF) exercises uses proprioceptive cues to facilitate the neuromuscular reactions. It uses the progressive resistive spiral or diagonal patterns to enhance the coordination between the two sides of body using the motor irradiation and outflow [7]. Especially rhythmic stabilization and alternating isometric exercise [2]. The performance of trunk has been identified as an imperative early predictor of functional outcome in post Stroke [8]. In contrary to hemiplegic limb

muscles, in the acute stage after stroke the trunk muscles are impaired on both sides of the body the patient is unable to move his trunk in both in lying and sitting position [9]. The movement analysis of trunk found selective control of trunk muscle, particularly the lower trunk muscle activity was minimal in stroke patients [10].

The basic contribution of the trunk muscle is to allow the body to adjust weight shift, remain upright, and performs some selective movements of the trunk against constant pull of gravity [11,12]. It demonstrated not merely trunk performance in sitting position but also postural balance in sitting, lying and standing. The post-stroke patients predicted functional ability and destination at the time of discharge from inpatient rehabilitation [13].

The ability to move independently during discharge had a significant relationship to early without support sitting balance and also found that this ability could predict independent ambulatory status in the later stages of stroke recovery [14]. However there is dearth in literature regarding the role of PNF in bed mobility, early transfer and trunk control in post stroke patients .Hence this study showed the effects of trunk stabilization PNF techniques on bed mobility, early transfer and trunk control.

**Aims:** The aim of this study was to observe the effects of Proprioceptive neuromuscular facilitation (PNF) Techniques to improve bed mobility, transfer and early trunk control in Stroke patients.

## 2 MATERIALS AND METHODS

### 2.1 Clinical Trial Design and Setting

It was single blinded (assessor) randomized control trial (trial registration no NCT04816422). Sample size was measured by using G power version 3.1.9.2 software with 0.80 power and an effect size 1.0500, [1] the minimum required

sample size was 50 with 5% margin of error by taking  $\pm$  SD from previous study. Consecutive sampling technique was used to recruit the patients over the duration from March 2019 to September 2020 at the physiotherapy department of Shalamar hospital, Lahore.

## 2.2 Participant Criteria

A total 50 patients with an age ranging between 50 to 70 years meeting the following inclusion criteria

- Stroke (Acute stage) within 48hours to 2 week of stroke.

Not contraindicated for early exercise intervention

- First attack without any prior residual impairment.

- Middle Cerebral Artery syndrome

All other patients not meeting the above mentioned criteria or patients with Cognitive deficits or Cognitive deficits or cognitive impairment (MMSE<19), very severe stroke (NIHSS>21), pregnancy related stroke, and high uncontrolled hyper tension or diabetes [1].

## 2.3 Study Design

Group A: Patients receiving trunk stability exercises using PNF techniques, rhythmic stabilization and alternating isometrics, rhythmic initiation slow reversals Bilateral upper extremity pattern for trunk by Chopping, Lifting. Frequency and Dosage. Initial two weeks subjects had performed 1 to 3 techniques, once they became expert in it the combination pattern had performed for next two weeks. The amount and intensity of the exercise at each session were graded according to each subject functional level, with 2 minutes rest in between. Progression was made by increasing the repetition and increasing the resistance, and changing the position like from supine to sitting according to the individual ability. Patients were re assessed at the end of 6 weeks [2].

Group B: Patients receiving conventional treatment. Conventional trunk exercise program

for 45 min/day, 4 days/ week for the period of 6 weeks. After 6 weeks they were assessed on ICU mobility scale, trunk impairment scale.

## 2.4 Statistical Analysis

The data was analyzed using SPSS for windows software, version 1.03. Statistical significance was set at P=0.05. Following tests were used: After assessing the normality by Shapiro-Wilk Test, The P value was greater than 0.05, so data was distributed normally. So parametric test was applied.

## 3. RESULTS

55 subjects were assessed on basis of inclusion and exclusion criteria. 54 were selected out of 55 subjects who met inclusion criteria. 50 subjects were allocated randomly to either PNF group or conventional treatment group 25 in each group. Baseline values of socio-demographic data of both groups were comparable on basis of to mean $\pm$  std. deviation. The mean age of participants in group A was 57.56 $\pm$ 3.85years compared to 57.20 $\pm$ 3.61 years in group B. The mean BMI of participants in group A was 25.40 $\pm$ 4.14 kg/m<sup>2</sup> compared to 26.28  $\pm$ 4.07 kg/m<sup>2</sup> in group B.

## 4. DISCUSSION

The aim of this study was to evaluate the effects of PNF based trunk stability exercise to improve bed mobility, transfer and early trunk control on TIS and ICU mobility score in acute stroke patients. The results showed that inclusion of PNF based trunk stability exercises are more effective than conventional treatment protocol [15]. Patients who underwent the early PNF based rehabilitation exercise get benefited from it by showing early and better bed mobility, transfer and upper body control and showed little assistance required in performing these activities. Our results showed the marked improvement in ICU mobility scores in those patients.

**Table 1. The Demographic data of both groups, n = 40**

Demographic Characteristic	Mean $\pm$ S.D/n%
Age (years)	57.56 $\pm$ 3.85
Gender	
Male	29(58%)
Female	21(42%)
BMI (kg/m <sup>2</sup> )	26.82 $\pm$ 4.07

**Table 2. Between group Comparison of FRT, TUG and OLS scores at baseline and at 6th week**

	<b>Trunk stability exercises using PNF techniques Group #A</b>	<b>Conventional treatment Group #B</b>	<b>p-value</b>
<b>Trunk Impairment Scale (TIS)</b>	<b>Mean±S.D</b>	<b>Mean±S.D</b>	
At baseline week 0	8.16±1.106	8.36±0.637	.438
End of treatment week 6	18.44±3.176	10.35±1.30	.004
<b>ICU Mobility Scale</b>			
At baseline week 0	1.60±0.645	1.84±0.746	.230
End of treatment week 6	7.52±2.583	5.84±1.434	.007

*Pre and post value of independent t test show significant values*

Our study showed demographical features of predominance of male in study which is in line with previous descriptive cross sectional study conducted on stroke patients in which (57.5%) were males and (42.5%) [16] were females and in current study showed (58 %) were males and (42%) females the fact that male show more prevalence maybe related to risk factor presence are commonly related to male population most common are cigarette smoking, less physical activity.

The present study showed improvement in ICU mobility score on average there is a study which observed the early mobilization such as within 48 to 72 hours effects on functional independence in acute patients with intracranial hemorrhage [17] this study elaborated that benefits of early mobilization is to achieve functional independence in stroke patients which is vivid in our study as well that may be due to prevention of loss of muscle strength, cardiovascular fitness, and maintenance of lean body mass [18] and may be due to the most evolving concept opportunity of narrow window of brain plasticity and repair to occur [19]. Therefore after incorporation of early target specific PNF based exercises lead to better results in bed mobility related activities and trunk control as it is required in sitting.

Trunk control is crucial in stroke patients to attain functional independence in stroke patients [20]. Multiple studies have done on trunk control after stroke one of them was conducted by Ching-Lin Hsieh showed that early trunk control is the predictive value to interpret the marked ADL activities recovery in stroke patients [21]. Current study early trunk targeted PNF exercise to develop trunk control and show the significant results on TIS. Hence early patient mobility along with target specific trunk control exercise may

improve the future outcome in ADLs of stroke patients.

Another study by Marco Di Monaco evaluated the Trunk impairment scale validity in lying, sitting and standing for inpatient stroke patients and showed that Trunk Impairment Scale Stroke patients scores were significantly associated with the Functional Independence Measure score at discharge (P = 0.010 )which shows TIS high relevance with independence of the stroke patients to carry out daily tasks as it is the strong indicator of the inpatient hospital discharge. Consistent with the above our study used this valid scale to interpret the patient outcome and improvements after PNF based trunk control exercise.

To our best knowledge this is a novel study exploring the benefits of PNF based trunk control exercise in acute stroke patients. However previous studies were conducted on PNF techniques in sub-acute or chronic patients. Hence if we will incorporate early PNF mediated trunk control exercise into our treatment protocol it may lead to better results in term of early bed mobility easy transfer and early trunk control and eventually functional independence.

Limitation of this study was smaller sample size due difficult patient approach due to Covid -19 pandemic which lead to less Statical power of the study and reduces the generalizability of the results. So it is recommended to conduct the follow up study on larger scale.

## 5. CONCLUSION

Results of the study shows that group I (experimental group) which received PNF techniques & group II which received conventional exercise program have good effect on trunk control in recovery stage stroke patients.

But when both the groups were compared, the group which received PNF technique gained better improvement in trunk control than the group received conventional therapy.

### CONSENT AND ETHICAL APPROVAL

This study was conducted after ethical approval obtained from the institutional ethical board (REC: Riphah ethical committee) of Riphah international university. Written consent was taken after explaining the whole treatment protocol to patients and their attended.

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### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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