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## TO COMPARE THE EFFECTIVENESS OF PELVIC PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION (PNF) AND CORE STABILITY EXERCISE ON TRUNK IMPAIRMENT IN SUB ACUTE – CHRONIC STROKE PATIENTS – A COMPARATIVE STUDY

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### ABSTRACT

**Background:** Stroke commonly leads to impairments in trunk control, resulting in difficulties in balance and postural stability. Pelvic Proprioceptive Neuromuscular Facilitation (PNF) and Core Stability exercises are two interventions aimed at improving trunk control in stroke patients.

**Objective:** To compare the effectiveness of Pelvic PNF and Core Stability exercises on trunk impairment and balance in stroke patients.

**Methods:** Thirty stroke patients were randomly assigned to either a Pelvic PNF group (Group A, n=15) or a Core Stability exercise group (Group B, n=15). Both groups received their respective interventions 5 days per week for 4 weeks. Trunk Impairment Scale (TIS) and Berg Balance Scale (BBS) were used to evaluate trunk control and balance before and after the intervention.

**Results:** Both Pelvic PNF and Core Stability exercises significantly improved TIS and BBS scores in the respective groups ( $p < 0.05$ ). However, there was no statistically significant difference between the groups in post-intervention outcomes ( $p > 0.05$ ).

**Conclusion:** Pelvic PNF and Core Stability exercises are equally effective in improving trunk control and balance in stroke patients. Either intervention can be utilized in clinical rehabilitation settings depending on patient needs and preferences.

**Keywords:** Stroke, Pelvic PNF, Core Stability, Trunk Impairment Scale, Berg Balance Scale

### INTRODUCTION

Stroke is a global health care problem leading to significant mortality and morbidity. According to WHO stroke is defined as “*Acute onset of Neurological Dysfunction due to abnormality in cerebral circulation with resultant signs and symptoms that corresponds to*

*involvement of focal area of brain lasting more than 24 hours*” (1-6)

The deficits resulting have significantly affecting Trunk, Unilateral Upper and Lower extremity functions, Quality of life and productivity of survivor. Trunk plays an important role to keep the body in upright position and also adjust weight shifts during static and dynamic

postural adjustment. (19-22) Following stroke one side of limbs are affected but trunk muscle are affected on both the side leading to insufficiency in trunk rotation, difficulty in maintaining Balance and gait.

Being able to sit, stand, and walk with ease requires good trunk function because the muscles in the trunk support the stabilisation of proximal body parts during voluntary movements of the extremities. Following a stroke, trunk function is often impaired, which affects balance, walking, and daily living tasks (ADL). Trunk control is a very important motor function used in stroke rehabilitation that is necessary for carrying out various functional tasks.

Although hemiplegia affects the activity of one limb only, it has the potential to worsen the function of the trunk muscles on both sides of the body, which would have an impact on the proximal control. The limbs are severely affected by the loss of proximal stability since they are only capable of moving in spastic synergistic patterns. In an attempt to move upright against gravity, this loss of fixation is compensated by increased distal spasticity. Walking is affected by the patient's inability to support his or her thoracic spine in extension while using just the lower abdominals due to the loss of selective activity in these trunk muscle groups (21).

Pelvis, a portion of the trunk that supports actions of the extremities. Therefore, the muscles in the trunk are what move the pelvis. The degree of motion in the lower spine affects the range of motion in the pelvic patterns. Because the pelvis is interconnected with the spine, it is biomechanically impossible to move the pelvis without moving the spine (22). Specific pelvic patterns of Proprioceptive Neuromuscular Facilitation (PNF) and Core stability exercise which are mentioned in the literature not only exercise the pelvis motion and stability but also facilitate trunk motion and stability.

## NEED OF THE STUDY

There are many previous studies showing the effectiveness of Pelvic Proprioceptive Neuromuscular Facilitation (PNF) (22) (29-30) and Core stability exercise (25-28) to improve Trunk control, balance and gait in stroke patients.

Previous studies had also combined Pelvic Proprioceptive Neuromuscular Facilitation (PNF) with Core stability exercise (17) or Hip extensor strengthening (8) to find the effect on Trunk control, Balance and Gait improvement.

Pelvis plays a key role to control Trunk musculature and the effectiveness of Pelvic Proprioceptive Neuromuscular Facilitation (PNF) is proved by comparing with conventional therapy to improve trunk control and also the effectiveness of core stability exercise had been proven by previous studies to obtain trunk control when compared with conventional therapy (22-30).

But there is lack of literature for the comparison of Pelvic Proprioceptive Neuromuscular Facilitation (PNF) with

Core stability exercise to improve Trunk control in stroke patients.

## METHODOLOGY

The research was designed as a clinical comparative study to assess the effectiveness of different treatments for subacute to chronic stroke patients. Convenient sampling was employed to select a sample of 30 participants from the Government Physiotherapy College in Jamnagar. The study was conducted over the course of one year, during which each participant received treatment sessions lasting 45 to 60 minutes, five days a week, for a duration of four weeks.

The criteria for selection in the study were carefully defined to ensure appropriate participant inclusion and exclusion. **Inclusion criteria** required participants to be willing to take part in the study, have experienced a unilateral ischemic or hemorrhagic stroke for more than two weeks, and be between the ages of 45 and 80 years. Both males and females were included, provided they reached at least Brunnstrom stage 3 in the lower extremity and were able to understand and follow verbal instructions. **Exclusion criteria** were established to prevent confounding factors and included individuals with known brain tumors, head injuries, brain infections, Parkinson's disease, or any other neurological conditions affecting balance and sensation. Acute stroke patients in the flaccid stage, those with musculoskeletal disorders, recent injuries to the lower limb or trunk, cognitive problems, neglect, dementia, or recent surgeries of the trunk and lower limb were also excluded from the study. Sample size was calculated using G power version 3.1.9.7 using pilot study. The effect size obtained was 1.1445086. The sample size was determined to be 15 for each groups. Ethical clearance was obtained from the ethical committee of M.P. Shah Government Medical College, Jamnagar (Ref no. ICE/Certi/84/03/2022).

A total number of 30 patients, including sub-acute and chronic stroke (> 2 weeks) were selected for the study. Patients who were deemed qualified and willing to participate in the study were asked to sign the consent form after receiving an adequate description of the study's goals and methods.

The patient was chosen using a simple convenient sampling technique. Following the assignment of a serial number to each patient and were divided alternatively into Group A (Pelvic PNF group) and Group B (Core Stability Exercise group) respectively. Total of 32 patients were divided into two groups; 16 patients in group A and 16 patients in group B were allocated in each group.

Later, Trunk Impairment Scale (TIS) and Berg Balance Scale (BBS) were administered to each patient before and after a 4-week follow-up period as outcome measures.

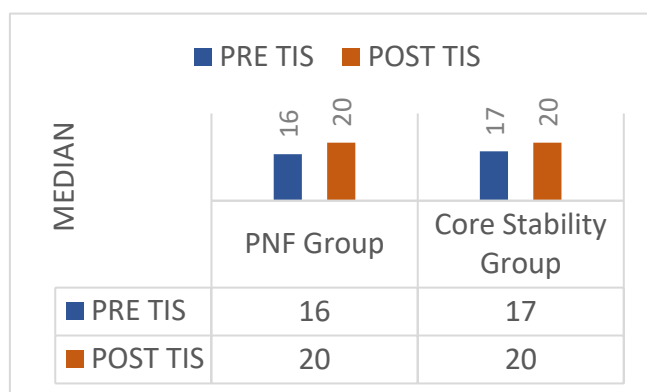
Out of 32 patients enrolled in the study, 1 patient from Group A and 1 patient from Group B had discontinued the treatment before completion of 4 weeks due to personal reasons.

## RESULT

Statistical analysis was done using SPSS statistics version 25 for windows software. Mean was calculated as a measure of central tendency. SD was calculated as a measure of dispersion. Level of significance was kept at 5% with Confidence Interval at 95% (p value = 0.05).

The mean age in Group A was  $53.67 \pm 4.85$  years, and in Group B, it was  $53.40 \pm 6.49$  years. Both groups were comparable in terms of age, gender distribution, and duration of stroke ( $p > 0.05$ ).

The study examined the difference in pre- and post-outcome measures of the Trunk Impairment Scale (TIS) between Group A (Pelvic PNF group) and Group B (Core Stability Exercise group). The median TIS score for Group A increased from 16 (pre-intervention) to 20 (post-intervention), while for Group B, it rose from 17 to 20.

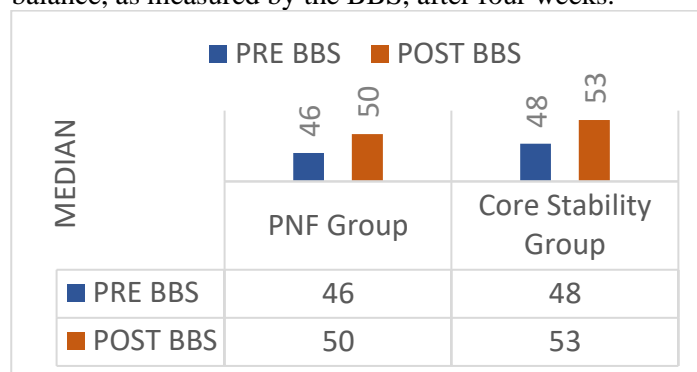


**Within group comparison of TIS for both the groups**

The mean rank for Group A increased from 13.03 to 14.63, and for Group B, it remained consistent at 17.97. A Wilcoxon signed-rank test was performed to compare the pre- and post-TIS scores within each group, yielding a p-value of 0.001 for both groups. This indicated significant improvements in TIS outcomes for both the Pelvic PNF and Core Stability groups, with p-values less than 0.05. Consequently, the null hypothesis was rejected, and the alternative hypothesis was accepted for both groups, suggesting that both interventions significantly improved TIS scores after four weeks.

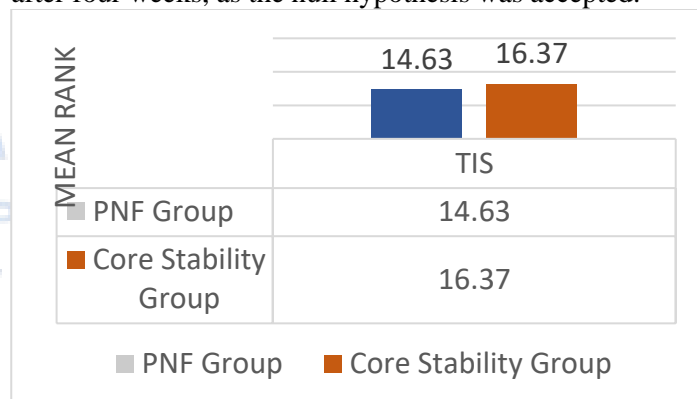
Similarly, for the Berg Balance Scale (BBS), the median pre-BBS score in Group A increased from 46 to 50, while in Group B, it increased from 48 to 53. The mean rank for Group A was 12.97 (pre) and 12.60 (post), while for Group B, it was 18.03 (pre) and 18.40 (post). The Wilcoxon signed-rank test for within-group comparisons showed a p-value of 0.001 for both groups, demonstrating significant improvements in BBS scores post-intervention. Therefore, the null hypothesis was rejected for both groups, affirming that both Pelvic PNF

and Core Stability exercises were effective in improving balance, as measured by the BBS, after four weeks.

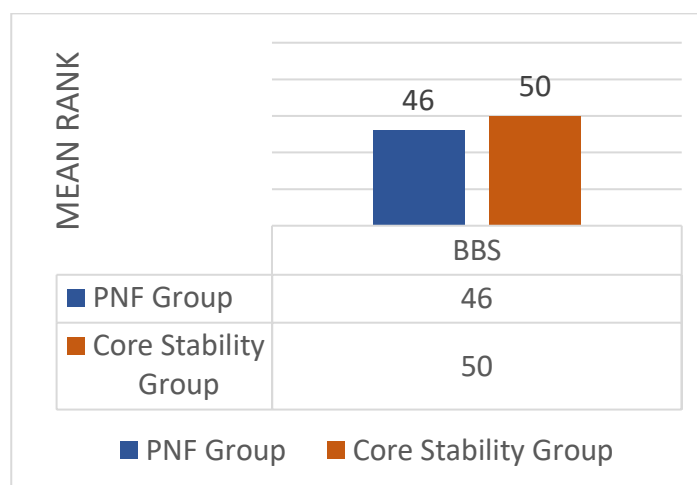


**Within group comparison of BBS for both the groups**

When comparing the differences between Group A and Group B for the TIS, the mean rank was 14.63 for Group A and 16.37 for Group B. A Mann-Whitney U-test revealed a p-value of 0.595, indicating no significant difference between the groups in TIS outcomes. This suggests that both Pelvic PNF and Core Stability exercises are equally effective in improving TIS scores after four weeks, as the null hypothesis was accepted.



**Between group comparison of Trunk Impairment Scale (TIS)**



**Between group comparison of Berg Balance Scale (BBS)**

In terms of the BBS, the mean rank for Group A was 46 and for Group B, it was 50. The Mann-Whitney U-test

comparing the BBS scores between the two groups yielded a p-value of 0.074, indicating no significant difference in balance improvements between the two groups. This implies that both interventions were equally effective in enhancing balance, as reflected in BBS scores, after four weeks of treatment. Consequently, the null hypothesis was accepted for both outcome measures, confirming that both Pelvic PNF and Core Stability exercises were equally effective in improving trunk control and balance in subacute-chronic stroke patients.

## DISCUSSION

This study demonstrates that both Pelvic PNF and Core Stability exercises significantly improve trunk control and balance in subacute to chronic stroke patients. However, the absence of significant differences between the two groups suggests that both interventions are equally effective.

The findings align with previous studies, such as Khanal et al. (22), who reported improvements in trunk control using Pelvic PNF, and Haruyama et al. (27), who found core stability exercises to be beneficial for stroke patients.

The use of Pelvic PNF facilitates neuromuscular coordination through specific movement patterns, which enhance trunk stability and postural control. Similarly,

Core Stability exercises strengthen the deep abdominal and spinal muscles, improving balance and reducing postural deviations.

The absence of a significant difference between the groups indicates that both techniques target trunk stability through different mechanisms, but achieve comparable outcomes. Clinicians can therefore use either intervention based on patient preferences, resource availability, and clinical judgment.

## LIMITATIONS

The study had a small sample size and a short follow-up period, which may limit the generalizability of the findings. Future research with larger sample sizes and longer follow-ups is recommended to further explore the long-term effects of these interventions.

## CONCLUSION

Both Pelvic Proprioceptive Neuromuscular Facilitation (PNF) and Core Stability exercises are effective in improving trunk control and balance in stroke patients. Given that there was no significant difference in outcomes between the two methods, either intervention can be utilized in clinical rehabilitation to enhance postural stability and functional independence in stroke survivors. Further studies with larger sample sizes are required to confirm these findings.

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