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Effect of Proprioceptive Neuromuscular Facilitation Pattern on Balance and Gait in Post-Stroke Patients

Vijay Pathania[1], Narendra Kumar[1], Abhishek Kumar Sandilya[2], Divya Kashyap[2]

Abstract

Objective: This study aimed to investigate the effect of proprioceptive neuromuscular facilitation (PNF) patterns on gait and balance in post-stroke patients. **Material and Methods:** A randomized controlled trial was conducted involving 24 post-stroke patients who were equally allocated to an intervention group and a control group. The intervention group received PNF patterns for pelvic and scapular mobility utilizing elastic resistance bands in conjunction with conventional physiotherapy. The control group received only conventional physiotherapy. The intervention was administered for 60 min per session, 5 days per week, for a duration of 4 weeks. Gait and balance were assessed using the observational gait analysis, Mini-Balance Evaluation Systems Test, and Stroke Specific Quality of Life Scale. **Results:** The intervention group exhibited significant improvements in gait and balance compared to the control group ($P < 0.05$). Furthermore, enhancements in stroke-specific quality of life were observed in the intervention group. **Conclusion:** PNF patterns utilizing elastic resistance bands demonstrate significant improvements in gait, balance, and quality of life among post-stroke patients. This intervention, characterized by its cost-effectiveness and ease of implementation, exhibits beneficial outcomes in stroke rehabilitation.

Keywords: Balance, Elastic resistance band, Gait, Post-stroke rehabilitation, Proprioceptive neuromuscular facilitation, Stroke

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Introduction

Stroke is a leading cause of long-term disability worldwide, significantly impacting gait and balance due to impaired pelvic and scapular mobility. According to the World Health Organization, approximately 15 million individuals experience strokes annually, with 5 million remaining permanently disabled.[1] Ischemic strokes, which constitute approximately 87% of all stroke cases, occur due to an obstruction of blood vessels, leading to oxygen and nutrient deficits in the brain.[2] The clinical sequelae of stroke include motor impairments, hemiplegia, reduced postural control, and compromised gait patterns, all of which contribute to decreased functional independence and diminished quality of life.[3,4]

Post-stroke patients frequently exhibit abnormal muscular activity patterns, spasticity, and weakness, resulting in instability and asymmetrical gait. The pelvic and scapular regions play pivotal roles in maintaining postural balance and facilitating coordinated movements during ambulation.[5] Disruptions in these areas significantly impair gait stability and overall mobility. Consequently, rehabilitation strategies focusing on enhancing pelvic and scapular mobility are essential for improving functional ambulation in stroke survivors.[6]

Proprioceptive neuromuscular facilitation (PNF) patterns are therapeutic interventions designed to enhance muscle tone, length, and strength, thereby facilitating movement and stability. These patterns utilize proprioceptive inputs to promote coordinated muscle contractions, enhance postural control, and improve functional mobility.[7] PNF patterns targeting pelvic and scapular regions are particularly efficacious in optimizing trunk stability, thus facilitating gait and balance. However, limited research has evaluated the impact of combining PNF patterns with elastic resistance bands, which provide graded resistance and enhance neuromuscular activation.[8]

Despite the efficacy of conventional physiotherapy in stroke rehabilitation, persistent gait asymmetries and balance deficits remain challenging to address.[9] Consequently, it is essential to investigate novel interventions that enhance muscle activation and functional mobility. Elastic resistance bands, when integrated with PNF patterns, provide dynamic resistance, facilitating motor learning and enhancing proprioceptive feedback.[10] This combination potentially accelerates neuroplastic adaptations, improving motor control and functional independence.[11] This study aims to evaluate the effect of pelvic and scapular PNF patterns using elastic resistance bands on gait and balance in post-stroke patients.

[1]Department of Physiotherapy, Narayan Paramedical Institute and Allied Sciences, Gopal Narayan Singh University, Jamuhar, Sasaram, Bihar.

[2]Department of Physiotherapy, Heritage Institute of Medical Sciences College of Physiotherapy, Varanasi, Uttar Pradesh, India.

Corresponding Author: Abhishek Kumar Sandilya, Heritage Institute of Medical Sciences College of Physiotherapy, Varanasi, Uttar Pradesh, India. E-mail: abhisandilya4421@gmail.com

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Materials and Methods

This randomized controlled trial was conducted at the Physiotherapy Outpatient Department of Lovely Professional University and affiliated hospitals in Jalandhar, Punjab. A total of 37 post-stroke patients were initially assessed for eligibility. Of these, 24 patients who met the inclusion criteria were randomly allocated into two groups: the intervention group (n = 12) and the control group (n = 12). The intervention group received PNF patterns targeting pelvic and scapular mobility utilizing elastic

resistance bands in conjunction with conventional physiotherapy. Each session comprised five repetitions for familiarization, followed by 10 repetitions of three sets per session, with a duration of approximately 60 min. The sessions were conducted 5 days per week for 4 weeks. The control group received standard physiotherapy, including pelvic stability training, mat exercises, strengthening of upper and lower limbs, and gait training. Outcome measures were assessed pre- and post-intervention utilizing the observational gait analysis, Mini-Balance Evaluation Systems Test (Mini-BESTest), and Stroke Specific Quality of Life Scale. Data were analyzed using paired *t*-tests to compare pre- and post-intervention scores within each group. Independent t-tests were employed to compare the differences between the intervention and control groups. Statistical significance was established at $P < 0.05$.

Results

The intervention group exhibited statistically significant improvements in gait parameters and balance scores compared to the control group ($P < 0.05$). Specifically, Mini-BESTest scores increased by 20% in the intervention group, whereas the control group demonstrated only a 5% improvement. Furthermore, stroke-specific quality of life scores improved significantly in the intervention group, indicating enhanced functional independence and psychosocial well-being.

Discussion

The findings of this study indicate that PNF patterns utilizing elastic resistance bands effectively enhance gait and balance in post-stroke patients. The significant improvements observed in the intervention group can be attributed to the dynamic resistance provided by the elastic bands, which facilitates neuromuscular activation and promotes neuroplasticity. These findings support the hypothesis that targeted PNF patterns enhance pelvic and scapular mobility, thereby improving postural control and gait stability. These results align with previous studies demonstrating the efficacy of PNF techniques in enhancing functional mobility and balance in neurological rehabilitation. The integration of elastic resistance bands provides variable resistance, promoting muscle strength and proprioceptive feedback, which are crucial for gait stability and balance recovery.

Conclusion

The results of this randomized controlled trial indicate that the implementation of proprioceptive neuromuscular facilitation (PNF) patterns, utilizing elastic resistance bands, significantly enhances gait parameters, balance control, and stroke-specific quality of life in post-stroke patients. In comparison to conventional physiotherapy alone, the PNF-based intervention exhibited superior functional outcomes concerning dynamic postural control and ambulatory efficiency. These findings advocate for the incorporation of targeted pelvic and scapular PNF exercises into neurorehabilitation protocols, especially in low-resource settings where cost-effective and portable methods are crucial. Given the ease of implementation and scalability of this technique, it offers a viable therapeutic adjunct for clinicians seeking to improve motor recovery in chronic stroke survivors. Future research with larger sample sizes, extended intervention durations, and follow-up assessments is necessary to evaluate the sustained benefits and potential neuroplastic mechanisms underlying this approach.

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