

Original Article

Comparative Effects of Neural Mobilization and Proprioceptive Neuromuscular Facilitation in Patients with Bell's Palsy

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ABSTRACT

Background: Bell's palsy, characterized by sudden unilateral facial nerve paralysis, presents significant challenges in physical therapy and rehabilitation. Proprioceptive Neuromuscular Facilitation (PNF) and Neural Mobilization have emerged as potential interventions, yet their comparative efficacy remains underexplored. This study aims to fill this gap by evaluating the effectiveness of these treatments in improving facial function in patients with idiopathic Bell's palsy.

Objective: The primary objective of this randomized control trial (RCT) was to compare the effects of PNF and Neural Mobilization on physical and social functioning in patients with mild to moderately severe idiopathic Bell's palsy.

Methods: This RCT involved 36 participants, aged 25 to 45, diagnosed with idiopathic Bell's palsy, randomly allocated into two groups: PNF and Neural Mobilization, with 18 participants in each. The study spanned three weeks, with treatments administered 3-4 days per week. Conventional physiotherapy, including facial exercises and electrical muscle stimulation (EMS), served as the baseline treatment for both groups. The Shapiro-Wilks test assessed data normality, employing parametric tests for intra-group reliability analysis. The Mann-Whitney Test and Wilcoxon signed-rank test were utilized for inter and intra-group comparisons, respectively.

Results: Post-treatment, the PNF group exhibited significant improvements with a mean post-treatment House Brackmann Scale score of 90.28, compared to 73.61 in the Neural Mobilization group. Similarly, significant enhancements were noted in the Facial Disability Index, with both physical and social scores increasing from a median of 48 to 80 post-intervention. Statistical analysis revealed significant differences in treatment outcomes ($p < 0.001$ for House Brackmann Scale; $p < 0.001$ for Physical and Social FDI scores), favoring the PNF approach.

Conclusion: PNF was more effective than Neural Mobilization in improving the physical and social functions of patients with idiopathic Bell's palsy. This study underscores the potential of PNF as a superior treatment modality, advocating for its inclusion in conventional physiotherapy regimens for Bell's palsy patients.

Keywords: Bell's Palsy, Proprioceptive Neuromuscular Facilitation, Neural Mobilization, Randomized Control Trial, Facial Disability Index, House Brackmann Scale.

INTRODUCTION

Bell's palsy, characterized by Sir Charles Bell, is a condition defined by unilateral facial nerve palsy with no identifiable cause, leading to partial or complete loss of muscular movement on the affected side of the face. This condition is attributed to lower motor neuron facial palsy, emerging rapidly and affecting individuals regardless of age or gender, although certain groups such as immunocompromised individuals, pregnant women, and those with diabetes or upper respiratory infections are at increased risk (1, 2). The etiology of Bell's palsy remains largely speculative, with studies suggesting links to viral infections, including herpes simplex virus type 1, varicella-zoster virus, and others, implicating an immune or inflammatory response that leads to nerve dysfunction. Clinically, Bell's palsy presents with rapid onset of symptoms such as facial weakness, numbness, and sometimes pain around the ear, leading to significant facial asymmetry and functional impairment (3, 4).

The impact of Bell's palsy extends beyond physical symptoms, affecting psychological and social aspects of individuals' lives due to the facial disfigurement and loss of facial muscle control. This condition emphasizes the necessity for effective treatment approaches

to restore facial function and improve quality of life. Among the various interventions, physical therapy techniques such as neural mobilization and proprioceptive neuromuscular facilitation (PNF) have been explored for their potential benefits in the management of Bell's palsy (5, 6).

Neural mobilization, a technique that applies gentle stretching and mobilization of neural structures, aims to improve nerve gliding and reduce nerve entrapment, thereby facilitating recovery of nerve function (7, 8). Proprioceptive Neuromuscular Facilitation, on the other hand, is a method that uses specific patterns of stretching and contracting muscles to enhance muscular strength and coordination, potentially aiding in the re-education of paralyzed or weakened facial muscles. The application of these therapies, alongside conventional treatments such as corticosteroids and antiviral medication, presents a holistic approach to managing Bell's palsy by addressing both the neural and muscular components of the condition (9, 10).

Research into the comparative effectiveness of neural mobilization versus PNF in Bell's palsy patients suggests a nuanced understanding of treatment outcomes. Studies have shown varied results, with some patients responding favorably to one treatment over the other, indicating that individualized treatment plans based on patient-specific characteristics and the severity of nerve involvement may be necessary. The exploration of these physical therapy techniques underscores the importance of a multidisciplinary approach in treating Bell's palsy, incorporating medical, physical, and supportive therapies to optimize recovery (11, 12).

Furthermore, the significance of early intervention cannot be overstated, as the timing of treatment initiation plays a crucial role in the prognosis of Bell's palsy. The use of outcome measures such as the House-Brackmann scale for facial grading, along with patient-reported outcome measures, provides a comprehensive evaluation of treatment effectiveness, guiding clinicians in refining therapeutic strategies to achieve better functional and cosmetic outcomes (12-14).

In conclusion, Bell's palsy remains a complex condition with multifactorial etiologies, presenting significant challenges in management and rehabilitation (15, 16). The comparative study of neural mobilization and proprioceptive neuromuscular facilitation offers valuable insights into the dynamic interplay between neural and muscular systems in facial palsy, emphasizing the need for personalized, evidence-based treatment protocols. As research continues to evolve, the integration of these physical therapy techniques with conventional medical treatments holds promise for enhancing recovery and improving the quality of life for patients with Bell's palsy (16-18).

MATERIAL AND METHODS

This study was designed as a quantitative Randomized Control Trial (RCT) aimed at evaluating the comparative effects of Proprioceptive Neuromuscular Facilitation (PNF) and Neural Mobilization in patients diagnosed with Bell's palsy. Conducted over a four-month period, the research took place in the physical therapy department of Allied Hospital Faisalabad, after receiving the necessary approval for the study synopsis. The methodology encompassed the recruitment of participants, intervention procedures, and assessment of outcomes, adhering strictly to ethical guidelines to ensure the integrity and reliability of the research findings (19, 20).

A total of 36 patients suffering from Bell's palsy were selected for the study, utilizing a convenience sampling method for random allocation into two distinct groups. Group A received treatment through Proprioceptive Neuromuscular Facilitation (PNF), incorporating rhythmic initiation and repeated stretch techniques alongside conventional physiotherapy measures. This approach aimed at facilitating muscle contraction responses by stimulating proprioceptors, specifically targeting muscles such as the Frontalis, Orbicularis oculi, Zygomaticus major, and Levator Labii. Group B, on the other hand, was treated with Neural Mobilization techniques, which involved manual traction and circular movements around the ear area to enhance nerve mobility and function. Both groups additionally underwent conventional physical therapy, including Electrical Muscle Stimulation (EMS) and a prescribed regimen of facial exercises to support the primary treatment modalities (21, 22).

To determine the efficacy of the interventions, the House Brackmann Scale (HBS) and the Facial Disability Index (FDI) were employed as primary outcome measures. The HBS was used to grade the severity of facial dysfunction, ranging from normal function to complete paralysis, while the FDI provided a comprehensive assessment of physical and social functions affected by Bell's palsy. Data collection and analysis were meticulously planned to ensure the accuracy and relevance of the results. Participants' demographic and professional details were gathered, and their progress was monitored through pre- and post-treatment assessments (23, 24).

Ethical considerations were paramount throughout the research process. Written informed consent was obtained from all participants, ensuring they were fully aware of the study's purpose, procedures, and potential risks. Confidentiality and anonymity were strictly maintained to protect participants' privacy, with all data handled in a manner that preserved the dignity and rights of the individuals involved. Approval for data collection was also obtained from the hospital's medical superintendent, further affirming the study's adherence to ethical standards (24-26).

Statistical analysis of the collected data was conducted using SPSS version 25, enabling a thorough examination of the treatment outcomes. The analysis included tests of significance to compare the effectiveness of PNF and Neural Mobilization in improving the symptoms of Bell's palsy, with results presented in a clear and concise manner (27, 28).

Inclusion criteria for the study were deliberately chosen to focus on patients with idiopathic Bell's palsy, specifically those with unilateral symptoms and graded as having mild to moderate dysfunction according to the House Brackmann scale. Exclusion criteria ensured the omission of patients undergoing other treatments for Bell's palsy, those with head injuries, recent surgeries, psychological disorders, or severe comorbidities, and individuals taking medications such as NSAIDs or steroids that could influence the study's outcomes (18, 23).

This research was conducted with the utmost respect for the ethical principles outlined in the Declaration of Helsinki, ensuring the protection and welfare of the participants at all stages of the study. The methodological rigor, combined with strict ethical adherence, aimed to contribute valuable insights into the effectiveness of PNF and Neural Mobilization in the treatment of Bell's palsy, offering potential pathways for enhanced patient care and recovery (9, 12).

RESULTS

In this study, a total of 36 participants diagnosed with Bell's palsy were evenly divided into two treatment groups: the PNF (Proprioceptive Neuromuscular Facilitation) group and the Neural Mobilization group, with each group comprising 18 individuals. The mean age of participants in the PNF group was approximately 34.75 years, while those in the Neural Mobilization group had a slightly higher mean age of 35.16 years. Gender distribution across the groups showed a slight male predominance in the PNF group with 11 males and 7 females, compared to the Neural Mobilization group, which had a more balanced gender ratio of 8 males to 10 females. The analysis of the affected side of the face revealed that in the PNF group, a larger proportion of patients, 61.1%, had the left side of their face affected, whereas, in the Neural Mobilization group, the majority, 61.1%, had the right side affected (Table 1). Clinical outcomes, measured by the House Brackmann Scale and the Facial Disability Index, highlighted significant improvements post-intervention in both groups. Both the PNF and Neural Mobilization groups showed a median score increase from 60 to 90 on the House Brackmann Scale, indicating substantial recovery in facial nerve function. Similarly, improvements were observed in the Facial Disability Index, where both the physical and social facets showed a rise in median scores from 48 to 80, suggesting enhanced physical functionality and social well-being post-treatment (Table 2).

Table 1 Participant Demographics and Clinical Characteristics by Treatment Group

Variable	PNF Group N=18	Neural Mobilization Group N=18
Number of Participants	18	18
Age, Mean, SD, Years	34.75	35.16
Gender (Male/Female)	11/7	8/10
Affected Side of Face		
Right Side	7 (38.9%)	11 (61.1%)
Left Side	11 (61.1%)	7 (38.9%)

Table 2 Clinical Outcomes Pre and Post-Intervention

Treatment Group	Pre-Intervention Median	Post-Intervention Median	Improvement
House Brackmann Scale			
PNF for Bell's Palsy	60	90	Yes
Neural Mobilization	60	90	Yes
Facial Disability Index (Physical and Social)			
Pre-Physical FDI	48	80	
Pre-Social FDI	48	80	

Table 3 Statistical Analysis of Clinical Outcomes

Outcome Measure	Statistical Test	Value	Significance (p-value)
Pre vs. Post Physical FDI	Wilcoxon Test	Z=-3.745	<0.001
Pre vs. Post Social FDI	Wilcoxon Test	Z=-3.183	<0.001

Outcome Measure	Statistical Test	Value	Significance (p-value)
Pre vs. Post HBS	Wilcoxon Test	Z=-3.862	<0.001
Outcome Measure	T-Test / Mann-Whitney U	Value	Significance (p-value)
Post Physical FDI	Independent Samples T-Test	T=7.754	<0.001
Post Social FDI	Mann-Whitney U	U=63.000	0.001
Post House Brackmann Scale	Mann-Whitney U	U=18.000	<0.001

Statistical analysis underscored these clinical improvements with significant p-values. The Wilcoxon Test applied to compare pre and post-intervention scores for the Physical FDI, Social FDI, and House Brackmann Scale yielded Z-values of -3.745, -3.183, and -3.862, respectively, all indicating significance with p-values less than 0.001. This denoted statistically significant improvements across all measured outcomes post-intervention. Furthermore, a comparison between the two treatment modalities using the Independent Samples T-Test for the Post Physical FDI and the Mann-Whitney U test for both the Post Social FDI and Post House Brackmann Scale revealed significant differences, with T=7.754 for the Physical FDI and U values of 63.000 for the Social FDI and 18.000 for the House Brackmann Scale, all showing significant p-values (Table 3).

DISCUSSION

In this randomized control trial, the comparative efficacy of proprioceptive neuromuscular facilitation (PNF) and neural mobilization in treating idiopathic Bell's palsy was meticulously evaluated. The study, incorporating a conventional physiotherapy regimen as a baseline treatment, which included facial exercises and electrical muscle stimulation (EMS), was structured to provide a comprehensive analysis over a three-week period, entailing 3-4 treatment sessions weekly for each designated group (24, 26).

The cohort, comprising 36 individuals randomly allocated into two groups, spanned an age range of 25 to 45 years, with the mean age slightly varying between the groups. Notably, the PNF group exhibited a gender distribution leaning towards a higher male participation (61.1%), whereas the Neural Mobilization group presented a female majority (55.6%). This demographic setup facilitated an equitable comparison across the two treatment methodologies (27, 28).

The analytical approach to data normality employed the Shapiro-Wilks test, laying the groundwork for applying parametric tests to assess intra-group reliability. The significance levels set for various scales, including the House Brackmann scale and both physical and social facets of the Facial Disability Index (FDI), underscored the methodological rigor of this investigation. Interestingly, the post-intervention analysis revealed a marked improvement in the PNF group, evidenced by a higher mean value on the post-treatment assessments compared to the Neural Mobilization group (28, 29).

The statistical analysis, utilizing the Mann-Whitney Test for comparative assessment, delineated a pronounced efficacy of PNF in ameliorating symptoms of Bell's palsy, thereby challenging the null hypothesis and underscoring a significant variance in the impact of PNF and Neural Mobilization techniques. This revelation is corroborated by the literature, which predominantly suggests PNF as a more robust treatment modality for enhancing physical and social functionality in Bell's palsy patients. The correlation between pre and post-treatment scores further emphasized the substantial recovery facilitated by PNF, highlighting its superiority in not just alleviating physical symptoms but also in bolstering patients' social engagement (26, 30).

The study's strengths lie in its methodical approach and the clear demarcation of treatment protocols, allowing for an in-depth analysis of each modality's effectiveness. However, the limitations cannot be overlooked. The relatively small sample size and the short duration of the study may hinder the generalizability of the findings. Furthermore, the scarcity of extensive research comparing neural mobilization and PNF in Bell's palsy treatment presents a challenge in directly correlating these findings with existing literature (21, 24).

To mitigate these limitations and build on the current study's insights, further research is recommended. Expanding the sample size and extending the duration of follow-up would provide a more comprehensive understanding of the long-term benefits of these treatment techniques. Additionally, securing funding for such research endeavors could facilitate a more extensive exploration into the comparative effectiveness of different physiotherapy interventions for Bell's palsy, thereby enriching the existing body of knowledge (29, 30).

CONCLUSION

In conclusion, while both PNF and Neural Mobilization demonstrate efficacy in treating Bell's palsy, this study highlights PNF's superior role in improving both the physical and social functions of affected individuals. These findings, juxtaposed with the broader context of physiotherapy research, pave the way for future investigations aimed at refining treatment strategies for Bell's palsy, ultimately enhancing patient care and recovery outcomes.

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