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Comparison Of Muscle Energy Technique And Proprioceptive Neuromuscular Facilitation Technique In Periarthritis Shoulder

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ABSTRACT

Aim:

This study aims to compare the effectiveness of Muscle Energy Technique (MET) and Proprioceptive Neuromuscular Facilitation (PNF) in the management of periarthritis shoulder.

Background:

Periarthritis, also referred to as adhesive capsulitis, is marked by severe shoulder pain and a gradual loss of movement without a clearly known cause. Muscle Energy Technique is an osteopathic, soft-tissue intervention that uses controlled, patient-initiated isometric contractions to enhance musculoskeletal function and relieve pain. Proprioceptive Neuromuscular Facilitation is a stretching-based approach designed to improve muscle elasticity and increase both active and passive ranges of motion.

Methodology:

Thirty individuals aged 50–70 years diagnosed with periarthritis shoulder were selected based on inclusion criteria. Patients with fractures, ligament injuries, dislocation, or those unable to cooperate with treatment were excluded. Participants were divided into two groups: Group A received MET, while Group B received PNF. Pain and functional status were evaluated before and after the intervention using the Visual Analog Scale (VAS) and the Shoulder Pain and Disability Index (SPADI). Both groups underwent

treatment for 8 weeks, 5 days per week, with each session lasting 15–20 minutes. The total study duration was 3 months.

Results:

At baseline, both groups demonstrated similar mean VAS and SPADI scores (VAS: 57.27 ± 3.59; SPADI: 57.27 ± 3.59). Post-treatment analysis showed a statistically significant difference between the two groups, with Group B (PNF) showing superior improvement in both pain and shoulder function.

Conclusion:

The findings indicate that Proprioceptive Neuromuscular Facilitation is more effective than Muscle Energy Technique in reducing pain and improving functional mobility in individuals with periarthritis shoulder.

KEYWORDS: Muscle energy technique, Proprioceptive Neuromuscular Facilitation technique, SPADI, VAS and Periarthritis shoulder.

INTRODUCTION

Periarthritis of the shoulder—commonly termed adhesive capsulitis—is a progressively painful condition characterized by stiffness and substantial limitations in active and passive glenohumeral motion. These functional deficits significantly disrupt activities of daily living, including dressing, grooming, and overhead tasks **[1]**. Population studies report a prevalence of 2–5%, with peak incidence between 40 and 60 years, particularly among females and individuals with diabetes or thyroid dysfunction **[2]**.

The shoulder complex comprises the humerus, scapula, and clavicle, functioning through the glenohumeral, acromioclavicular, sternoclavicular, and scapulothoracic joints to provide extensive mobility **[3]**. Owing to its anatomical design—where the large humeral head articulates with the shallow glenoid fossa—the joint depends on both static stabilizers (capsule, ligaments, labrum) and dynamic stabilizers (rotator cuff and scapular muscles) to maintain joint integrity and coordinated scapulohumeral rhythm **[3]**.

Adhesive capsulitis is characterized by chronic inflammation, capsular fibrosis, and contracture, leading to reduced joint volume and mechanical restriction of movement **[4]**. Clinically, the disorder progresses through three stages: freezing, frozen, and thawing. Although recovery may occur spontaneously, full functional restoration can take months or years, and some patients may experience persistent mobility deficits.

Diagnosis is primarily clinical, supported by tools such as the Visual Analog Scale (VAS) for pain and the Shoulder Pain and Disability Index (SPADI) for functional assessment **[4]**. Imaging is typically utilized only to exclude differential diagnoses such as rotator cuff injury or osteoarthritis.

Management generally involves a combination of pharmacological and physiotherapeutic interventions. NSAIDs, corticosteroid injections, joint mobilization, stretching, strengthening, and neuromuscular re-education are standard components of conservative care. In refractory cases, hydrodilatation, manipulation

under anesthesia, or arthroscopic capsular release may be indicated **[5]**.

Muscle Energy Technique (MET) and Proprioceptive Neuromuscular Facilitation (PNF) are commonly used physiotherapy techniques. MET involves patient-generated isometric contractions against controlled resistance to achieve post-isometric relaxation and improved tissue extensibility. PNF techniques, such as hold-relax and contract-relax, use cycles of contraction and passive stretching to enhance proprioception, neuromuscular control, and range of motion **[5]**.

Although both techniques have shown positive outcomes in reducing pain and improving mobility, comparative studies in adhesive capsulitis are limited. This study therefore aims to evaluate and compare the effectiveness of MET and PNF in reducing pain (VAS), improving function (SPADI), and restoring shoulder range of motion in patients with periarthritis shoulder.

METHODOLOGY

The present study employed a comparative experimental design with a pre-test and post-test approach to evaluate the effectiveness of the interventions. The research was carried out in the Outpatient Department of Physiotherapy at ACS Medical College and Hospital. A total of 30 participants were selected using a convenient sampling method. Each participant underwent one treatment session per day, six days per week, over a period of four weeks.

INCLUSION CRITERIA:

- Subjects diagnosed and referred by an Orthopedician with PA shoulder.
- Subjects having shoulder rotational ROM limitation of 25 degree
- Age group: 35 - 60 years
- Having a baseline VAS of 6
- Apley's scratch test positive
- Painful shoulder at least for 3 months
- Male and female.

EXCLUSION CRITERIA:

- Subjects with history of recent surgery on head neck and upper limb
- Fractures and Dislocation
- Recent rotator cuff injuries
- Sympathetic dystrophy
- Musculoskeletal disorder with hyper mobility
- Subjects who have taken Physiotherapy treatment for the affected shoulder before
- Patients on Corticosteroid injections for affected shoulder

OUTCOME MEASURES:

VAS (Visual analogue scale) **[6]**.

SPADI (Shoulder Pain and Disability Index) **[7]**.

After screening participants according to the inclusion and exclusion criteria, eligible subjects were invited to participate in the study and were thoroughly briefed about the purpose, procedures, and expected outcomes. Written informed consent was obtained from each participant prior to enrolment. All subjects were then allocated into two groups: Group A received Muscle Energy Technique (MET), while Group B underwent Proprioceptive Neuromuscular Facilitation (PNF). Both groups received five treatment sessions per week for a duration of four weeks, with each session lasting approximately 30–45 minutes. Pre- and post-intervention scores for the Shoulder Pain and Disability Index (SPADI) and the Visual Analog Scale (VAS) were recorded to assess changes in pain intensity and functional disability. For Group A, MET was administered by positioning the shoulder just short of the restricted range, following which the patient performed a gentle isometric contraction of the targeted musculature for 5–10 seconds against therapist resistance. Upon relaxation, the therapist moved the limb further into the new available range and maintained the stretch for 20–30 seconds, repeating the sequence three to five times. The muscles commonly addressed included the posterior capsule and rotator cuff to improve external rotation, pectoralis major and minor for abduction deficits, latissimus dorsi and teres major for flexion limitations, and upper trapezius and levator scapulae for elevation and scapulocervical restrictions. Group B received PNF techniques primarily using contract–relax and hold–relax methods. Each session began with the therapist passively moving the shoulder to the initial point of resistance, followed by either an isometric contraction (hold–relax) or a controlled isotonic contraction (contract–relax) of the target muscle group for approximately 5–10 seconds. After the contraction phase, the patient relaxed, and the therapist facilitated a gradual increase in ROM by passively stretching the joint into the newly gained range and holding for 20–30 seconds. This procedure was repeated for 3–5 cycles. PNF targeted major movement patterns essential for shoulder rehabilitation, including flexion–abduction–external rotation and extension–adduction–internal rotation, thereby enhancing neuromuscular control, proprioceptive feedback, and functional mobility. Both interventions were performed under the supervision of an experienced physiotherapist to ensure safety, consistency, and optimal therapeutic outcomes.

FIG.1: MUSCLE ENERGY TECHNIQUE

FIG.2: PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION

DATA ANALYSIS

The collected data were tabulated and analyzed using both descriptive and inferential statistical methods. All parameters were assessed using the Statistical Package for the Social Sciences (SPSS) version 24, with the level of significance set at $p < 0.05$ and a 95% confidence interval for all analyses. The Shapiro–Wilk test was performed to assess the normality of the data, with values of $p > 0.05$ indicating a normal distribution**[8]**..

In this study, the VAS (Visual Analog Scale) and NDI (Neck Disability Index) scores were examined. Although these measures can yield both parametric and non-parametric data depending on distribution characteristics, they generally tend to produce non-parametric data due to their ordinal nature and frequent deviation from normality. Accordingly, non-parametric statistical tests were adopted for analyzing VAS and NDI scores.The Wilcoxon Signed Rank Test was used to determine within-group differences, while the Mann–Whitney U Test was used to assess between-group differences. The two-tailed p-value obtained was < 0.001, indicating a highly statistically significant difference according to conventional standards**[9]**.

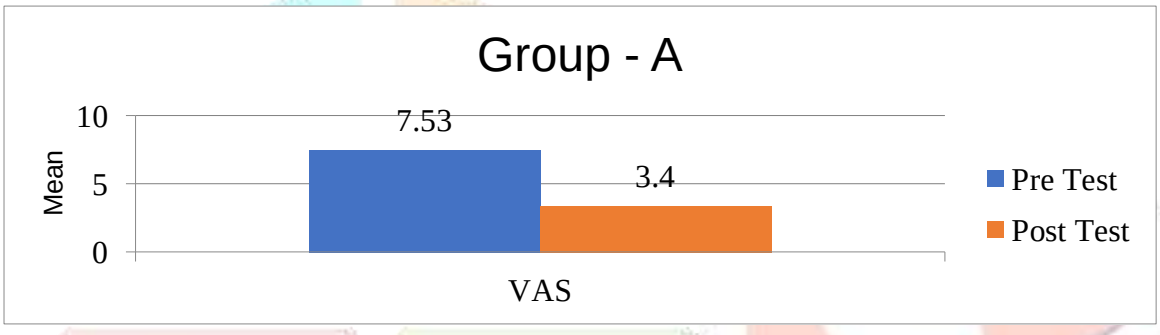
Table-1: Comparison of pre-test & post-test values for VAS– Group A

Group A		Mean	SD	Z test	p value
VAS	Pre test	7.53	0.52	3.4078	0.00064
	Post test	3.4	0.63		

(*P value < 0.05 - Statistically Significant)

The above table reveals the Mean, z-value and p-value between VAS in pre-test and post-test.

This Group A table shows that there is highly significant difference in VAS values between pre-test and post-test (P value is 0. 00064).



Graph -1: Comparison of pre-test & post-test values for VAS – Group A

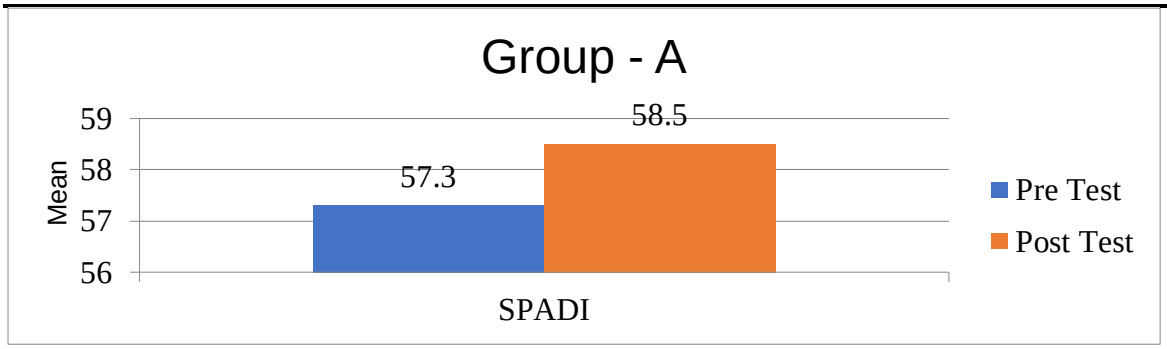
Table-2: Comparison of pre-test & post-test values for SPADI – Group A

Group A		Mean	SD	Z test	p value
SPADI	Pre test	57.3	4.79	3.4078	0.00064
	Post test	38.5	4.47		

(*P value < 0.05 - Statistically Significant)

The above table reveals the Mean, z-value and p-value between SPADI in pre-test and post-test.

This Group A table shows that there is highly significant difference in SPADI values between pre-test and post-test (P value is 0.00064).



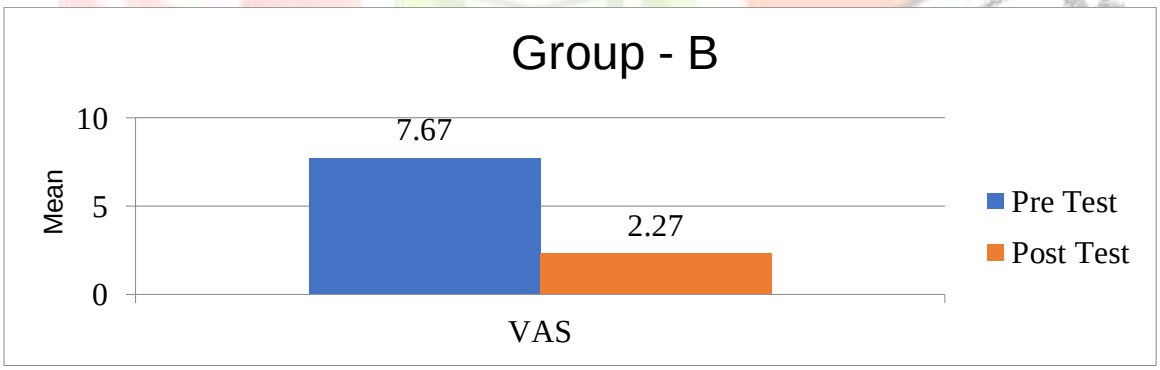
Graph -2: Comparison of pre-test & post-test values for SPADI – Group A

Table-3: Comparison of pre-test & post-test values for VAS – Group B

Group B		Mean	SD	Z test	p value
VAS	Pre test	7.67	0.49	3.4078	0.00064
	Post test	2.27	0.46		

(*P value < 0.05 - Statistically Significant)The above table reveals the Mean, z-value and p-value between VAS in pre-test and post-test.

This Group B table shows that there is significant difference in VAS values between pre-test and post-test (P value is 0.00064).



Graph -3: Comparison of pre-test & post-test values for VAS – Group B

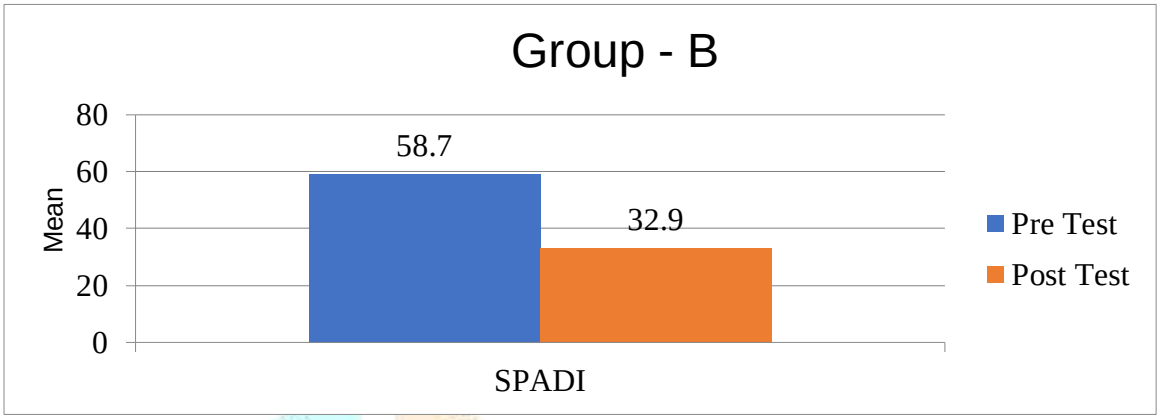
Table-4: Comparison of pre-test & post-test values for SPADI – Group B

Group B		Mean	SD	Z test	p value
SPADI	Pre test	58.7	6.6	3.4078	0.00064
	Post test	32.9	5.67		

(*P value < 0.05 - Statistically Significant)

The above table reveals the Mean, z-value and p-value between SPADI in pre-test and post-test.

This Group B table shows that there is significant difference in SPADI values between pre-test and post-test (P value is 0.00064).



Graph -4: Comparison of pre-test & post-test values for NDI – Group B

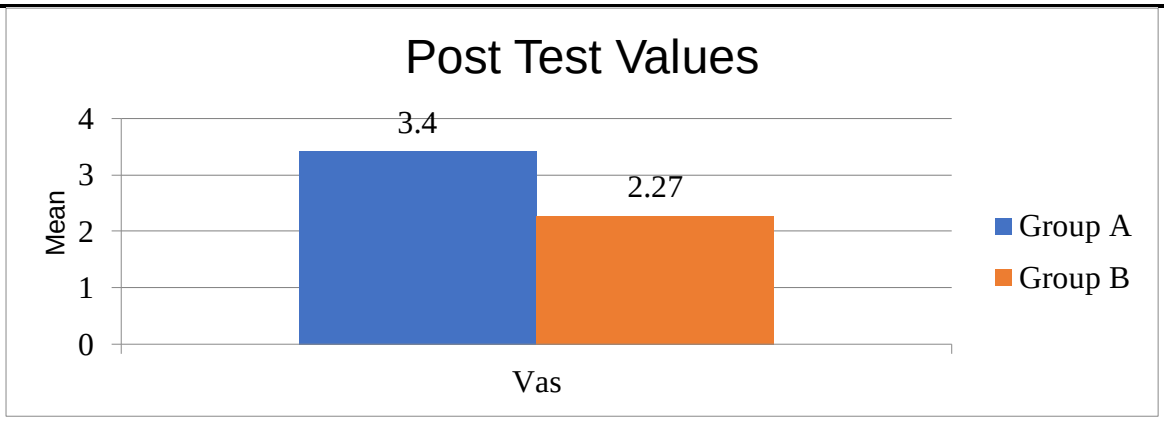
Table -5: Comparison of post-test values VAS of Group A & Group B

Parameter	Post Test Values		Z Score	U value	Significance
	Group A	Group B			
	Mean	Mean			
VAS	3.4	2.27	3.67081	23.5	0.00024

(*P value < 0.05 - Statistically Significant)

The above table reveals the Mean, Z score, U-value and p-value between pre-test and post-test within Group – A & Group – B

There is a statistically significant difference between the post-test values of Group A and Group B (P value is 0.00024).



Graph- 5: Post Test Values of Group A & Group B – VAS

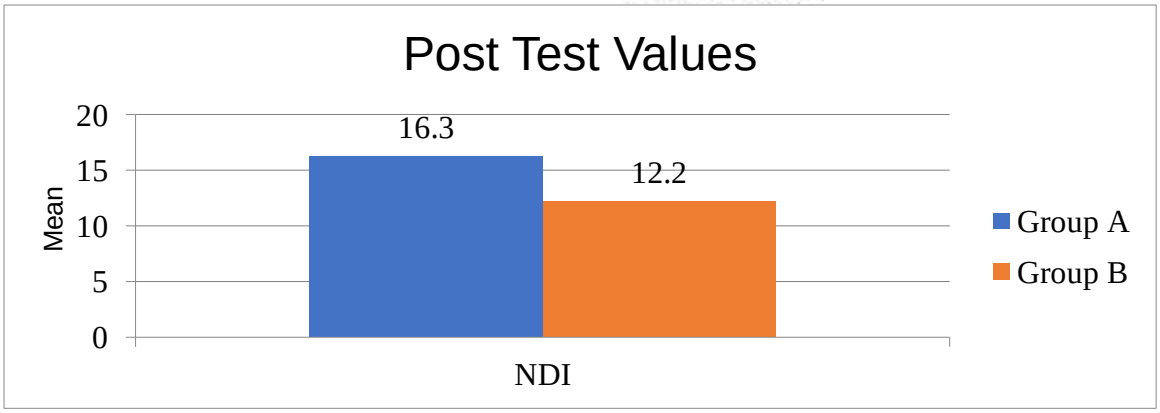
Table -6: Comparison of post-test values SPADI of Group A & Group B

Parameter	Post Test Values		Z Score	U value	Significance
	Group A	Group B			
	Mean	Mean			
SPADI	38.5	32.9	2.5509	50.5	0.01078

(*P value < 0.05 - Statistically Significant)

The above table reveals the Mean, Z score, U-value and p-value between pre-test and post-test within Group – A & Group – B

There is a statistically significant difference between the post-test values of Group A and Group B (P value is 0.01078).



Graph- 6: Post Test Values of Group A & Group B – SPADI

RESULTS

A statistically significant difference between Group A and Group B, as well as within each group, was found by statistical analysis of the quantitative data. In Group-A pre intervention mean to VAS was 7.53(±0.52) and SPADI scores are 57.3(±4.79). After treating the subject with Muscle energy technique, the mean value of VAS was 3.4(±0.63) and SPADI scores are 38.5(±4.47), which show statistical significant difference within the groups. In Group-B pre intervention mean to VAS was 7.67(±0.49) and SPADI scores are 7.67(±0.49). After treating the subject with Proprioceptive neuromuscular facilitation technique, the mean value of VAS was 2.27(±0.46) and SPADI scores are 2.27(±0.46), which show statistical significant difference within the groups.The results of the post-test statistical analysis for the VAS and SPADI showed that there was a significant statistical difference between groups A and B. The research is thus deemed to be statistically significant there by adopting the alternative hypothesis since Group-B (Proprioceptive neuromuscular facilitation technique) has a large statistical difference then Group-A (Muscle energy technique).

DISCUSSION

This study was conducted to compare the therapeutic effectiveness of Muscle Energy Technique (MET) and Proprioceptive Neuromuscular Facilitation (PNF) in reducing pain and disability among individuals diagnosed with periarthritis shoulder (adhesive capsulitis). Both interventions were administered for four weeks, and outcome measures included the Visual Analog Scale (VAS) for pain and the Shoulder Pain and Disability Index (SPADI) for functional disability.

The findings demonstrated that both treatment groups—Group A receiving MET and Group B receiving PNF—showed statistically significant improvements from pre-test to post-test on both VAS and SPADI scores. This confirms the effectiveness of both MET and PNF in alleviating pain and enhancing functional abilities in patients with periarthritis shoulder. However, between-group comparisons revealed that Group B (PNF) achieved significantly superior improvements in pain reduction and functional outcomes when compared to Group A (MET). These results indicate that while both interventions are beneficial, PNF may offer a greater therapeutic advantage in managing adhesive capsulitis.

The observed outcomes are consistent with the biomechanical and neurophysiological mechanisms of each technique. MET operates through controlled isometric contractions, promoting post-isometric relaxation, stretching of shortened tissues, and reciprocal inhibition. This leads to decreased muscle tension and improved joint mobility **[10].** In contrast, PNF incorporates diagonal and rotational movement patterns combined with proprioceptive stimuli to enhance neuromuscular control, facilitate coordinated movement, and increase muscle flexibility **[11,12].** Such dynamic multi-planar movements closely mimic functional shoulder activities, potentially resulting in faster gains in mobility and reduced pain in adhesive capsulitis, a condition characterized by capsular tightness and movement restrictions.

The findings of this study are supported by prior research. Al Dajah SB (2014) reported significant reductions in pain and improvements in range of motion (ROM) among frozen shoulder patients treated

with MET, highlighting the technique's effectiveness in soft-tissue mobilization**[13,14].** Similarly, studies by Shinde M et al. (2020) and Sudhakar P et al. (2019) demonstrated that PNF techniques significantly improve ROM, flexibility, and neuromuscular coordination, especially in patients with adhesive capsulitis where capsular stiffness is prominent **[15,16].** Moreover, other studies indicate that PNF's emphasis on proprioceptive input produces superior neuromuscular re-education and functional recovery compared to conventional stretching techniques**[17,18].** These findings align with the present study, where the PNF group showed a greater percentage reduction in both pain and disability scores.

In the present study, VAS scores in Group B (PNF) decreased markedly from 7.67 (±0.49) to 2.27 (±0.46), while SPADI scores decreased from 58.7 (±6.6) to 32.9 (±5.67). These reductions were more pronounced than those observed in Group A (MET), supporting the hypothesis that PNF may facilitate better functional recovery and pain modulation. This could be attributed to the activation of multiple muscle groups, improvement in scapulohumeral rhythm, and enhanced proprioceptive feedback inherent to PNF techniques **[19,20].**

Nevertheless, this study has some limitations. The sample size (n = 30) was relatively small, which may limit the generalizability of the findings. The intervention period was restricted to four weeks, potentially insufficient to capture long-term functional changes in adhesive capsulitis, a condition known for prolonged recovery phases. Additionally, only pain and functional disability were examined. Including other outcome measures such as range of motion, muscle strength, scapular kinematics, and quality of life would have provided a more comprehensive assessment of therapeutic effectiveness. Future research with a larger population, extended follow-up period, and additional functional measures is recommended to strengthen evidence regarding the superiority of PNF over MET in treating periarthritis shoulder.

CONCLUSION

The findings of this study indicate that both Muscle Energy Technique (MET) and Proprioceptive Neuromuscular Facilitation (PNF) are effective in reducing pain and disability associated with periarthritis shoulder. However, PNF demonstrated markedly superior improvements in both pain reduction and functional recovery compared to MET following the 4-week intervention period. These results suggest that PNF may be considered a more effective physiotherapeutic option for the conservative management of adhesive capsulitis. Incorporating PNF stretching techniques into routine physiotherapy protocols may enhance clinical outcomes in patients with periarthritis shoulder. Nevertheless, MET remains a valuable adjunct, particularly for individuals who may not tolerate dynamic or multi-planar movement patterns required in PNF.

LIMITATIONS

This study had a small sample size (n = 30) and a short intervention period of four weeks, which limits the generalizability of the results. Only VAS and SPADI were used as outcome measures, without assessing ROM, muscle strength, or long-term follow-up. Variations in patient compliance and therapist technique were not controlled, which may have influenced the outcomes.

Recommendations

Future studies should include a larger sample, longer intervention and follow-up periods, and additional outcome measures such as ROM and muscle strength. Comparing MET and PNF with other physiotherapy approaches may provide deeper insights. Clinically, PNF may be prioritized in rehabilitation for periarthritis shoulder, while MET can be used as a supportive or preparatory technique.

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