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Original Article

Efficacy of Maitland Mobilization Along with Strengthening Exercises Compared with PNF Technique in Treatment of Adhesive Capsulitis

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ABSTRACT

Background: Adhesive capsulitis commonly known as frozen shoulder, is the disease of shoulder in which the shoulder becomes inflamed, stiff, and have restricted ROM. It is more common in females than in males. The common age of its onset is mid-fifties.

Objective: The aim of the study was to compare the effects of Maitland mobilization along with strengthening exercises and PNF technique and to evaluate the more effective protocol for the treatment of adhesive capsulitis.

Methods: This study was a randomized clinical trial with a sample size of 32 members. Participants were randomly assigned into Group 1(Maitland mobilization along with strengthening Exercises) and Group 2 (PNF technique). Each group consisted of 16 participants. The duration of each intervention was 3 sessions per week for 1 month. The participants were assessed by SPADI scale, Numeric pain rating scale, and Goniometer at baseline, after the 2nd and 4th week of treatment.

Results: One way ANOVA and Repeated measures ANOVA were applied to infer results with a 95% confidence level, the level of significance of 0.05 was considered statistically significant. The mean age of subjects was recorded as 51.25±4.938. Out of 32 patients, 11 patients (34.48%) were Males, and 21 patients (65.63%) were Females. For Numeric Pain Rating Scale and SPADI, results demonstrate that significant differences is present in between both groups having significant value of $p<0.05$.

Conclusion: The study concluded that Maitland mobilization along with strengthening exercises showed more significant results reduction in pain, stiffness, and increased ROM for patients with adhesive capsulitis.

Keywords: Arthritis, Physical conditioning, Adhesive capsulitis, Physical Therapy, Activities of daily living

INTRODUCTION

Adhesive capsulitis, commonly referred to as frozen shoulder, is a condition characterized by inflammation, stiffness, and pain in the shoulder joint, leading to a significant reduction in range of motion (ROM). This condition progresses through distinct stages, including the freezing, frozen, and thawing phases, each marked by varying levels of pain, stiffness, and ROM loss. Adhesive capsulitis is more prevalent in females and can be associated with various risk factors, including metabolic disorders, thyroid disease, and prolonged immobilization (1, 2). The diagnosis of adhesive capsulitis involves distinguishing between primary and secondary forms, recognizing the stages of the condition, and employing imaging techniques such as radiographs and MRI to aid in diagnosis (3-5).

Effective management of adhesive capsulitis requires a stage-specific approach, incorporating pain management, reduction of inflammation, and efforts to regain ROM. In the early stages (Stages 1 and 2), treatment primarily focuses on managing pain and improving ROM. In the later stages (Stages 3 and 4), the emphasis shifts to addressing chronic stiffness and functional disability (3, 5). Various treatment modalities have been employed, including physical therapy, surgical interventions, and intraarticular corticosteroid injections (6). Among the physiotherapeutic interventions, Maitland mobilization and Proprioceptive Neuromuscular Facilitation (PNF) techniques are commonly utilized.

Maitland mobilization is a manual therapy technique developed by Australian physiotherapist George Maitland, aimed at restoring joint and soft tissue mobility through graded oscillatory movements. The technique employs a five-grade rating system, ranging from

small-amplitude movements for pain and spasm relief (Grade I) to high-velocity thrusts for joint manipulation (Grade V). These mobilizations target both physiologic (osteokinematic) and accessory (arthrokinematic) movements, enhancing joint function and reducing pain (7-10). In contrast, PNF is a set of stretching and strengthening techniques designed to enhance neuromuscular activity, flexibility, and muscle length. Developed in the 1940s by Margaret Knott and H. Herman Kabat, PNF initially aimed at rehabilitating patients with spasticity and muscle weakness but has since been adapted for broader therapeutic applications. PNF techniques include various stretching methods that improve flexibility and ROM, as well as strengthening exercises that enhance muscle strength and endurance (11-13).

The efficacy of these interventions in treating adhesive capsulitis has been explored in various studies. Maitland mobilization has been shown to be effective in reducing pain and improving ROM in patients with frozen shoulder, often yielding significant results compared to traditional physiotherapy methods (7-10). Similarly, PNF techniques have demonstrated substantial benefits in enhancing ROM and reducing pain, occasionally outperforming conventional physical therapy approaches (11, 13, 15). Despite the documented effectiveness of both methods, comparative studies evaluating the relative efficacy of Maitland mobilization combined with strengthening exercises versus PNF techniques in the treatment of adhesive capsulitis are limited. This study aims to fill this gap by assessing the combined effects of Maitland mobilization and strengthening exercises compared to PNF techniques, with the goal of determining the most effective protocol for reducing pain and improving functional activities of daily living (IADLs) in patients with adhesive capsulitis.

This randomized clinical trial was conducted over a period from March 2023 to August 2023, involving 32 participants diagnosed with Stage 2 adhesive capsulitis. The sample size was calculated using the OpenEpi tool, ensuring a power assumption of 0.8, a margin of error of 5%, and a 95% confidence interval. Participants were randomized into two groups: Group 1 received Maitland mobilization combined with strengthening exercises, while Group 2 underwent PNF techniques encompassing both stretching and strengthening exercises. Both groups also received baseline electrotherapy, including TENS and heating pads. The intervention was administered thrice weekly for one month, with assessments conducted at baseline, and after the 2nd and 4th weeks using the SPADI scale, Numeric Pain Rating Scale, and Goniometer. Statistical analysis was performed using SPSS version 26, employing One-Way ANOVA and Repeated Measures ANOVA to infer results, with a significance level set at 0.05.

The findings of this study are anticipated to contribute valuable insights into the optimal physiotherapeutic approach for managing adhesive capsulitis, potentially informing clinical practice and improving patient outcomes in terms of pain reduction, ROM improvement, and overall functional capacity (16, 17).

MATERIAL AND METHODS

The study was a randomized clinical trial conducted over a six-month period from March 2023 to August 2023. A total of 32 patients diagnosed with Stage 2 adhesive capsulitis were recruited, meeting the inclusion criteria of being aged 45 to 60 years, experiencing shoulder pain for more than three months, and exhibiting restricted ROM in shoulder external rotation, abduction, internal rotation, and flexion. Patients with shoulder injuries (fractures, dislocation), prior shoulder surgery, neurological disorders, other comorbidities (such as thyroid diseases, heart diseases, lung diseases), musculoskeletal disorders (osteoarthritis, osteoporosis, damage of GH cartilage, and rheumatoid arthritis), or malignancy were excluded from the study.

Participants were selected using a convenience sampling technique and were randomized into two groups using the even-odd method of simple random sampling. Group 1 received Maitland mobilization along with strengthening exercises and electrotherapy as baseline treatment, while Group 2 received PNF stretching and strengthening techniques with electrotherapy as baseline treatment. Both groups received TENS applied at a frequency of 150 Hz in burst mode for 15 minutes and heating pads for 10-15 minutes. Each group consisted of 16 participants. The intervention for both groups included three sessions per week over a four-week period, totaling 12 sessions, with each session lasting 45 minutes.

The interventions for Group 1 included Maitland mobilization techniques (anterior, posterior, and inferior glides) with 10-15 repetitions, along with various strengthening exercises such as Codman exercises, pulley exercises, shoulder wheel exercises, and isometric shoulder exercises targeting flexion, extension, abduction, external rotation, and internal rotation. Group 2 interventions involved PNF techniques including hold/contract relax and hold relax with agonist contraction for 10-15 repetitions, and rhythmic initiation and rhythmic stabilization for 10-15 repetitions. Both groups adhered to a baseline electrotherapy protocol of TENS and heating pads.

Data collection was carried out at three time points: baseline, after the 2nd week, and after the 4th week of treatment. The primary outcome measures included the SPADI scale, Numeric Pain Rating Scale, and goniometric measurements of shoulder ROM. These assessments were conducted by a blinded assessor to minimize bias. Ethical approval for the study was obtained from the

institutional review board, and all procedures adhered to the principles outlined in the Declaration of Helsinki. Informed consent was obtained from all participants prior to their inclusion in the study.

Data analysis was performed using the Statistical Package for Social Sciences (SPSS) version 25. Descriptive statistics were used to summarize the demographic data, and inferential statistics were applied to evaluate the treatment outcomes. One-way ANOVA was employed to compare the baseline characteristics and outcome measures between the two groups. Repeated measures ANOVA was utilized to assess within-group differences over time and the interaction effects between treatment groups and time points. A significance level of 0.05 was set for all statistical tests.

The study aimed to determine the comparative efficacy of Maitland mobilization combined with strengthening exercises versus PNF techniques in reducing pain and improving ROM in patients with adhesive capsulitis. The rigorous methodology and adherence to ethical standards ensured the reliability and validity of the findings, which are expected to contribute to the optimization of treatment protocols for this condition (16, 17).

RESULTS

The study included 32 participants diagnosed with Stage 2 adhesive capsulitis, with a mean age of 51.25±4.938 years. The sample comprised 11 males (34.48%) and 21 females (65.63%). Participants were randomly assigned to Group 1 (Maitland mobilization with strengthening exercises) and Group 2 (PNF techniques).

Table 1 Demographic Data:

Variable	Group 1 (n=16)	Group 2 (n=16)	Total (n=32)
Mean Age (years)	51.38±4.75	51.13±5.21	51.25±4.94
Gender			
Male (%)	5 (31.25%)	6 (37.50%)	11 (34.48%)
Female (%)	11 (68.75%)	10 (62.50%)	21 (65.63%)

Outcome Measures:

Table 2 Numeric Pain Rating Scale (NPRS):

Assessment	Group	Mean	Standard Deviation	Mean Difference	Significant Value (p)
Baseline	Maitland Mobilization	4.94	1.389	0.812	0.103
	PNF	5.75	1.342		
1st Assessment	Maitland Mobilization	2.75	1.238	1.750	0.000
	PNF	4.50	1.095		
2nd Assessment	Maitland Mobilization	0.63	0.957	2.125	0.000
	PNF	2.75	1.065		

The NPRS results indicated a significant reduction in pain for both groups over time, with Group 1 showing a more substantial decrease in pain levels compared to Group 2 ($p<0.05$).

Table 3 SPADI Pain Scale:

Assessment	Group	Mean	Standard Deviation	Mean Difference	Significant Value (p)
Baseline	Maitland Mobilization	35.13	16.41	2.75	0.566
	PNF	37.88	9.48		
1st Assessment	Maitland Mobilization	20.88	11.00	9.50	0.013
	PNF	30.38	9.39		
2nd Assessment	Maitland Mobilization	7.75	7.86	10.75	0.001
	PNF	18.50	8.59		

The SPADI pain scale showed significant improvements in both groups, with Group 1 demonstrating a greater reduction in pain compared to Group 2 ($p<0.05$).

Table 4 SPADI Disability Scale:

Assessment	Group	Mean	Standard Deviation	Mean Difference	Significant Value (p)
Baseline	Maitland Mobilization	32.11	16.77	0.55	0.907
	PNF	32.66	7.82		
1st Assessment	Maitland Mobilization	19.14	11.28	7.27	0.041
	PNF	26.41	7.55		
2nd Assessment	Maitland Mobilization	6.33	6.35	8.98	0.001
	PNF	15.31	7.49		

The SPADI disability scale also demonstrated significant improvements, with Group 1 showing more pronounced improvements compared to Group 2 ($p<0.05$).

Table 5 SPADI Total Scores:

Assessment	Group	Mean	Standard Deviation	Mean Difference	Significant Value (p)
Baseline	Maitland Mobilization	33.27	16.52	1.39	0.766
	PNF	34.66	8.30		
1st Assessment	Maitland Mobilization	19.86	11.15	8.07	0.027
	PNF	27.93	8.22		
2nd Assessment	Maitland Mobilization	6.87	6.87	9.66	0.001
	PNF	16.54	7.83		

The total SPADI scores confirmed that both groups experienced significant improvements, with Group 1 showing a greater overall improvement compared to Group 2 ($p<0.05$).

Table 6 Range of Motion (ROM) Improvement:

ROM	Group 1 (Mean)	Group 2 (Mean)	Mean Difference	Significant Value (p)
Flexion	22.687	17.5	5.187	0.012
Extension	12.250	8.9	3.350	0.021
Abduction	25.250	18.5	6.750	0.005
External Rotation	18.312	13.4	4.912	0.018
Internal Rotation	28.937	20.1	8.837	0.002

The ROM measurements revealed significant improvements in both groups, with Group 1 exhibiting superior gains across all measured movements compared to Group 2 ($p<0.05$).

Overall, the results demonstrated that while both Maitland mobilization combined with strengthening exercises and PNF techniques were effective in treating adhesive capsulitis, the former provided more substantial improvements in pain reduction, ROM, and functional outcomes. These findings support the hypothesis that Maitland mobilization, along with strengthening exercises, is more effective than PNF techniques in managing adhesive capsulitis.

DISCUSSION

The study aimed to compare the efficacy of Maitland mobilization combined with strengthening exercises versus Proprioceptive Neuromuscular Facilitation (PNF) techniques in treating adhesive capsulitis. The results indicated that both interventions effectively reduced pain and improved range of motion (ROM) in patients; however, Maitland mobilization demonstrated superior outcomes

across all measured parameters. These findings align with previous research that has established the benefits of Maitland mobilization in enhancing joint function and reducing pain in musculoskeletal conditions (Al Shehri et al., 2018; Do Moon et al., 2015).

The significant reduction in pain observed in the Maitland group could be attributed to the technique's specific grading system, which allows for precise targeting of joint mechanics and pain relief through controlled mobilizations. The five-grade system used in Maitland mobilization addresses both pain and stiffness, effectively promoting joint mobility and function (Bhatikar and Bhodaji, 2018). This targeted approach may explain the greater reduction in Numeric Pain Rating Scale (NPRS) and SPADI scores compared to the PNF group.

PNF techniques, while also effective, did not yield as substantial improvements as Maitland mobilization. PNF's focus on enhancing neuromuscular activity and muscle length has been proven beneficial in various rehabilitation settings, particularly for conditions involving spasticity and muscle weakness (Hindle et al., 2012; Darda et al., 2021). However, the chronic stiffness and functional limitations characteristic of adhesive capsulitis might require more direct joint mobilization techniques, as provided by the Maitland method. This could explain why PNF, though beneficial, was less effective in achieving the same level of pain reduction and functional improvement.

The study's strengths include its randomized design, adequate sample size, and the use of standardized outcome measures, which enhance the reliability and generalizability of the findings. The blinding of assessors further reduced potential bias, ensuring objective evaluation of treatment effects. However, some limitations must be acknowledged. The study's duration was relatively short, spanning only four weeks, which may not fully capture the long-term effects of the interventions. Additionally, the sample was limited to patients with Stage 2 adhesive capsulitis, and the findings may not be applicable to other stages of the condition or to patients with different comorbidities.

Future research should consider longer follow-up periods to assess the sustained benefits of these interventions and their impact on long-term functional outcomes. Including patients with varying stages of adhesive capsulitis could provide a more comprehensive understanding of the effectiveness of Maitland mobilization and PNF techniques across the spectrum of the condition. Moreover, incorporating other therapeutic modalities, such as corticosteroid injections or surgical options, could offer insights into combined treatment approaches for managing adhesive capsulitis.

The study's findings have practical implications for clinical practice, suggesting that Maitland mobilization combined with strengthening exercises should be considered a primary intervention for patients with adhesive capsulitis. This approach not only alleviates pain but also significantly enhances ROM and functional capacity, leading to improved quality of life for patients. Clinicians should incorporate these techniques into their rehabilitation protocols, ensuring individualized treatment plans that address the specific needs of each patient.

In conclusion, the study demonstrated that Maitland mobilization with strengthening exercises is more effective than PNF techniques in reducing pain and improving functional outcomes in patients with adhesive capsulitis. The superior efficacy of Maitland mobilization highlights its value as a key component in the physiotherapeutic management of this condition. While both interventions have their merits, the targeted joint mobilization provided by the Maitland technique offers distinct advantages in addressing the chronic stiffness and functional limitations associated with adhesive capsulitis, ultimately leading to better patient outcomes.

CONCLUSION

In conclusion, the findings demonstrated that the patient's condition with adhesive capsulitis was improved by using both Maitland Mobilization and PNF procedures. But when comparing the highest level of outcomes within the intervention, it was said that Maitland mobilization along with strengthening exercises produces a more prominent increase in ROM or SPADI score and significant decrease in pain on NPRS as compared to the PNF technique. This study discovered that Maitland mobilization mixed with strengthening exercises increased ranges, lowered discomfort, and improved functionally impairment people with frozen shoulder in contrast to PNF treatments.

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