

Effect of Scapular Proprioceptive Neuromuscular Facilitation versus Scapular Mobilization on Pain and function in adhesive capsulitis – A Pragmatic Randomized Clinical Trial

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Abstract

Objectives: The aim of this study was to compare the effects of scapular proprioceptive neuromuscular inhibition technique and scapular mobilisation on pain, range of motion and function in participants with adhesive capsulitis. **Methods:** 30 participants were randomly allocated into two groups: Group A – Scapular PNF+ conventional physiotherapy, Group B - Scapular Mobilization + Conventional physiotherapy. The intervention was applied for 6 days/week for 2 weeks. The Numerical Pain Rating Scale, Shoulder range of motion and Shoulder pain and disability index was taken before and after the intervention in both groups. **Results:** Non-parametric tests were used to analyse the data. Within the group data was analysed with Wilcoxon signed rank test. Between the group data was analysed with Mann Whitney U test. Result was found to be significant, p value 0.001 for within group. Between group analysis showed p value <0.05, suggesting significant difference between the effect of two interventions. **Conclusion:** Scapular mobilisation along with conventional physiotherapy was found to be more effective in reducing pain, improving range of motion and function in participants with Adhesive Capsulitis.

Keywords

Adhesive capsulitis, Scapular proprioceptive neuromuscular facilitation, scapular mobilization

Introduction

Idiopathic (primary) adhesive capsulitis occurs spontaneously without a specific precipitating event. Primary adhesive capsulitis results from a chronic inflammatory response with fibroelastic proliferation, which may be an abnormal response from the immune system. Secondary adhesive capsulitis occurs after a shoulder injury or surgery or may be associated with another condition such as diabetes, rotator cuff injury, cerebrovascular accident or cardiovascular disease, which may prolong recovery and limit outcomes (Gill et al., 2018). Shoulder pain and stiffness are accompanied by severe disability. Although it is generally believed to be a self-limiting condition lasting 2-3 years, some studies have reported that up to 40 % of patients have persistent symptoms

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and stiffness beyond 3 years. This condition therefore is a serious pathology, which is also known as “frozen shoulder”, and it has three phases: the painful stage, the frozen stage and the thawing stage. Stage 1) The painful stage is characterized by the gradual onset of diffuse shoulder pain that usually lasts one to two months; Stage 2) The frozen stage is characterized by progressive loss of motion that lasts several months to a year or longer; Stage 3) The thawing stage, the final stage, is characterized by gradual improvement of range of motion. The treatment of adhesive capsulitis may be either conservative or surgical. Conservative treatment includes medications, intra-articular injections physiotherapy modalities and exercise programs. With respect to physiotherapy modalities, a variety of interventions are used, which includes thermotherapy, ultrasound, transcutaneous electrical nerve stimulation (TENS). The goals of exercise programs consisting of ROM, strengthening and stretching exercises, proprioceptive neuromuscular facilitation (PNF) and mobilizing techniques are to relieve pain resulting from capsular contracture and improve glenohumeral ROM (Kahlaee et al., 2017).

Kabat and Knott developed PNF treatment method in early 1950s (Adler et al., 2013). PNF has been reported to be effective in relieving pain and improving functional abilities. PNF methods, particularly those involving reciprocal activation of the agonist and antagonist to the desired motion, provide the greatest potential for muscle functioning. Proper function of the upper extremities requires both motion and stability of the scapula. The scapula patterns defined in PNF are activated within the upper extremity patterns and scapular motions together (Tedla & Sangadala, 2019). The rhythm of scapular movements is the basis of shoulder rehabilitation. In the rehabilitation of adhesive capsulitis, increasing movements is expected to be effective in increasing the range of motion of the joint. Surenkok et al. (2009) have reported an acute effect of scapular mobilization on shoulder joint mobility in patients with adhesive capsulitis (Duzgun et al., 2019). Several studies on the effectiveness of different techniques have demonstrated reduction in pain and improvement in range of motion in patients with adhesive capsulitis. However, no study has compared the effectiveness of proprioceptive neuromuscular inhibition technique and scapular mobilization on pain and function in patients with adhesive capsulitis.

Methodology

30 patients who were referred from the Orthopaedic outpatient Department to Physiotherapy Department were enrolled in this study after obtaining consent. Institutional ethical approval was obtained prior to the commencement of the study. On the first visit, a complete assessment was done. Patients who have been found suitable to participate according to inclusion criteria were explained the nature of study and were allocated into two groups by simple random sampling. The inclusion criteria were as follow: a) Patient diagnosed with adhesive capsulitis stage 1 and 2, b) Limitation of passive range of motion in glenohumeral joint compared with unaffected side, more than 30 degree for at least 2 of these 3 movements: flexion, abduction or external rotation, c) Age group: 40-70 years, d) Gender: both male and female, e) Unilateral involvement, f) Patients who are willing to participate in the study. Patients with rotator cuff tear, shoulder ligament injuries, Malignancy, Fractures, Neurological disorders, Cervical radiculopathy were excluded from the study. Preparticipation evaluation form consisted of NPRS (ICC 0.67) (Young et al., 2018), Shoulder Pain and Disability Index (SPADI- ICC 0.989) (Venturin et al., 2023) and upper extremity goniometry (Norkin et al., 2003) chart and musculoskeletal assessment which included

chief complaint and history. Patients were divided randomly into two groups. Patients were treated for 6 days a week for 2 weeks. Group A received scapular PNF along with conventional physiotherapy and group B received scapular mobilization along with conventional physiotherapy.

In the group A, scapular PNF was applied in two diagonals, anterior elevation and posterior depression and posterior elevation and depression. Patient lay on the unaffected side while the therapist stood in the line of desired motion. In the beginning of the pattern, the therapist pulled the scapula to the elongated position and then gave instructions for the desired movement. Rhythmic initiation and repeated contraction techniques were applied in all patterns. These techniques are the best matched scapular facilitation techniques of the PNF agonistic techniques. Total 10 repetitions were performed with a rest interval of 20 seconds. Group B received scapular mobilization with patients lying on their sides with their arms at 90° flexion. The therapist held the scapula from the medial border and applied medio-lateral, supero-inferior and circumduction movements, 10 times each. A 30 second break was given between each repetition. Both the groups received moist heat pack for 10 minutes, Codman's exercise, finger ladder exercises, wand exercise, active exercises, and capsular stretching along with the experimental intervention. (Kisner & Colby, 2007).

Results

Total 30 patients were enrolled in the study, out of which statistical analysis of 27 patients was done as shown in allocation chart. Data analysis was done using SPSS version 26.0. Confidence interval was set at 95% and p value < 0.05 was considered significant. Normality of data was assessed using the Shapiro-wilk test. Data was analysed using Wilcoxon signed rank test to evaluate the mean difference within the group. Mann-Whitney U test was employed to assess the pre and post differences in mean between the group. Table 1 shows demographic and clinical variables of all patients at baseline, both groups were similar at the baseline.

Table 1: Demographic and clinical variables at baseline

Variables	Group A	Group B
Male	8	8
Female	6	5
Mean Age	58.44 (6.10)	57.46 (5.85)
Mean NPRS	6.93 (1.73)	6.46 (1.66)
Mean SPADI	69.42 (1.89)	64.21 (1.34)

Table 2 & 3 shows significant difference in NPRS, SPADI scores and ROM following post intervention between the group with p <0.05.

Table 2. Mean difference in NPRS and SPADI between Group A and B

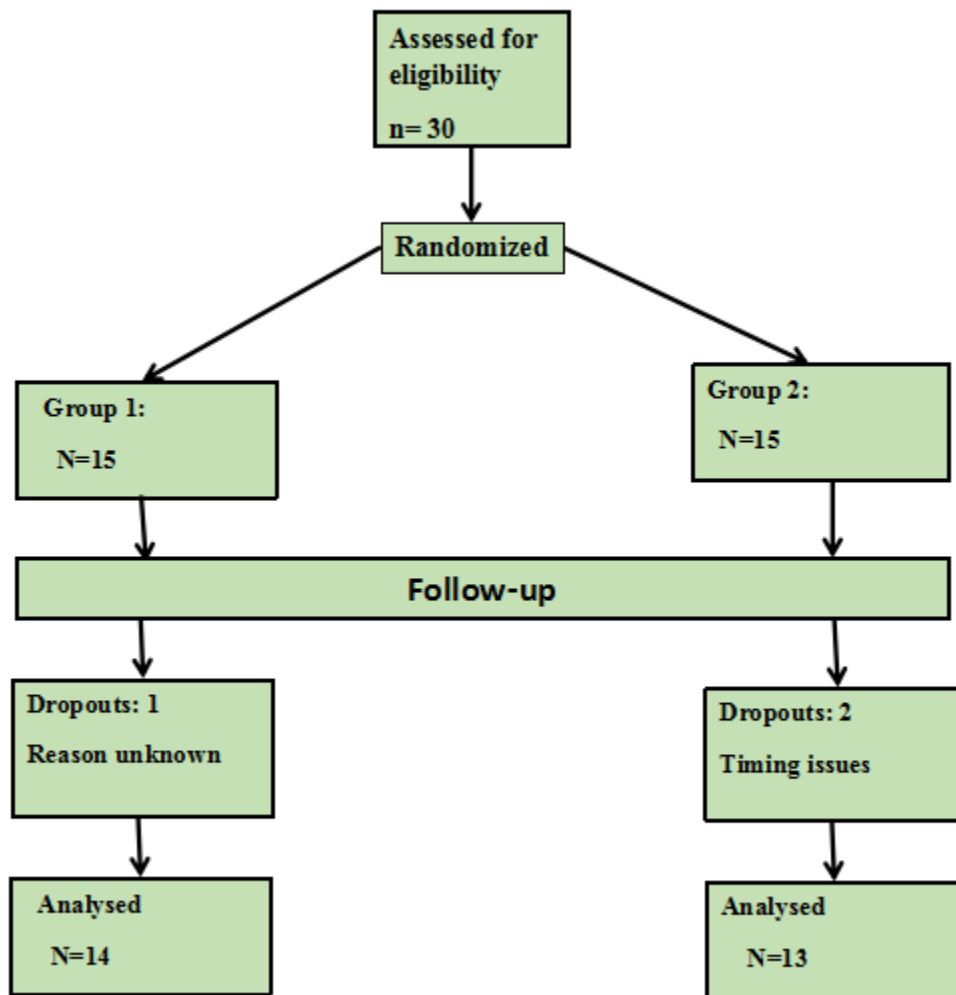
Outcome	Group A	Group B	U value	p value
NPRS	2.92 ± 1.14	4.30 ± 1.43	41.500	0.014*
SPADI	33.87 ± 10.16	42.90 ± 13.66	21.000	0.012*

NPRS -Numerical Pain Rating Scale, SPADI – Shoulder Pain & Disability Index, *P<0.05

Table 3: Mean difference in ROM between Group A and B

Outcome	Group A	Group B	U value	p value
Flexion	22.14 ± 11.88	33.07 ± 15.07	47.500	0.033*
Abduction	24.28 ± 10.16	38.46 ± 10.87	31.000	0.003*
Internal Rotation	9.28 ± 4.32	16.15 ± 7.40	37.000	0.007*
External Rotation	10.71 ± 5.13	22.69 ± 10.33	23.500	0.001*

* $P < 0.05$



CONSORT 2010 Flow Diagram

Figure 1. Allocation chart

Discussion

Adhesive capsulitis is a condition of unknown etiology, characterized by shoulder joint pain and progressive limitation of both active and passive range of motion (Neviaser & Neviaser, 2011). Decreased scapular mobility is an important factor causing a decreased range of motion of the

shoulder joint in patients with adhesive capsulitis (Yang et al., 2009). With this as the background, the aim of this study was to compare the effects of scapular proprioceptive neuromuscular inhibition technique and scapular mobilisation on pain, range of motion and function in participants with adhesive capsulitis. According to our results, both scapular PNF and scapular mobilisation combined with conventional physiotherapy were effective for reducing pain intensity and improving shoulder ROM and function, however, more improvement was found in group B which received scapular mobilisation. Joint mobilization techniques cause a series of mechanical changes. In particular, positive effects on the range of motion of the joint include decreased adhesions, reformation of collagen and increased sliding of fibres (Frank et al., 1984). Another mechanism is the effect of neurophysiological influence obtained during joint mobilization techniques. This effect is essentially explained by the stimulation of peripheral mechanoreceptors and the inhibition of the nociceptors (Nicholson, 1985). Mobilization techniques applied in this study are considered to increase the range of motion of the shoulder joint via the relaxation of adjacent soft tissues. Lee et al. (2013) stated that PNF with general physiotherapy techniques were effective for improving pain and function in myofascial pain syndrome (Lee et al., 2013). Weon-Sik et al. investigated the effects of scapular pattern and hold relax technique of PNF on ROM and pain in 30 patients with adhesive capsulitis. They treated the patients for 4 weeks and found that PNF was effective for improving ROM and pain (Lim et al., 2002). During the mobility exercises, the joint is repetitively brought to full available ROM. Thus, there occurs stretching of the joint capsule leading to increased ROM. Our study showed superior effect of scapular mobilization on pain and function in patients with adhesive capsulitis. One limitation of this trial was that we evaluated the short-term effects of both interventions, therefore, further studies can be conducted with long-term follow up.

Conclusion

Scapular PNF and Scapular Mobilization, both are effective in reducing pain, improving range of motion and function in participants with Adhesive Capsulitis, but among these two, the group which received scapular mobilization was found to be more effective in reducing pain, improving range of motion and function in participants with Adhesive Capsulitis.

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