

Original Article

Which method for frozen shoulder mobilization: manual posterior capsule stretching or scapular mobilization?

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Abstract

Objectives: This study aimed to compare the superiority of scapular mobilization, manual capsule stretching, and the combination of these two techniques in the treatment of frozen shoulder patients to evaluate the acute effects of these techniques on shoulder movements. **Methods:** This study designed to a single-blinded, randomized, and pre-post assessment study. This study was included 54 patients diagnosed with stage 3 frozen shoulder. Group 1 (n=27) received scapular mobilization, and Group 2 (n=27) received manual posterior capsule stretching. After the patients were assessed, the interventions were re-applied with a crossover design to obtain results for the combined application (n=54). The range of motion, active total elevation, active internal rotation, and posterior capsule tensions of the shoulder joint were recorded before and immediately after mobilization. **Results:** Statistical analysis showed an increase in all range of motion values ($p < 0.05$), except for shoulder internal rotation ($p > 0.05$), without significant difference among the groups ($p > 0.05$). The posterior capsule flexibility did not change in any group ($p > 0.05$). **Conclusions:** Scapular mobilization and manual posterior capsule interventions were effective in improving the acute joint range of motion in frozen shoulder patients.

Keywords: Frozen Shoulder, Manual Therapy, Rehabilitation, Scapula, Posterior Capsule

Introduction

The rehabilitation of frozen shoulder is challenging for both the patient as well as the physiotherapist. It requires effort and patience along with different conservative and surgical treatment options available.

Frozen shoulder has four stages: pain, freezing, frozen, and thawing phases¹. Clinically, most patients undergo physiotherapy in stage 2 and 3. In these stages, pain is relatively reduced, but there are adhesions in the joint capsule combined with restrictions in active and passive joint movements². Restrictions in active movements are often related to pain

experience, whereas those in passive movements are often related to affected soft tissues adjacent to the joint capsule.

The rhythm of scapular movements is the basis of shoulder rehabilitation. Scientific studies in frozen shoulder patients have demonstrated a decrease in scapular movements, specifically increased superior rotation and decreased external rotation³⁻⁵. Increasing the glenohumeral joint mobility is important for rehabilitation and should be included in physiotherapy programs.

Another significant problem in frozen shoulder is capsule tension. Studies on frozen shoulder patients have reported anterior and posterior capsule tensions^{6,7}. Posterior capsule tension decreases the glenohumeral internal rotation movements⁸. Nonetheless, a tense posterior capsule decreases the glenohumeral rhythm and results in the scapula and humerus acting as a single entity.

In the rehabilitation of frozen shoulder, increasing scapular movements and decreasing posterior capsule shortness is expected to be effective in increasing the range of motion of the joint^{1,9}. Sürenkök et al. have reported an acute effect of scapular mobilization on shoulder joint mobility in patients with frozen shoulder problems⁹.

The authors have no conflict of interest.

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Studies on the effectiveness of different mobilization techniques have demonstrated some superiority between anterior capsule stretching, posterior capsule stretching, end-range mobilization, and high- and low-grade mobilization techniques¹⁰⁻¹⁴. However, no study has compared the effectiveness of scapular mobilization and manual posterior capsule stretching in frozen shoulder patients. This study aimed to compare scapular mobilization, manual posterior stretching, and the combination of these two mobilization techniques on shoulder joint movements in frozen shoulder patients and to evaluate the superiority of either of these techniques. Our hypothesis is, mobilization increases glenohumeral joint movement in the acute phase. A secondary objective of this study was to determine the direction of the effect of mobilization technique on the shoulder range of motion. Our hypothesis is might differentiate shoulder range of motion directions depending with different mobilization techniques.

Materials and methods

Subjects

This study was designed as a single-blinded, randomized, pre-post assessment trial conducted according to the Declaration of Helsinki, the guidelines for Good Clinical Practice, and the Consolidated Standards of Reporting Trials (CONSORT) Statement guidelines¹⁵. Fifty-four patients, aged 40-65 years old and diagnosed with stage 2 or 3 frozen shoulder by an orthopedist, were included. This study was conducted between April and July 2015 at the Hacettepe University Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation. A consent form was signed by all patients.

Ethical consent was obtained from the Hacettepe University ethical board for non-interventional clinical researches ethics board (April 29, 2015; ID: 15/316-22).

The inclusion criteria were as follows: (a) a diagnosis of stage 3 frozen shoulder (frozen phase)², (b) the presence of pain and limited movement in the shoulder for at least 3 months, and (c) passive joint movements limited to 50-75% of the normal range of motion of the joint¹. The exclusion criteria were as follows: (a) limited joint movements because of the fracture of the humerus, (b) radiographic investigation showing evidence of osteoarthritis or bone lesion, and (c) the presence of any systemic disease such as benign hypermobility joint syndrome.

Frozen shoulder patients were divided into two groups using random number tables to determine the intervention order. One group received scapular mobilization and the other group received posterior capsule stretching first. Assessments were performed both before and immediately after the intervention by a blinded assessor. After the first treatment, the groups were crossed: manual posterior capsule stretching was applied to the group that first received scapular mobilization and the scapular mobilization was applied to the group that first received posterior capsule



Figure 1. Scapular mobilization.



Figure 2. Manual posterior capsule stretching.

stretching on the same session. A re-assessment was performed after the second treatment. Finally, the results for three groups were obtained. The first group received scapular mobilization (n=27), the second group received manual posterior capsule stretching (n=27), and the third group received both scapular mobilization and manual posterior capsule stretching combined (n=54).

Scapula mobilization was performed with patients lying on their sides with their arms at 90° flexion. The physiotherapist held the scapula from the medial border and applied medio-lateral, supero-inferior, and circumduction movements 10 times each. A 30-s break was given between each practice (Figure 1). Posterior capsule stretching was applied with patients lying in a lateral position. The scapula was stabilized

Table 1. Demographic characteristic of patients.

	Scapular mob (N=27) X±SD	Posterior Capsule (N=27) X±SD	Combined (N=54) X±SD	p
Age (yrs)	51.2 ± 9.08	53.04 ± 7.8	51.5 ± 8.2	0.678
Height (cm)	165.3 ± 10.04	167.7 ± 8.8	166.4 ± 9.3	0.113
Weight (kg)	70 ± 11.7	73.5 ± 9.3	71.4 ± 10.7	0.712
BMI (kg/m ²)	25.8 ± 4.5	26 ± 2.7	26 ± 3.8	0.848

Table 2. Mean ROM and differences among groups pre and post mobilization.

	Scapular mob (N=27)		Posterior Capsule (N=27)		Combined (N=54)		Group Comparison		Main Effects	
	Pre (X±SD)	Post (X±SD)	Pre (X±SD)	Post (X±SD)	Pre (X±SD)	Post (X±SD)	F	p	F	p
Flexion (°)	132.6±13.4	140±11.3	133±19.3	136.5±18.2	133±16.4	140±15.4	1.329	0.27	44.526	<0.001
Abduction (°)	105±16.5	111±13.7	102.5±20.3	110±17.3	104.3±20	113±16.7	0.64	0.529	34.225	<0.001
ER (°)	36±15	40.4±14.5	39.3±19	42.3±20.4	38±17.4	43.3±17.7	0.593	0.554	24.139	<0.001
IR (°)	48.8±16.5	46.7±15.7	51.4±18.2	55±18	49.7±16.4	55±18	2.662	0.075	2.665	0.106
Active Total Elevation (°)	113±16.2	121±15	113.5±19.2	118.6±19.6	114.1±17.04	119±25	0.433	0.010	17.447	<0.001
Active Internal Rotation (cm)	29.07±6.6	20.5±19	27.1±9.6	24±9	27.4±8.5	20.2±15.8	0.740	0.481	12.804	0.001
Posterior Capsule Length (cm)	6.4±2.1	7.5±2.2	7.1±3	7.2±5.5	6.7±2.7	7.4±4.6	0.312	0.733	1.661	0.201

at the lateral side with the arm was at 90° flexion. Stretching was applied from the elbow with a downward force. The stretch was repeated 10 times for 20 s each. A 30-s break was given between each stretching (Figure 2).

Assessment

Demographic information (age, height, weight, and sex) was recorded for all patients. The resting pain and pain during activity is assessed by Visual Analog Scale¹⁶. Shoulder flexion, abduction, and internal and external rotation movements were actively and passively evaluated in the supine position scapula was fixated from the lateral aspect using a goniometer. Active total elevation was evaluated in the sitting position also with a goniometer¹⁷. Active internal rotation was assessed by measuring the distance between the thumb and the T5 vertebra tip with the hand on the back¹⁸. Posterior capsule tension was evaluated with patients lying in the lateral position. The scapula was stabilized at the lateral border, and the upper arm was held parallel to the ground. Medial epicondyle level was measured using a ruler at the beginning and re-measured after the arm was stretched to the farthest possible point. The distance between the starting point and the farthest possible point was recorded as the capsule tension¹⁹. The reliability of the assessor was

calculated using the intraclass correlation (ICC), which had a value of 0.85 in this study.

Statistical analysis

The pre-post change in the group was assessed by Paired Samples Test and the change between the groups was assessed by ANOVA. The severity of the pain in the groups was assessed by Kolmogorov Smirnov Test. Statistical significance level was set as $p < 0.05$.

Results

There were no differences in the demographic characteristics among the groups ($p > 0.05$, Table 1). The range of motion of the joint and posterior capsule flexibility before the intervention were similar among groups ($p > 0.05$, Table 2). Similarly, there was no difference among the groups with regard to pain at rest that at night, and that during activity ($p > 0.05$, Table 3). Joint motions increased in all groups after scapula mobilization, manual posterior capsule stretching, and combined applications ($p < 0.05$). However, there was no difference among the groups in the range of motion with regard to effectiveness ($p > 0.05$, Table 2). In all groups, mobilization increased the joint flexion, abduction,

Table 3. Average pain among the groups.

	Scapular mob (N=27) Median (IQR 25-75)	Posterior Capsule (N=27) Median (IQR 25-75)	Combined (N=54) Median (IQR 25-75)	P
Rest	1.1 (0-3.02)	0 (0-4)	0 (0-3.05)	0.878
Activity	6.8 (4.77-8.12)	5.9 (3.6-9)	6.7 (4-8.75)	0.896
Night	5.55 (0-8.25)	3.4 (0-7)	4.9 (0-7.2)	0.547

IQR: Interquartile range.

external rotation, internal rotation, and active total elevation movements from 5.6 to 8.4 degrees, 4.8 to 12.3 degrees, 1.2 to 8.7 degrees, 2.2 to 6.5 degrees, and 2.5 to 6.5 degrees, respectively. Active internal rotation movement changed from 3.6 to 14.3 cm and posterior capsule flexibility from 0.7 to 1.3 cm.

Discussion

This study demonstrated an acute increase in the range of motion of the shoulder joint in stage 2 or 3 frozen shoulder patients after scapula mobilization, manual posterior capsule stretching, and the combination of these techniques, without any superiority of any technique.

Decreased scapular mobility in frozen shoulder patients is an important factor causing a decreased range of motion of the shoulder joint. Rehabilitation aims to increase scapular mobility; therefore, we applied scapular mobilization in our patients⁷. However, the posterior capsule is a structure that establishes the connection between the scapula and humerus. Increasing the capsule flexibility is among the suggested approaches for the treatment of frozen shoulder¹. Exercise and manual therapy approaches are suggested for capsule stretching. Our study demonstrated that the total range of motion of the shoulder joint increased in both scapular mobilization as well as posterior capsule stretching group. 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 fibers²⁰. Both scapular mobilizations applied in this study are considered to provide positive effects on the range of motion of the shoulder joint via the previously mentioned techniques. However, a lack of difference in pain suggests that the benefits are not related to the direction of the intervention but may be related to the sedative effects caused by touching the patients during interventions²⁰. Another hypothesis related to this effect is the neurophysiological influence obtained during joint mobilization techniques. This effect is essentially explained by the stimulation of peripheral mechanoreceptors and the inhibition of the nociceptors^{11,21}. 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.

A secondary objective of this study was to determine the direction of the effect of mobilization technique on the range of motion of the shoulder joint. Although there was no statistically significant difference, scapular mobilization and the combined application of techniques resulted in higher achievements, which may be related to increased scapular mobility and, thus, the increased range of motion of the glenohumeral joint after scapular mobilization. During the scapula mobility, the mobility of adjacent soft tissues also may have increased. Additionally, the sedative effect achieved by touching is believed to help relax the muscles, thereby contributing to the elimination of limited muscle mobility. However, the essential problem in frozen shoulder is the loss of joint capsule flexibility. Moreover, stiffness around the scapula and glenohumeral muscles affects the passive range of motion of the joint. Scapular mobilization may lead to relaxation in these muscles and, as a result, can act as a secondary factor in increasing the range of motion of the joint.

Scapular mobilization toward abduction and combined interventions led to an increase of approximately 10 degrees, whereas posterior capsule stretching achieved an increase of 5 degrees. Although scapular mobilization achieved an increase of 5.5 degrees in external rotation, posterior capsule stretching resulted in an increase of only 1.2 degrees. Clinically, this is a significant increase after one session. From a clinical perspective, if the aim is to increase the abduction and external rotation range of motion, then scapular mobilization or combined applications may be suggested rather than manual posterior stretching.

In a study that evaluated the acute effects of scapular mobilization, Sürenkk et al.⁹ have reported an 8-degree increase in the flexion movement and a 6-degree increase in the abduction. Our study reported an 8-degree increase in the flexion movement and a 10-degree increase in the abduction. This better abduction outcome may be related to differences in the applied scapular mobilization techniques. Although Sürenkk et al.⁹ used rotation and distraction techniques, our study implemented circumduction and mediolateral shifting. In particular, the scapular distraction technique is considered to apply a higher loading to the scapula toward the internal rotation direction. During arm abduction, the scapula undergoes superior rotation, external rotation, and posterior tilt movements²². Therefore, the distraction technique should be used carefully in patients

with shoulder problems, and mobilization techniques should be investigated by more detailed studies.

At the beginning of this study, we predicted a greater increase in the internal rotation movement; interestingly, this increase was only 2.2 degrees after posterior capsule stretching and 3.8 degrees after scapular mobilization. This increase in internal rotation was not significant among any group. Interestingly, although there was no significant increase in the internal rotation, the change in active internal rotation was statistically significant. The posterior capsule stretching provided an increase of 3.6 degrees, the scapular mobilization provided an increase of 6 degrees, and the combination of the two techniques provided an increase of 9.8 degrees. This suggests that the effect was achieved as a result of the relaxation of active tissues. Flexion and active total elevation movements similarly increased in all three groups. In conclusion, we suggest that all three mobilization techniques used in this study can be applied to improve these movements.

Shortness of the posterior capsule is an important problem in frozen shoulder patients. Different techniques are employed in clinics during manual therapy practices to increase the posterior capsule flexibility. This study demonstrated an acute increase in the posterior capsule flexibility with manual posterior capsule stretching, scapula mobilization, and the combination of the two techniques by approximately 1 cm, although without statistical significance. Although this increase in the posterior capsule can be considered satisfactory for a single session, we believe that outcomes over longer durations should be observed to achieve more efficient clinical results.

There are some limitations of the study. Goniometer was used to assess the range of motion. Although the reliability of the goniometric measurement is low, it is widely used in the clinical settings. Since the same physiotherapist done the goniometric measure, we try to minimize the negative affect. The study was design to assess the acute affects. The long term affect should also be assessed in the future studies. Since this intervention is additionally used to the conventional physiotherapy methods, it is hard to show the isolated effects of mobilization in long term study. So, this study could be accepted to show the acute effects.

In conclusion our study demonstrated the effects of mobilization techniques on the range of motion of the shoulder joint. However, the effects on soft tissues were not evaluated. Therefore, studies assessing the acute effects on soft tissues are necessary. Scapular mobilization and manual posterior capsule stretching interventions are suggested in clinical practice for the treatment of frozen shoulder patients. Although there was no difference in the applied mobilization techniques in increasing the range of motion of the shoulder joint, important achievements were recorded in a single session.

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