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Effect of capsular stretch on frozen shoulder

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Abstract: Frozen shoulder is a chronic disabling disease of the shoulder. The management of the frozen shoulder are numerous, but the studies show their own limitation. Biomechanically, it was noted that the cause of the frozen shoulder is capsular tightness. However, previous studies are not explained this well. So, this study was designed to identify the effect of capsular stretch on a frozen shoulder. Study was conducted at the OPD of physiotherapy, Chettinad Super Specialist Hospital, Chennai. Two hundred and twenty participants were selected for the study. Screening was conducted for these participants, and eighty were recruited for the study. They were all randomly allocated into two groups, with twenty-five (25) in each. Group I, with 25 subjects,, was given capsular stretching for 15 minutes and moist heat therapy for 10 mins. Group II, with 25 subjects, was given general shoulder exercises for 15 minutes and moist heat therapy for 10 mins. All the subjects were taught with Codman's pendular exercises as a home programme. Study was conducted for eight (8) weeks. The outcomes selected in this study are pain and range of motion (Abduction & External rotation). This was assessed using a Numerical pain rating scale and Goniometer. Collected data were analyzed using SPSS 24.0. The NPR and ROM variables were examined using the unpaired 't'-test with the 0.05%. The result of the study shows that the 't' value for the NPR is 20.25 ± 0.15 with p< 0.05%, the Abduction range of motion is 15.6 ± 2.77, and External rotation is 15.04 ± 1.53. This indicates a marked difference obtained among Group I and Group II, as well as a substantial variation between the pre-intervention and post-intervention values. This study concluded that capsular stretching had significantly improved pain and shoulder range of motion more than shoulder exercises.

Introduction

Frozen shoulder is a chronic disabling disease of the shoulder (van de Laar et al., 2014; Phansopkar and Qureshi, 2022). It is characterized by pain and stiffness in the shoulder (Zuckerman and Rokito, 2011). In the general population, the prevalence of the frozen shoulder

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is between 3% and 5%, but it is rising to 20% in those with diabetes (Robinson et al., 2012). A retrospective study found that the one year and life time adhesive capsulitis were 0.4% and 2.4 %, respectively (Jacob et al., 2023).

Frozen shoulder pain typically worsens at night and the range of motion over the shoulder is restricted, chiefly the external rotation (Brue et al., 2007; Shahjahan and Patil, 2022). Shoulder movement limitation is due to a reduction in the intra-articular volume. This results in fibrosis and thickening of the glenohumeral joint capsules. It aids in adhering to the humeral head (van de Laar et al., 2014). The course of the frozen shoulder takes about 12 months to 42 months before resolution (Hand et al., 2008).

A biomechanical view of the frozen shoulder indicated that the primary pathology is related to the contracture in the capsule and not on the other structures (Hsu et al., 2011). Tightness on the anterosuperior capsule produces an external rotation restriction with the reduction in shoulder adduction. The anteroinferior capsule restricts external rotation with the abduction of the shoulder, posterior capsular constriction limits the shoulder's internal rotation range of motion (Gerber et al., 2003).

Management includes structured physiotherapy, manipulation under anaesthesia, and arthroscopic capsular release is the modern way to manage a frozen shoulder (Brealey et al., 2017). Physiotherapy plays a major role in reducing pain and restoring the shoulder function (Page and Labbe, 2010). The range of motion exercises is commonly recommended as a home programme. Moist heat or cold packs are also advised for the frozen shoulder to reduce muscle soreness during the exercises (Chan et al., 2017).

Several heating modalities are used to manage the frozen shoulder, but none are effective (Carette et al., 2012; Lin et al., 2022). The low-level laser reduces pain but does not improve the range of motion (Jain and Sharma, 2014). Other therapies like ultrasound, wax bath, Tens, and IFT provides pain relief in the short term (Green et al., 1996a). Due to a lack of research and clinical experience, many therapies are regarded as experimental (Green et al., 1996b).

Gentle stretching exercises to the muscles around the shoulder are commonly recommended to improve the range of motion (Noureen et al., 2021). Capsular stretching is also preferred to improve the shoulder range. Evidence shows that capsular stretching improves intra-articular pressure, increases joint space, and enhances the release of synovial fluids (Paul et al., 2014). However, there are not many extensive studies on the capsular stretch on a frozen shoulder. So, this study proposes to identify the effect of capsular stretching on a frozen shoulder.

Methodology

This study was submitted to the institutional ethical committee and the subject selection was initiated after approval. Patients visiting the Outpatient Department of Physiotherapy, Chettinad Super Specialist Hospital, Chennai, were selected as study subjects. This study was conducted from January 2022 to August 2022 and during this period, about 500 subjects visited the OPD with shoulder pain and shoulder-related conditions. Everyone was individually assessed and identified as a study participant when they fell in the predetermined selection criteria. Two-hundred and twenty patients were selected for the study. They all underwent a screening process including history, disability, pain, functional activity, and quality of life. Hundred and twenty participants were excluded as they did not clear the screening process and 100 participants were selected for this study. Clear instructions about the study were given to every participant. Those who were willing to participate were asked to visit the OPD after a week. Eighty subjects volunteered for this study and were all randomly segregated into two sets. Twenty-five (25) subjects in each set (groups) were selected and the remaining 30 participants were sent to the regular physiotherapy measures.

Predefined inclusion criteria of this study are a) age of 35-55 years, b) both gender, c) complains of shoulder pain for more than six months, d) reduced range of motion or 50% of ROM in the abduction and External rotation, e) Unilateral shoulder complains, f) Pain score less than 6 cms in a 10 cm NPR, g) without any complains of chest pain, h) without any radiating pain, i) without any cervical related conditions, i) able to do exercises, and j) willing to participate in the study.

Written consent was obtained from each participant before beginning the interventions. Fifty subjects were randomly separated into two groups using a computer-assisted sampling procedure. Group I, with 25 subjects, was given capsular stretching for 15 minutes and moist heat therapy for 10 mins. Group II, with 25 subjects, were given general shoulder exercises for 15 minutes and moist heat therapy for 10 mins. All the subjects were taught with Codman’s pendular exercises as a home programme and advised them to visit the OPD on alternate days. This study was conducted for 8 weeks, so each participant attended the OPD for 24 sessions.

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Capsular stretching was done to the painful shoulder, prior to that, a ten minutes warm up was given to the subjects. Anterior capsule (Figure 1) was stretched in sitting with the shoulder and arms brought backwards and the therapist applied stretch force for 20-30 seconds. The posterior capsule (Figure 2) was stretched by arm crossing the body (cross adduction) and held for 20-30 seconds. Anterior-inferior capsule (Figure 3) stretched through elevation of the arms to the maximal range; hold it for 20-30 seconds (Paul et al., 2014; Satapathy and Mnbsp, 2021). All the procedures were carried out by a senior physiotherapist having 10 years of experience in manual therapy.

Figure 1. Anterior capsule stretch.

Figure 2. Posterior capsule stretch

Figure 3. Inferior capsule stretch

The outcomes selected in this study are pain and range of motion (Abduction & External rotation). This was assessed using a numerical pain rating scale and Goniometer. Data were gathered during the subject's first visit and the 8th week. Alternate week data was also collected, but first and last visit data were taken for the analysis. There were no dropouts and all the subjects attended all the sessions. Regular follow-ups by the treating therapist ensured continued motivation for the subject to attend all the sessions.

SPSS 24.0 and MS Excel were both used to gather and assess the data. The NPR and ROM variables within groups were examined using the paired 't' test, and unpaired 't' test for between-group comparison. P values were predetermined to be $p<0.05$. The normality test produced positive outcomes. The significance level applied at 0.05. According to this study, H0 is rejected at p-value $<\alpha$. The population's average is thought to be less than zero following a negative value. The research demonstrates that there is very little probability of the type I error. The effects that have been observed across all variables are more significant.

Table 1. Within group analysis of the Pain scale and External rotation and Abduction range of motion of Shoulder.

Groups	Pre-intervention (Mean ± SD)	Post-intervention (Mean ± SD)	Paired 't' test values	Effect Size	Level of significance
Group I: Pain	7.12 ± 0.781	1.48 ± 0.510	23.84 ± 2.89	5.67	0.005
Group II: Pain	7.12 ± 0.781	4.60 ± 0.577	13.08 ± 1.43	2.62	0.005
Group I: Abduction	29.72 ± 5.31	66.2 ± 6.00	19.19 ± 15.01	3.84	0.005
Group II: Abduction	29.84 ± 4.41	43.2 ± 4.76	13.03 ± 5.68	2.61	0.005
Group I: External Rotation	83.4 ± 7.03	141 ± 12.58	22.6 ± 8.07	4.52	0.005
Group I: External Rotation	83.0 ± 6.29	97.8 ± 5.79	16.92 ± 3.95	3.39	0.005

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important role in promoting the range and reducing pain

Table 2. Between-group analysis of the Pain scale and External rotation and Abduction range of motion of Shoulder.

Groups	Group I	Group II	Effect size	Student 't' test	Level of Significance
NPR (Mean ± SD)	1.48 ± 0.510	4.60 ± 0.577	5.73	20.25 ± 0.15	0.005
ROM Abduction (Mean ± SD)	66.2 ± 6.00	43.2 ± 4.76	2.77	15.6 ± 2.77	0.005
ROM External Rotation (Mean ± SD)	141 ± 12.58	97.8 ± 5.79	4.25	15.04 ± 1.53	0.005
*If the null hypothesis is accepted, then this result has a probability of less than 0.0005. This indicates a variance between Group I and Group II, as well as a substantial variation between the pre-intervention and post-intervention values.					

Results

Pain values

The pain scores among the pre-interventions and post-interventions results were significantly different in both groups. When comparing the groups, it was discovered that some significance could be seen in the post-intervention values of the groups. Compared with Group II, Group I have progressed significantly (p=0.005).

Range of motion

The Range of motion for the external rotation and the abduction values between the pre- interventions and post-interventions results were significantly different in both groups. When comparing the groups, it was discovered that some significance could be seen in the post-intervention values of the groups. Compared with Group II, Group I have progressed significantly (p=0.005). Therefore, this study's results show a highly substantial modification amongst the average, which is μ0 large in magnitude.

Discussion

The study purpose was to determine the effect of capsular stretching on a frozen shoulder. Frozen shoulder starts with pain and later progresses to stiffness around the shoulder due to inflammatory responses that evolve into a fibrotic reaction (Hand et al., 2008). Tightness on the capsule causes a restriction in the range of motion. External rotation movements are affected, followed by abduction (Le et al., 2017). Initially active range will be lost, followed by the passive range of motion (Neviaser and Neviaser, 2011).

Management of the frozen shoulder varies from non-surgical to surgical measures. Physiotherapy plays an (Uppal et al., 2015). Multiple adjuncts are available for managing frozen shoulder, but their efficacy is not well-established (Robinson et al., 2012).

Capsular stretching exercises help to increase the space between the particular areas in the shoulder and improve intra-articular pressure (Izumi et al., 2008). Passive stretching causes the greatest amount of passive tension in the shoulder joint capsule, reducing the adhesion in the capsule (Iida et al., 2021). Stretching over the contracted soft tissues in the joint helps improve the chronicity of shoulder tightness (Lukasiewicz et al., 1999). Improvement in the shoulder range is also reported in studies done. They reported that capsular stretching improves shoulder movements (Lukasiewicz et al., 1999; Mertens et al., 2022).

Gentle shoulder exercises also improve the range of motion and pain reduction. Pendular exercises use gravity to distract the glenohumeral joint and improve the glenoid fossa space (Griggs et al., 2000). This will reduce stress in the joint and also aids in reducing pain in shoulder. The gentle traction and oscillation of movements provide an early movement to the joint structures and facilitate synovial fluid movements (Dundar et al., 2009).

Gentle passive range of motion exercises to the shoulder within the pain-free range alters the pain modulations and reduces pain. These motions cause alteration in the neuromodulation over the mechanoreceptors within the joint, which in turn blocks the pain gate. The slow movements reduce the reflex spasm in the muscles and improve the range in the joint (Samnani, 2004). Rehabilitation programs help to reduce pain and improve the functional ability among frozen shoulder subjects (Macías-Hernández et al., 2017).

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Similar studies by Keramat and Babur in 2020 identified that posterior capsule stretch improves the functional range of motion in the shoulder (Keramat and Babur, 2020). Noureen et al. (2021) stated that capsular stretching improves the shoulder range, but not significantly more significantly than angular joint mobilization (Noureen et al., 2021). A identified that capsular stretching promotes a good range of motion (Satapathy and Mnbsp, 2021). In patients with adhesive capsulitis, there were improvements in shoulder abduction and flexion (Paul et al., 2014).

Conclusion

Based on the statistical analysis, this study found a marked difference between the pre-intervention and post-intervention values in both groups. When both groups were compared, it was noted that Group I, who underwent capsular stretching, showed a more significant reduction in pain and improved range of motion. So, this study concluded that capsular stretching helps to reduce frozen shoulder-related pain significantly and improves shoulder range of motion more than shoulder exercises.

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Conflict of Interest

Nil declared by the authors.

Consent

Written consent was obtained from all the participants.

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