Effects of Anterior Versus Posterior End Range Mobilizations on Shoulder Rotations Range of Motion in Adhesive Capsulitis Stage II

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Abstract

Background: Adhesive capsulitis is characterized by a spontaneous onset of shoulder pain accompanied by progressive limitation of both active and passive glenohumeral joint movements.

Aim and Objectives: This study was done to compare effectiveness of anterior versus posterior end range mobilizations on shoulder rotations range of motion (ROM) in subjects with adhesive capsulitis stage II.

Method: 56 participants with clinical diagnosis of adhesive capsulitis stage II were randomly allocated in two groups A & B. Both groups received therapeutic ultrasound and pre-set of prescribed home exercises in common. While Group 'A' received Anterior and Group 'B' received Posterior end range mobilizations. Shoulder rotations ROM was assessed as Outcome measure using universal goniometer at baseline, at end of 2 weeks post intervention.

Results: Result showed both anterior (% of change was -66.88) and posterior (% of change was -67.80) end range mobilization were equally effective in increasing internal rotation (IR) ROM.

Posterior end range mobilisation (% of change was -187.50) was more effective than anterior end range mobilization (% of change was -101.37) in increasing external rotation(ER) ROM.

Conclusion: We concluded that application of posterior end range mobilization is more effective than anterior end range mobilisation in increasing ERROM.

Keywords: *Adhesive capsulitis Stage II, End range Mobilization, Pain, ROM.*

Introduction

Glenohumeral joint (GH) commonly referred to as shoulder joint, its large ROM with three degrees of freedom, Mobility of shoulder joint relies upon the congruent articulating surfaces and surrounding soft tissues.[1]

Adhesive capsulitis is an insidious onset of painful stiffness of glenohumeral joint. It is also known as frozen shoulder, scapulohumeralperiarthritis, periarthritis of Dupley, periarthritis of shoulder and check-rein shoulder.[2]

Adhesive capsulitis has a prevalence of 2-5% in the normal population. In diabetic patients this is increased with a prevalence of 10% in type I and 22% in type II. It is more common between the ages of 40 and 60 years.[3,4]

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Adhesive capsulitis is mainly classified into: Primary which is characterised by a spontaneous onset of shoulder pain accompanied by progressive limitation of both active and passive glenohumeral joint movements[3]and Secondary is associated with a known predisposing condition of the shoulder.eg, humerus fracture, shoulder dislocation, avascular necrosis, osteoarthritis, or stroke etc.[5]

Reeves has described 3 stages of adhesive capsulitis[6]: Stage I is mainly characterized by pain usually lasting 2-9 months, in Stage II (frozen stage)pain gradually subsides but stiffness is marked lasting 4-12 months and in Stage III (thawing phase) pain resolves and improvement in range of motion appears.

Many treatments have been employed in management of shoulder disorders; few have been proven to be effective. Non-steroidal anti-inflammatory drugs, local anaesthetic and corticosteroid injections into glenohumeral joint, calcitonin and antidepressants, distension arthrography, closed manipulation, physical therapy modalities and exercises are showed to be effective in management of shoulder disorders.[7]

Rehabilitation programs consisting of exercise, massage and modalities have been shown to reduce pain and improve shoulder ROM in all planes except external and internal rotation.[8]

Joint mobilization is a form of passive movement usedto treat painful and stiff synovial joints. The optimal directions of force and movement application for the Joint mobilization techniques are assumed to induce various beneficial effects.[9]

Kaltenborn`s mobilization of extremity joints consists of two passive rectilinear movements traction/ separation and translatoric gliding, called joint play and depends on concave convex rule. There are 3 grades of Mobilization.[4,10]

There is evidence, however, that joint mobilization procedures can lessen the associated glenohumeral rotational deficits characteristic of this condition.[11]End range mobilization techniques are clearly indicated for stiff and hypomobile joints.[4] In addition to manual therapy, therapeutic ultrasound can be used as an adjunct treatment in order to help the subjects regain ROM and restore function to the affected shoulder.[12] The rational for achieving therapeutic goals through deep heating is to alter the viscoelastic properties of the connective tissues and maximize the effectiveness of the stretch mobilizations to follow. Studies have shown that a significant drop in tensile stress occurs with a rise in the temperature of soft tissues by 3^0C to 4^0C, which is deemed adequate to alter the viscoelastic properties of connective tissues.[13]

Goniometry is a reliable assessment scale for measuring shoulder range of motion in subjects with adhesive capsulitis.[14]

Materials and Method

After obtaining the institutional ethical clearance, the study was carried out in 56 patients with adhesive capsulits (stage II) of age between 40-60 years of either gender[1] Subsequently after briefing about the study, written consent was obtained and screened.

Group A- subjects received Therapeutic Ultrasound, Anterior (Posterio-Anterior) end range mobilization (AM) and pre set of prescribed home exercises.

Group B- subjects received Therapeutic Ultrasound, Posterior (Anterio-Posterior) end range mobilization (PM) and pre set of prescribed home exercises.

We included the patients of unilateral conditions suffering from Idiopathic or primary adhesive capsulitis stage II. We excluded patients of Malignancy, History of fracture/dislocation, Hypermobility, Inflammation/ infection, Shoulder girdle motor control deficit associated with neurological disorders (eg, stroke, or Parkinson's disease etc.) and Cortico steroid injection preceding 3 months which are contraindicated for end range mobilization.[2]

The targeted capsule was preheatedby the use of thermal ultrasound. Ultrasound was administered to the anterior capsule of those in the AM group and to the posterior capsule of those in the PM group, all ultrasound treatments were applied at 1.5 W/cm2 continuously for 10 minutes. Joint mobilization followed the ultra-sound treatment as, Kaltenborn grade III mobilizations, which apply force "after the slack of the joint has been taken up," to stretch tissues crossing the joint.[10]The end range position of the mobilization was held for at least 1 minute. No oscillatory motions were performed. Then rest period of half minute was given. Same stretch mobilization was repeated so that a total of 15 minutes of sustained stretch was performed at each treatment session.

Codman's pendular, Wall bar for flexion and abduction, shoulder protraction and retraction keeping the arm at the side of the body were then taught and made to do in the department and advised to follow the same as home programme exercise. Each subject was treated for 6 sessions. The subjects were asked to schedule therapy sessions 3 times per week.

Anterior end range mobilization group (group A): In the beginning subject was positioned in supine for the AM group.[10] Subject was brought to the side of the couch and maintaining the shoulder in neutral rotation, the affected arm was abducted to the maximum available ROM and therapist stood between the subject's trunk and arm. In this position, the therapist obtained a lateral humeral distraction in its midrange position then the anterior stretch mobilization was performed to end range. As the subject was able to tolerate a stronger stretching force, he/she was positioned prone (with arm resting position over the edge of the mobilization table and stabilizing acromion with padding) to allow the therapist to utilize the subject's body weight and gravity to generate the mobilization force in a similar combined fashion of distraction to midrange and anterior glide to end range (**photograph 1**).

Posterior end range mobilization group (group B): Here subject was positioned in supine and was brought at the side of the couch and maintaining the shoulder in neutral rotation (scapula stabilizing with padding), the affected arm was abducted to the maximum available ROM. Therapist stood between the subject's trunk and arm. In this position, the therapist obtained a lateral humeral distraction in its midrange position then the posterior stretch mobilization was performed to end range (**photograph 2**). The position chosen for the progression of the posterior mobilization took the humerus into flexion, with the intent to provide a greater stretch to the posterior CapsuleAnd subjects of both the groups will be asked to carry out the pre set of prescribed home exercises at home every day, twice daily like.

1. Codmans exercises.
2. Wall bar exercises.
3. Shoulder protraction and retraction exercise.

Statistical analysis was done by using SPSS version 16 software.

Students unpaired t test was performed to find out significance difference between two groups.

Students paired t was performed to assess significant changes between pre and post treatment with respect to all parameters in Group A and Group B separately.

Results

Table 1: Comparison of Pre and post treatment with respect to internal rotation of range of motion scores in group A and group B by Paired t-test

Group	Treatment	Mean	Std.Dv.	Mean Diff.	SD diff	% of change	Paired t	P-value
A	Pre	28.57	10.35					
	Post	47.68	11.10	-19.11	6.67	-66.88	-15.1489	0.0000*
B	Pre	31.61	9.72					
	Post	53.04	10.03	-21.43	9.41	-67.80	-12.0447	0.0000*

Table 2: Comparison of Pre and post treatment with respect to external rotation of range of motion scores in group A and group B by Paired t-test

Group	Treatment	Mean	Std.Dv.	Mean Diff.	SD diff	% of change	Paired t	P-value
A	Pre	13.04	5.83					
	Post	26.25	8.35	-13.21	6.41	-101.37	-10.9019	0.0000*
B	Pre	15.71	7.03					
	Post	45.18	9.57	-29.46	6.98	-187.50	-22.3239	0.0000*

*$p<0.05$

Table 1: In group A mean pre and post treatment IR ROM are 28.57(SD=10.35) and 47.68(SD=11.10) respectively. The percentage of change in IR ROM is -66.88.

In group B mean pre and post treatment IR ROM are 31.61(SD=9.72) and 53.04(SD=10.03) respectively. The percentage of change in IR ROM is -67.80.

After data analysis we have found out that in both groups A and B post treatment there is significant increase in IR ROM.

Table 2: In group A mean pre and post treatment ER ROM are 13.04(SD=5.83) and 26.25(SD=8.35) respectively. The percentage of change in ER ROM is -101.37.

In group B mean pre and post treatment ER ROM are 15.71(SD=7.03) and 45.18(SD=9.57) respectively. The percentage of change in ER ROM is -187.50.

After data analysis we have found out that in both groups A and B post treatment there is significant increase in ER ROM.

So here we concluded that: AM and PM, both the techniques are effective in increasing IR ROM in AC stage II.

AM and PM, both the techniques are effective in increasing ER ROM but PM technique is more effective than AM technique in increasing ER ROM in AC stage II.

Photograph 1: Progression of anterior mobilization

Photograph 2: Initial position of posterior mobilization

Discussion

Falconer and associates reviewed the literature to determine the effects of ultrasound on musculoskeletal conditions. In their review, they suggested that ultrasound appears to be effective in relieving pain and increasing range of motion in acute periarticular inflammatory conditions.[15]

Sustained stretch at the end range will breaks the adhesions intern elongating the shortened muscle tendon unit and periarticular connective tissues by moving a restricted joint just past the available ROM. Capsular stretching increases mobility of the soft tissues and subsequently improve ROM by elongating structures that have adaptively shortened and have become hypomobile over time, which inturn reduces pain.[4]

For IR: both the techniques AM and PM are effective in increasing IR ROM. In this study also there is significant improvement of IR ROM in both the groups after the intervention period. So, we can say a combination of US, mobilization and exercises could be responsible for this significant improvement in IR ROM.

Both the techniques increase the ER ROM significantly, means ultrasound, exercise, stretch mobilisation increases ER ROM.

Posterior mobilisation group is more effective in increasing ER ROM because,The changes in the PM group are mainly because of following effects which could have been attributed. The results of this study indicate that posterior glide stretch mobilizations combined with therapeutic ultrasound and upper

extremity exercises were more effective in overcoming ER ROM deficits commonly found in patients with adhesive capsulitis.

Novotny et al[16] studied the glenohumeral joint in vitro using techniques in which only the capsule and articular surface contact controlled the motion of the humerus. They found that at low moments the humeral head initially translates across the glenoid surface in the direction opposite to the motion, due to the joint surface geometry, as consistent with the concave-convex rule. Then, with increasing moment and angle of rotation, the humeral head changes direction as the capsule tightens, "pushing the humeral head back along the glenoid surface." Thus, it is thought that the tension in the capsular tissues rather than joint surface geometry controls the translatory movements of the humeral head. Asymmetrical capsular tightness has the potential to impact humeral head motion.

Roubalet al[17] suggest that by manipulating the humeral head posteriorly, they might have increased the total allowable excursion of the capsule, thus improving external and internal rotation. The results of this study are not at odds with the concave-convex rule. Our results do, however, support the concept that the capsule plays an important role in dictating the humeral head translation, possibly in the opposite direction to the expected effect of joint geometry if restricted. Thus, the normal shoulder joint requires adequate coordination of all passive and active stabilizers to maintain shoulder stability and pathological changes in any of these can lead to unphysiological translations of the humeral head relative to the glenoid fossa.

Harryman et al[18] found in their cadaver studies that altering the capsule (tightening or cutting) affects the translation of the humeral head on the glenoid during physiologic movement of the humerus. They suggest that a tight rotator cuff interval "may not only limit the ROM, but it may also produce unwanted obligate anterosuperior translation," thus limiting the posterior translation associated with ER.

Kardunaet al[19] found that joint conformity had an influence on translations during active positioning but not during passive positioning. Joint mobilization is a passive movement applied to the joint surfaces, so shoulder mechanics under passive conditions need to be considered. The joint glides that accompany glenohumeral motions support the clinical practice of restoring translational movement to restore full physiological motion in the shoulder joint, even though care must be taken in attributing joint translations to external mobilizing glides.

In this study, the stretch mobilization procedures were performed for a total of 15 minutes of low-load stretch at available end range of abduction during each treatment session, with the intention to elongate the glenohumeral capsular contracture. Substantial improvements were made in the PM group in just 6 treatment sessions. Here the gain for the improvement in ER ROM in group B may be associated with normalizing the humeral head position in the glenoid fossa.

Conclusion

The study was to compare the effects of anterior versus posterior end range mobilization on rotations range of motion in adhesive capsulitis stage II of shoulder. In Group A- anterior end range Mobilization had 28 subjects with mean age of 51.18(SD=5.64) and Group B-posterior end range mobilization group had 28 subjects with mean age of 50.43(SD=5.39).

We conclude that posterior end range mobilization can be preferred to anterior end range mobilization in regaining rotations ROM for adhesive capsulitis stage II of the shoulder.

Conflicts of Interest: No conflicts of interest

Source of Funding: Self

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