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Effectiveness of scapular stabilisation exercises for scapular dyskinesis in patients with phase II adhesive capsulitis: A randomized control trial

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Abstract
The purpose of the study was to find out the effect of scapular stabilisation exercises for scapular dyskinesis. 60 participants (including both males and females) ranging from 40-60 years old diagnosed with unilateral phase II adhesive capsulitis and scapular dyskinesis were selected and they were randomly assigned into 2 groups (Group A-30 & Group B-30). Group A received conventional treatment for Group B in addition to conventional, scapular stabilisation exercises were given. Duration of the treatment was 2 weeks with 3 days/week. Outcome measures such as Shoulder pain and disability index and Lateral scapular slide test were measured pre and post interventions. Statistical analysis of the data was done using paired and unpaired t-test. When pre and post analysis of Shoulder pain and disability index and Lateral scapular slide test were done within group and both Group-A and Group-B showed significant improvement in both Shoulder pain and disability index and Lateral scapular slide test. Hence, it is concluded that scapular stabilisation exercises seemed to be beneficial in patients with adhesive capsulitis and scapular dyskinesis.

Keywords: adhesive capsulitis, scapular dyskinesis, scapular stabilization exercises, shoulder pain and disability index, lateral scapular slide test

1. Introduction

Adhesive capsulitis is an insidious painful condition with gradual restriction of shoulder movements in all planes. Adhesive capsulitis is the main cause of shoulder pain and dysfunction in middle aged and elderly populations.

There are three phases of adhesive capsulitis of shoulder: First phase is painful phase and will last for 3-9 months (Freeze). Second phase is stiffness phase and last for 9-15 months (Frozen) and Third phase is recovery phase and last for 15-24 months (Thawing). The main pathology is in the capsule of glenohumeral joint and there will be thickness of capsule and synovium of the inferior axillary recess. Due to capsular tightness there will be tightness of pectoralis major, latissimus dorsi and teres major muscles which leads to stretch, weakness of middle and lower trapezius, rhomboid major and minor muscles. This muscular instability produce protracted shoulder girdle and increased scapulothoracic joint motion which alters glenohumeral mechanics leads to additional stress to capsule, rotator cuff muscles and subacromial bursa.

Scapulohumeral rhythm: During 180º of abduction, there is roughly a 2:1 ratio of movement of the humerus to the scapula with 120º of movement occurring at the glenohumeral joint and 60º at the scapulothoracic joint.

Due to these factors scapular movements are also important component in rehabilitation of adhesive capsulitis of shoulder. The exact role and function of scapula are misunderstood in many clinical situations; this often translates into complete evaluation and diagnosis of shoulder problems. So while caring glenohumeral joint, scapular stability is also important in adhesive capsulitis for the faster recovery.

Scapular stabilisation refers to a set of exercises that strengthen the shoulder girdle muscles to restore normal scapular motion and correct dyskinesia. So adding scapular stabilisation technique to the rehabilitation program of adhesive capsulitis may improve functional ability, range of motion and early recovery [1].

Scapular dyskinesia is defined as an observable alteration in the position of the scapula and the pattern of scapular motion in relation to the thoracic cage during static or dynamic movement of scapula [2].

Kibler, classified scapular dyskinesia in three dysfunctional patterns from observing the dynamics of the scapular dyskinesia combined with the rest position of the scapula. Type I is characterized, at rest, by the posteriorly displaced or winging of the inferior medial scapular border, and during arm elevation, by the posterior winging of the inferior angle of the scapula. Type II is characterized by projection of the entire medial border of the scapula at rest and in motion. Type III is characterized by excessive superior translation, with elevation and some anterior displacement of the superior border of the scapula on the thorax. Type IV in this both scapulae is symmetrical at rest and during motion; they rotate symmetrically upwards with the inferior angles rotating laterally away from midline (rotatory winging) [3].

Scapular dyskinesia manifests itself through decreased shoulder movements. This has been seen with many glenohumeral problems including periarthritis of shoulder. The scapular instability is found in 68% of rotator cuff conditions and 100% of glenohumeral instability problems. Scapula altered kinematics plays a major role in shoulder pathology. So, rehabilitation generally begins and focuses on axio-humeral and scapula humeral than axio-scapular muscles [2].

2. Methodology

2.1 Purpose

The purpose of this study is to find the effectiveness of scapular stabilization exercises on scapular dyskinesia in patients with phase II adhesive capsulitis.

2.2 Selection of the subjects

60 participants (including both males and females) ranging from 40-60 years old diagnosed with unilateral phase II adhesive capsulitis and scapular dyskinesis were selected from hospitals and clinics in and around Pune and they were randomly assigned into 2 groups (Group A-30 & Group B-30).

2.3 Procedure

Ethical clearance was taken from the college. Consent was taken from the participants. According to inclusion and exclusion criteria participants were selected. Participants were divided into 2 groups 30 each group by simple random method (odd even method) and evaluated. Pre measures of Shoulder pain and disability index and Lateral scapular slide test were taken. Group 1 and Group 2 received following exercises;

Group 1

- Moist pack: 15 Minutes.
- Conventional exercises: Active range of motion exercises, Capsular stretching and Codman's exercises.[7]
- Post Treatment Measures of SPADI & Lateral scapular slide test were obtained.

Group 2

- Moist pack: 15 Minutes.
- Conventional exercises: Active range of motion exercises, Capsular stretching, and Codman's exercises.[7]
- Scapular stabilisation exercises[1]:
  1. Scapular clock exercises.
  2. Towel slide.
  3. Serratus anterior punch.
- Duration: 3 days/week for 2 weeks
- Post Treatment Measures of SPADI & Lateral scapular slide test were obtained.
- Data obtained was analysed statistically.

2.4 Findings

Pre and post analysis was done within the groups using paired t test which showed significant results.

Table 1(a): Shows pre and post analysis of group A on lateral scapular slide test.

Group A	P value	Significance
Neutral	<0.0001	Extremely significant
45°	0.0169	Significant
90°	0.0005	Extremely significant

Table 1(b): Shows pre and post analysis of group A on shoulder pain and disability index.

	P-Value	Significance
Spadi PRE	<0.0001	Extremely Significant
Spadi Post		

Table 2(a): Shows pre and post analysis of group B on lateral scapular slide test.

Group A	P value	Significance
Neutral	<0.0001	Extremely significant
45°	<0.0001	Extremely significant
90°	<0.0001	Extremely significant

Table 2(b): Shows pre and post analysis of group B on shoulder pain and disability index.

	P-value	Significance
Spadi PRE	<0.0001	Extremely Significant
Spadi Post		

Post analysis of comparison was done using unpaired t test and the results showed that Group B (Scapular Stabilisation Exercises along with Conventional Exercises) has shown significant improvement on Shoulder pain and disability index and Lateral scapular slide test for treatment of patients with scapular dyskinesis with phase II adhesive capsulitis as compared with Group A (Only Conventional Exercises).

Table 3(a): Shows pre and post analysis between both the groups A and B on lateral scapular slide test.

		Mean ± SD	Significance
Neutral	AB	1.5± 0.110 1.4± 0.231	Significant
45°	AB	1.0±0.371 0.8± 0.219	Significant
90°	AB	0.8± 0.360 0.6±0.287	Significant

Table 3(b): Shows pre and post analysis between both the groups A and B on shoulder pain and disability index.

	P-Value	Significance
Spadi A	0.0022	Very Significant
Spadi B		

3. Results

Post data analysis shows that Group B (Scapular Stabilisation Exercises along with Conventional Exercises) has shown significant improvement on Shoulder pain and disability index and Lateral scapular slide test in patients with scapular dyskinesis with phase II adhesive capsulitis as compared with Group a (Only Conventional Exercises).

4. Discussion

The present study was done to see the effectiveness of conventional exercises and scapular stabilisation exercises for scapular dyskinesis in patients with phase II adhesive capsulitis assessed by using Shoulder pain and disability index and Lateral scapular slide test.

For the study 60 subjects were divided into 2 groups of 30 each. Group A received only conventional exercises and Group B received Scapular stabilisation exercises along with conventional exercises. Patients with phase II adhesive capsulitis were selected having scapular dyskinesis are the diagnostic tool for use of these exercises. Other types of shoulder pathologies recent trauma, recent surgery was excluded.

Study was done in hospitals in and around pune for 2 weeks. Data was collected pre and post treatment. Pain and Disability was measured using SPADI and Scapular dyskinesis by using Lateral scapular slide test.

Later the data was statistically analysed using paired t-test for outcome within the groups and unpaired t-test for outcomes between the 2 groups.

The results from statistical analysis supports the alternate hypothesis which states that scapular stabilisation exercises are more effective than conventional exercises to reduce scapular dyskinesis in patients with phase II adhesive capsulitis.

The present study result demonstrates that subjects receiving scapular stabilisation exercises along with conventional exercises experienced greater improvement in reduction of pain and disability and decrease in scapular dyskinesis as compared to those receiving only conventional exercises.

The result of the current study is supported by Prabhakaran Jayprakasan *et al*. (2016), who concluded that the scapular stabilisation exercises were effective in reducing scapular dyskinesis.

The study found that the Scapular stabilization exercise protocol was effective in improving lateral scapular slide test and SPADI in Scapular type 2 Dyskinesia in subjects with shoulder impingement.

Weakness of the scapulothoracic muscles potentially leads to abnormal positioning of the scapula, disturbances in scapulohumeral rhythm, and generalized shoulder complex dysfunction. In this study, the exercise protocol designed and applied on the subjects were proposed to facilitate activation of mainly periscapular muscles-Serratus Anterior, Lower fibers of trapezius, Rhomboids major and minor to balance force couple altered due to scapular malposition. The protocol also included stretch of posterior capsule and Pectoralis minor stretch. The rationale behind the closed-chain framework is to maximize the ability of the inhibited muscles to activate. This involves placing the extremity in a closed-chain position, emphasizing normal activation patterns, and focusing on the muscle of interest by deemphasizing compensatory muscle activation. Typically, during soft tissue pathology, closed chain exercises are implemented early in the rehabilitation process.

There are 3 components which make usage of closed kinetic chain exercise advantageous in early rehabilitation. Firstly, the exercise environment can be controlled. This allows the focus to be taken away from the arm as an integrated unit with high dynamic demands and place it in a stable, axially loaded, and static setting. Secondly, closed chain exercises are ideal for working "at" specific ranges of motion compared to working "through" a range of motion which helps to provide a "snapshot" within the full arc of normal motion.

Finally, closed chain exercises allow the rotator cuff and scapular musculature to be unloaded by decreasing the amount of force generated and stress applied to the involved soft tissues. These type of exercises are best suited for re-establishing the proximal stability and control in the links of the kinetic chain such as the pelvis and trunk. Open chain exercises, which generate greater loads in comparison to closed chain activities, should be utilized later in rehabilitation programs due to their increased demand on the soft tissue due to the longer arm levers.

Based on the above studies, recommendation of closed kinematic chain exercises and kinetic chain concept of exercise intervention incorporated in early stages have proved beneficial. This protocol assisted in reducing pain, disability of activities of daily living by maintaining the force couple of scapula altered due to muscle imbalance and inhibition, Prabhakaran Jyaprakasan.*et al*. (2016) [2].

The result of the present study is supported by Mithen Dev. *et al*. (2012) [1], who concluded that scapular stabilisation exercises seemed to be beneficial in improving range and functional ability in patients with phase II adhesive capsulitis.

In adhesive capsulitis capsular tightness leads to tightness of pectoralis major, latissimus dorsi and teres major muscle which leads to weakness of middle and lower trapezius, rhomboid major and minor muscles. This muscular instability produce protracted shoulder girdle and increased scapulothoracic joint motion. This altered glenohumeral mechanics will produce additional stress to capsule, rotator cuff muscles and sub acromial bursae.

Scapular stabilisation exercises maintain length-tension relationship by strengthening rhomboid major, minor and lower trapezius muscle, thus relieves additional stress to the capsule and other pain causing tissues this may be the cause of improvement of pain and thus improvement in functional ability.

5. Conclusion

The present study states that both the groups are effective in improving scapular dyskinesis in patients with phase II adhesive capsulitis, but scapular stabilisation exercises along with conventional exercises are more effective as compared to only conventional exercises in improving scapular dyskinesis in patients with phase II adhesive capsulitis.

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