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EFFECT OF SCAPULAR STABILISATION EXERCISES FOR TYPE 2 SCAPULAR DYSKINESIS IN SUBJECTS WITH SHOULDER IMPINGEMENT

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ABSTRACT

Background: Abnormal altered scapular position during rest or motion have been termed as Scapular Dyskinesia. Scapula Dyskinesia Type-2 is one type of dyskinesia in which there is a visual prominence of entire medial border of scapula that occurs due to weakness of the serratus anterior and tightness of posterior shoulder joint capsule that results in reduction in glenohumeral flexion and abduction, resulting in decreased acromial elevation. This type of dyskinesia is commonly seen in Secondary impingement of shoulder. Rehabilitation generally begins and focused on axio-humeral and scapula- humeral than axio-scapular muscle. Early application of closed kinetic exercises on scapular stabilization and its effect of application on scapular dyskinesia type 2 is unknown. The study was proposed to find the effect of scapular stabilization exercise for type 2 Scapular Dyskinesia in subjects with shoulder impingement.

Methods: An experimental study design, 7 male patients with mean age 37 years diagnosed with Shoulder impingement associated with Type 2 scapular dyskinesia were included in the study. The protocol includes closed kinematic chain exercises (scapula clock), Black burn exercises, Sleepers stretch, and thera band exercises aimed to balance force couple of upper, lower trapezius and serratus anterior. Duration of intervention was 3 sessions per week for 2 weeks. Outcome measurements such as Lateral scapular slide test and SPADI were measured pre and post interventions.

Results: Analysis using Paired 't' test as a parametric test found that there is statistically significant difference $p < 0.000$ when pre to post interventions means were compared within the groups showing significant improvement in post SPADI and lateral scapular slide test.

Conclusion: It is concluded that Scapula stabilization exercise protocol found to be effective in Scapular type-2 Dyskinesia.

Keywords: Impingement syndrome, Scapular Dyskinesia, Scapular stabilization exercises, Serratus anterior, lateral scapular slide test, Shoulder disability.

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INTRODUCTION

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 [1-3]. Kibler et al [3-5] 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 the 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. A symmetrical pattern and the normal scapular thoracic rhythm is classified as type IV. Scapular dyskinesia has been associated with various conditions such as shoulder injury, instability, rotator cuff tears, and impingement syndrome [1-3]. It also occurs as a result of changes in activation of the scapular stabilizing muscles [4].

Shoulder impingement has been defined as compression and mechanical abrasion of the rotator cuff structures as they pass beneath the coraco-acromial arch during elevation of the arm [3]. Paula M Ludewig [6] stated that in the rehabilitation of patients with symptoms of shoulder impingement, it is important to consider scapular tipping (rotation about a medial to lateral axis) and serratus anterior muscle functions. Ludewig and Cook found that in a group with subacromial impingement relative to a group without impingement there is a decreased scapular upward rotation, increased anterior tipping and increased scapular internal rotation under load conditions [7].

In Type 2 Scapula Dyskinesia, weakness of the serratus anterior results in reduction in both glenohumeral flexion and abduction. The medial border of the scapula is elevated off the rib cage, resulting in decreased acromial elevation. This problem manifests itself through decreased shoulder abduction and secondary impingement. This lack of acromial elevation and secondary impingement has been seen concomitant with many glenohumeral problems including periarthritis of shoulder [8-10]. The scapular instability is found in 68% of rotator cuff problems and 100% of glenohumeral instability problems [8]. Scapula altered kinematics plays a major role in shoulder pathology. Rehabilitation generally begins and focuses on axio-humeral and scapula humeral than axio scapular muscles. Early application of closed kinetic exercises on scapular stabilization and its effect on application of the same on scapular dyskinesia type 2 is unknown. The purpose of our study is to find the effect of scapula stabilization on type 2 scapular dyskinesia in subjects with shoulder impingement.

METHODOLOGY

An experimental study design involved human subjects with the Ethical Clearance approval for the study were taken. 7 male patients of mean age 37 years and mean

weight of 65 Kg diagnosed as impingement syndrome of shoulder with scapular dyskinesia type-2, referred from Orthopedic surgeons of LLH/ Medeor 24x7 Hospital in Abu Dhabi were taken as subjects, painful arc with < 150° of active shoulder elevation in any plane,[11] positive empty can test indicating the possible supraspinatus involvement, [11] positive Hawkins–Kennedy test indicating possible external impingement. [11] Subjective complaint of difficulty performing activities of daily living, [11] a history of proximal anterior or lateral shoulder pain persisted for more than 1 week during the last six months [11]. Each subject underwent Scapula Dyskinesia Test with 1.5 kg dumbbell for below 68 kg body weight and 2.5 kg for above 68 Kg body weight of person. In this test, each subject performed five repetitions of bilateral active weighted shoulder flexion (sagittal plane) and bilateral active weighted shoulder abduction (coronal plane) while they were observed posteriorly for signs of scapula dyskinesia type-2 [4]. Seven subjects were selected with obvious winging of 1 inch or greater displacement in 3/5 trials. All inclusion subjects had characteristics of Glenohumeral internal rotation deficient (GIRD). Subjects with post fracture, neurological deficit, scapula dyskinesia test with normal or subtle abnormalities were excluded. Most of the subjects included in the study were professionals working with computer. The details of the study was explained to the subjects and informed written consent were taken prior to enrolment in the study.

Procedure:

Prior to application of intervention, baseline measures such as SPADI and Lateral scapular slide test were taken from each subject. Protocol designed were integrated functional kinetic chain rehabilitation, which assure optimal functioning of each segment. This protocol divided into two phases and applied at the frequency of 3 sessions per week for two weeks.

Scapular Stabilization Exercises include the Kinetic chain concept based on a proximal to distal control sequence. This emphasizes the achievement of full and appropriate scapular motion and the integration of that point into a subsequent global approach including trunk and hip movements (Scapular retraction is facilitated by trunk and hip extension) [2].

1ST Phase protocol:

To establish proper postural alignment- considering core, being the most proximal component of the kinetic chain (in relation to the arm) the critical link between the development and transfer of energy, primarily core stabilization exercises for transverse abdominal and multifidus muscle were given.

To establish proper motion at all involved segments- the primary goal to overcome from tightness of pectoralis major for which corner stretch hold 10 sec/ 6 times and for GIRD deficit, sleeper stretch hold applied for 10 sec at soft end feel, progressing further for 6 times facilitate scapular motion via exaggeration of lower extremity- lawn mover and robbery maneuver, exaggerate of scapular retraction in Controlling excessive protraction with

the closed chain exercise–Scapula clock exercises, wall wash. Low row exercise maneuver was applied. Scapular stabilization of Black burn exercises, press up, and push-ups were given. These exercises were given at the rate of 10 repetition/set holding at end range for 10seconds. Subjects were instructed to do the same exercises 10x2, twice a day at home.

2nd Phase protocol:

Rhythmic stabilization exercises, Thera band exercises (Red Color) were implemented as follows- Scaption, standing boxer punch, standing dynamic hug, Bilateral external rotation with abduction 0 degree, rowing exercises were given.



Figure1: Posterior view showing medial border of scapula protruding outwards during lowering arm from abduction above 90 degree down due to lack of control of Serratus Anterior and lower trapezius muscle-showing Type 2 scapula dyskinesia



Figure-2: Black Burner Exercise

Outcome Measurements:

Outcome measurements such as Lateral scapular slide test and SPADI were measured before and after 2 weeks of protocol.

1. Lateral scapular slide test:

The test was performed by evaluating scapular symmetry as varying loads are placed on the supporting musculature in three positions of the upper extremity: Position-1: The subject's arm is relaxed at the side (0° of humeral elevation); Position-2: The subject places his hand on the lateral iliac crest; Position-3: Corresponds to an internally rotated and abducted arm to 90°. In each position two measurements were taken using a tape in each position (between the inferior angle of the

scapula and the closest spinous process) in order to allow calculation of an average value. Test-retest and inter test reliability indicated that the test-retest (intra-tester) relationship was between 0.84 and 0.88 and that the inter-tester reliability was between 0.77 and 0.85, depending on the position [2,12,13].

2. Shoulder Pain and Disability Index

The Shoulder Pain and Disability Index (SPADI) was developed to measure current shoulder pain and disability in an outpatient setting. The SPADI contains 13 items that assess two domains; a 5-item subscale that measures pain and an 8-item subscale that measures disability [14].

Statistical Methods

Descriptive statistical analysis was carried out in the study. Outcome measurements analyzed are presented as mean ± SD. Significance is assessed at 5 % level of significance with p value was set at 0.05 less than this is considered as statistically significant difference. Paired 't' test as a parametric have been used to analysis the variables pre-intervention to post-intervention with calculation of percentage of change. The Statistical software namely SPSS 16.0, Stata 8.0, MedCalc 9.0.1 and Systat 11.0 were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc.

RESULTS

The result of the study found significant improvement in reducing pain and disability of SPADI with p<0.00 , 0.001 respectively and also found reduction in distance in lateral scapula slide test nearing to normal following intervention.

Table 1: Analysis of Lateral scapular slide test within Group (Pre to post test analysis)

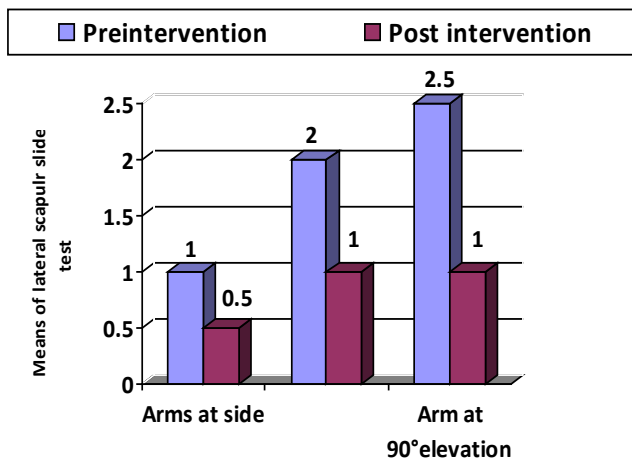
	Pre intervention Mean difference	Post intervention After 2week Mean difference
Position 1-Arm at side	1 cm	0.5 cm
Position 2-Hands on hip	2.0cm	1 cm
Position 3-Arms at 90 degree elevation	2.5 cm	1 cm

Table 2: Analysis of SPADI within Group (Pre to post test analysis)

	Pre intervention Mean±SD	Post intervention Mean±SD	t value ^a (Parametric)	P value
SPADI				
Pain	69.71± 4.64	25.71± 7.31	34.580	P <0.000**
Disability	61.71± 2.87	12.57± 1.81	69.736	P <0.000**

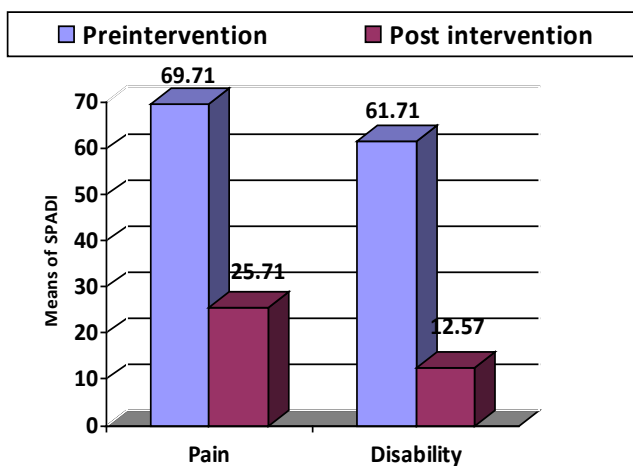
** Statistically Significant difference p<0.05; NS- Not significant; a. Pared t test.

Graph 1: Analysis of Lateral scapular slide test (Pre to post test analysis)



The above graph shows that there is a statistically significant reduction in means of Lateral scapular slide test measurement when means were analyzed from pre intervention to post intervention within Group.

Graph 2: Analysis of SPADI pain and disability (Pre to post test analysis)



The above graph shows that there is a statistically significant reduction in means of SPADI pain and disability components when means were analyzed from pre intervention to post intervention within Group .

DISCUSSION

The study found that the Scapular stabilization exercise protocol were found to be 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 scapula-humeral rhythm, and generalized shoulder complex dysfunction.^{2,4} The serratus anterior and lower trapezius are commonly weak or inhibited muscles of the scapulothoracic joint that may lead to abnormal movement. The serratus anterior and lower trapezius contributes to the acromial elevation. When the force couple is altered, movement becomes abnormal [2,4].

In this study, the exercise protocol designed [2-5] 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 mal-position. 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. Closed chain exercises such as the low row was performed as the short lever positioning in conjunction with the pelvis and trunk, facilitates lower trapezius and serratus anterior co activation which decreases the activation of the upper trapezius. 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 [15].

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.

LIMITATIONS OF THE STUDY

Subjects with primary frozen shoulder in the II stage were considered for the study, thus results cannot be generalized. The study was done for a period of two weeks. Follow-up was not done, therefore, long term effects were not known. Sample is size was small.

RECOMMENDATION FOR FUTURE RESEARCH

This study is lacking with control group who received only conventional exercises, so further studies with control group are suggested. Study on long term effects of scapular stabilization exercises are required. Effect of scapular stabilization exercises on other shoulder conditions with scapular dyskinesia needs to be experimented. Further studies are required to compare the effects with other conventional exercises and pain- relieving methods and

measuring the effect using other outcome measures.

CONCLUSION

This study concluded that the Scapular stabilization exercise incorporating early closed kinetic chain exercise were effective in reducing disability and pain in Type 2 Scapula Dyskinesia.

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Conflicts of interest: None

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