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Correlation between Scapular Dyskinesia and Endurance of Rotator-Cuff Muscles in Non-Symptomatic Individuals with Scapular Dyskinesia in Ahmedabad, Gujarat - An Observational Study

[1]Dr. Dhwani Jani, [2]Dr. Bhavna Gadhavi

[1]Junior Lecturer, JG College of Physiotherapy, Ahmedabad, India
[2]Dean and Principal, Parul Institute of Physiotherapy, Parul University, Vadodara, India

Corresponding Author: Dr. Dhwani Jani

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ABSTRACT

The position and motion of the scapula are closely interrelated with motion of the arm to accomplish most of the shoulder function. The scapula plays many roles in normal shoulder function which requires control of static and dynamic position of scapula. For maintaining the good kinematics of the scapula and the surrounding structures, the movement of the scapula must be synchronized. The dynamic muscle function is the major method by which the scapula is stabilized and purposefully moved to accomplish its role. Alteration of normal positioning of the scapula can lead to altered biomechanics of the shoulder as well. When there is weakness in scapulae musculature, the normal scapular position and mechanics gets altered leading to scapular dyskinesis. Scapular dyskinesis can also reduce rotator cuff strength and increase the rotator cuff strain. The study was carried out to find the correlation between scapular dyskinesis and endurance of the rotator cuff muscles in non-symptomatic individuals with scapular dyskinesia. Around 900 non-symptomatic subjects aged 18 to 25 years of both the genders from different colleges and hostels from Ahmedabad were assessed for the presence of scapular dyskinesia. Out of these about 402 subjects were found to have scapular dyskinesis. Those non symptomatic young adults were scanned for the presence of the scapular dyskinesis with the help of Modified Lateral Scapular Slide Test (MLSST). The subjects with scapular dyskinesis were included in the study, the type of dyskinesia was also ruled out. The subjects were than assessed for the strength of the rotator cuff muscles by using hand held dynamometer. The 25% weight of the best of three reading of strength of external rotation was given to assess the endurance of the rotator cuff in modified base position. The time holding an isometric contraction in modified base position was recorded in seconds. The correlation between the scapular dyskinesia and the endurance of the rotator cuff was analysed. The results suggest that amongst 402 subjects, there is significant but weak correlation between scapular dyskinesis and endurance of rotator cuff muscle in both dominant and the non-dominant arm.

Keywords: Scapular dyskinesis, Endurance, Rotator cuff Muscles, External Rotation

INTRODUCTION

The shoulder joint, of all the joints of the human body, has the greatest range of motion. The complex movement and functions carried out by the shoulder are very important for the activities of daily living. Effectiveness of shoulder position, stability, motion, muscle performance and the motor control are highly depended on the scapular performance.[1] The scapula anatomically, is part of both glenohumeral (GH) joint and the acromioclavicular (AC) joint, and acts as bony linkage between the humerus and the axial skeletal. [1] Physiologically, the scapula is the stable base of origin of various muscles

that contributes to the dynamic glenohumeral stability that produces the arm motion.[1] Mechanically, for efficient arm movement and allowing glenohumeral alignment to maximize joint stability, the coordinated coupled motion between the scapula and humerus called the scapulohumeral rhythm (SHR) is needed. [1] According to Kibler's study in 1991, alteration of normal positioning of scapula can lead to altered biomechanics of shoulder. When there is weakness in scapular musculature, the normal scapular position and mechanics gets altered. [4] These altered position and motion of scapula is termed as Scapular Dyskinesis. Many studies have showed the relation between scapular dyskinesis and shoulder pain, specifically shoulder impingement syndrome (SIS), multidirectional impairments and rotator cuff tendinopathy. [1,3]

There are various studies that show direct relation between scapular dyskinesis and the strength of the rotator cuff muscles. Excessive scapular protraction, a posture that is frequently seen in injured patients with scapular dyskinesis, decreased maximum rotator cuff strength by 23%.[6] Maximal rotator cuff strength was achieved in association with a position of 'neutral scapular protraction/retraction', and that the positions of excessive protraction or retraction demonstrated decreased rotator cuff abduction strength.[7] Researchers have also established that scapular dyskinesia is present in most of the cases of impingement syndrome of rotator-cuff. [1,3,5]. The endurance of the rotator-cuff muscles is also found to be reduced in most of the impingement syndrome. Weakness of the rotator-cuff muscles would lead to scapular dyskinesia.

Until now, it is believed also many studies have proven that the impingement syndrome results in the weakness of the scapular muscles leading to alteration in the scapular position that is scapular dyskinesia. So here arises the need to find out whether scapular dyskinesia is equally responsible of reduced rotator-cuff endurance and leading to impingement syndrome or vice-versa. Thus, the aim of the study is to find out correlation between scapular dyskinesia and endurance of rotator-cuff muscles in non-symptomatic individual with scapular dyskinesia.

MATERIALS & METHODS

The study was ethically approved from the institutional ethical committee. About 900 individuals, both males and females and aged 18-25 years were screened for non-symptomatic Scapular Dyskinesia through Random Convenient Sampling. The further observational study was conducted on selected 402 individuals that do not had any kind of neck, shoulder or cervical pain or injuries and also not involved in any kind of professional sports training or fitness with their written consent.

Modified Lateral Scapular Slide Test (MLSST) was used to evaluate the scapular dyskinesis. MLSST assess scapular asymmetry under varying load positions. [8] The MLSST differs from the routinely tested LSST as it includes weight of one kilogram. Measurements of scapular position were taken while scapular position with the arm abducted 0, 45, and 90 and 120 degrees in the scapular plane as shown in figures 1,2,3 and 4 respectively. Distance from the inferior angle of the scapula to the spinous process of the thoracic vertebra in the same horizontal plane was measured in all 4 positions. If the distance is greater than 1.5 cm, the test is positive.

Fig.1: MLSST at 0 degree

Fig.2: MLSST at 45 degrees

Fig.3: MLSST at 90 degrees

Fig.4: MLSST at 120 degrees

The subjects were also screened for the type of dyskinesis along with the test by visual method that has very good reliability. The subjects were categorized under three headings, type-1: inferior border of the scapula is prominent, type-2: medial border of scapula is prominent and type -3: superior border of scapula is prominent. [2]

Firstly, the subjects were assessed for the strength of the external rotation of the

shoulder with handheld dynamometer. [9] For that, the subjects were taken in the prone position with arm abduction and elbow at 90 degrees (Figures 5). Three readings were taken to know the strength of the external rotation. The best of the three readings was taken for further evaluation. The dumbbells representing the 25% of the best of three reading of the strength of the external rotators was used for the endurance test. The subjects were tested under modified base position (Figure 6) in scapular plane. The modified base position is 30 degree of abduction, 30 degree of flexion (scaption) and 30 degree of external rotation. The time holding an isometric contraction in the modified base position was recorded. The unit of endurance of rotator-cuff was in seconds. The correlation between the scapular dyskinesia with endurance of rotator cuff muscles was analysed.

Fig.5: Strength of external rotation

Fig.6: Endurance of rotator cuff

RESULT

The present study describes the correlation between scapular dyskinesia and endurance of rotator-cuff muscles in non-symptomatic individuals with scapular dyskinesia. Data was analysed using SPSS software version 20 and Microsoft Excel 2007. Before applying the test, the data was screened for normal distribution. The level of significance was kept at 5%.

The mean age for entire population: 21.67 ± 1.6 years with 60% female population and 40% male population. The mean BMI of the entire population is 21.2±3.6 kg/m^2. According to the dominancy of hand 90% of the subjects have right handedness while other 10% has left handedness.

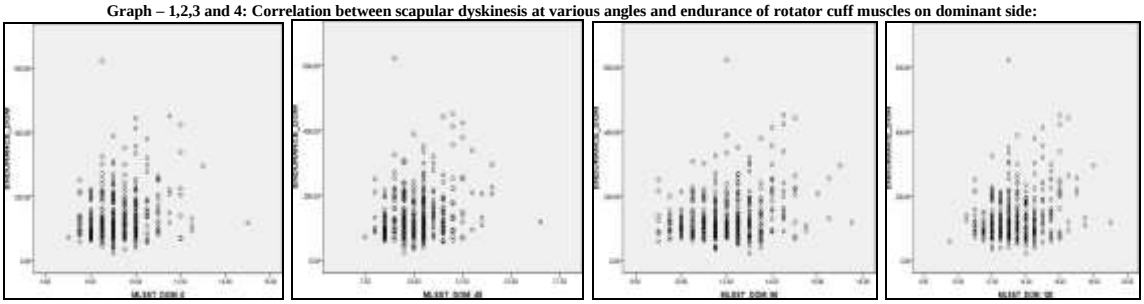
As the data was abnormally distributed, the correlation between scapular dyskinesia at each angle and endurance was analysed by Spearman's correlation on both dominant and non-dominant side.

Table – 1: Correlation of Scapular dyskinesis at Various Angles with Endurance (On Dominant Side):

Endurance On Dominant Side,Mean ± Sd (Secs)	Mlsst	Mean ± Sd	P Value	ϱ Value
139.1 ± 74.1	AT 0º	9.23 ± 1.1	<0.001	0.185
	AT 45º	10.1 ± 1.2	<0.001	0.181
	AT 90º	11.96 ± 1.5	<0.001	0.176
	AT 120º	13.4 ± 1.4	<0.001	0.188

As shown in Table-1, the mean endurance of the rotator cuff muscle on dominant side is 139.1 ± 74.1 seconds. The p value is less than 0.001 in all the angles of the dominant side which suggests that there is significantly positive correlation between scapular dyskinesis at each angle and endurance of the rotator cuff on dominant side. But the row value is less than 0.4 that suggest weak correlation between the two on dominant side.

Graph – 1,2,3 and 4: Correlation between scapular dyskinesis at various angles and endurance of rotator cuff muscles on dominant side:



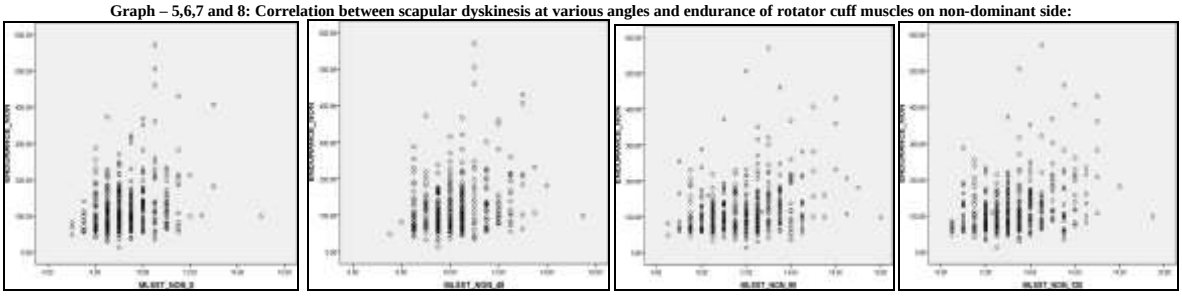
Graph-1: At 0 degrees(dominant)	Graph-2: At 45 degrees(dominant)	Graph-3: At 90 degrees(dominant)	Graph-4: At 120 degrees (dominant)

Table – 2: Correlation of Scapular dyskinesis at Various Angles with Endurance (On Non-Dominant Side):

Endurance On Dominant Side,Mean ± Sd (Secs)	Mlsst	Mean ± Sd	P Value	ϱ Value
123.1 ± 71.7	AT 0º	9.2 ± 1.1	<0.001	0.262
	AT 45º	10.1 ± 1.2	<0.001	0.265
	AT 90º	11.9 ± 1.6	<0.001	0.267
	AT 120º	13.3 ± 1.5	<0.001	0.292

As shown in Table-2, the mean endurance of the rotator cuff muscle on non-dominant side is 123.1 ± 71.7 seconds. The p value is less than 0.001 in all the angles of the non-dominant side which suggests that there is significantly positive correlation between scapular dyskinesis at each angle and endurance of the rotator cuff on non-dominant side. But the row value is less than 0.4 that suggest weak correlation between the two on non-dominant side.

Graph – 5,6,7 and 8: Correlation between scapular dyskinesis at various angles and endurance of rotator cuff muscles on non-dominant side:



Graph-5: At 0 degrees(non-dominant)	Graph-6: At 45 degrees(non-dominant)	Graph-7: At 90 degrees(non-dominant)	Graph-8: At 120 degrees(non-dominant)

DISCUSSION

The purpose of the study was to correlate the Scapular Dyskinesis and the Endurance of the

Rotator-cuff muscles in asymptomatic individuals having scapular dyskinesis. The studies have established that any injury or the pathology to the shoulder can lead to scapular dyskinesis. But there are some studies that show that the scapular dyskinesia is also present in asymptomatic subjects. When weakness is present in the muscles of the scapula, normal mechanics and position may become altered. Efficient concentric and eccentric activity of the muscles surrounding the shoulder depends strongly on the muscles anchored to stabilize the scapula. The scapula may slide laterally without a strong and stable base position thereby allowing the glenoid fossa to become more antetilted which will place excessive stress on the anterior structure[24].

The result shows weak correlation between scapular dyskinesia and the endurance of rotator cuff muscle at each angle in both dominant and non-dominant side in spite of the fact that the scapular dyskinesis alters the shoulder function and the passive joint mechanics. Altered scapular orientation infers altered acromial position which may lead to mechanical impingement of the rotator cuff which as a result deficits in its mechanical properties[24].

Budoff JE et al, in their study titled, "Debridement of partial thickness tear of rotator cuff without acromioplasty: a long-

term follow-up and review of the literature", estimated that 90% to 95% of rotator cuff abnormalities could be attributed to the intrinsic breakdown of the rotator cuff tendons due to tension overload, overuse and traumatic injuries rather than direct mechanical compression. This could be the reason for the significant but weak correlation between scapular dyskinesis and endurance of the rotator cuff muscles even after the mechanical load due to scapular dyskinesis

No significant difference is found in the endurance of the dominant and the non-dominant arm in the whole study. This supports the article Shoulder strength, power, and endurance in college tennis players by T. Jeff Chandler, W Kibler et al that states that there is no significant difference in the endurance of the external rotation of both the dominant and non-dominant arm.

CONCLUSION

Overall, the study clearly demonstrates the correlation between the scapular dyskinesis, endurance of rotator cuff muscles. From this study, it can be concluded that there is weak but significant correlation between the scapular dyskinesis and the endurance of the rotator cuff muscle in both the dominant and non-dominant arm.

Declaration by Authors

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