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ORIGINAL ARTICLE

SCAPULAR DYSKINESIS AMONG PATIENTS WITH SHOULDER DYSFUNCTION – A CROSS SECTIONAL STUDY.

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ABSTRACT:

Background: Scapula plays a vital role in a closed chain mechanism by being stable for coordinated muscle activation and functioning as a link in the kinetic chain. Scapular dyskinesis alters scapular resting position and dynamic motion due to various causes like bony or soft tissue injury and weakness or inflexibility. So this study was carried out to determine the prevalence of scapular dyskinesis and study the association of scapular dyskinesis with shoulder pain and disability among patients with shoulder dysfunction. **Procedure:** This Cross-Sectional study was carried out in 55 patients with unilateral shoulder dysfunction. The outcome measures were the Lateral scapular slide test and shoulder pain and disability index questionnaire. **Result:** Scapular dyskinesis was measured in patients with shoulder dysfunction with age 49± 6.92 and duration of symptoms was 2.72 ± 1. 83 months. The prevalence rate of scapular dyskinesis was at 0 degrees, 45 degree and 90 degrees of shoulder abduction 5.45 %, 12.72% and 18.18 %, respectively. **Conclusion:** Prevalence of scapular dyskinesis at 0 degrees, 45 degrees and 90 degrees of shoulder abduction 5.45%, 12.72% and 18.18%, respectively, shoulder pain and disability was not directly linked with scapular dyskinesis. This suggests that shoulder pain and disability may not always be associated with shoulder dysfunction; it may also be due to other factors like thoracic vertebral dysfunction, serratus anterior muscle weakness, rhomboid or muscle weakness, etc.

Keywords: Scapular dyskinesis, shoulder dysfunction, SPADI, frozen shoulder, LSST.

Introduction:

The shoulder joint is a ball and socket type of joint with a closed-chain mechanism that balances the mobility and stability of the joint. The scapula fulfils many roles to encourage the optimal function of the shoulder, and it should be appropriately aligned in multiple planes of motion of the upper extremity for the normal function of the shoulder joint.[1,3]

The scapula play critical roles in the closed-chain mechanism by being a stable base for coordinated muscle activation to compress the humerus into the glenoid and by being mobile enough to place the glenoid in optimal relation to the humerus to facilitate concavity1 and role include providing coordinated scapular rotation during humeral motion, serving as a stable base for rotator cuff activation and functioning as a link in the kinetic chain.[2]

Scapular resting position and dynamic motion can be altered due to bony and soft tissue injandl as muscle weakness and inflexibility. This altered scapular position/movement has been termed "scapular dyskinesis". Although it is seen in a large number of shoulder injuries.[2]

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As such, it may be the underlying cause or the result of many forms of shoulder pain and dysfunction.[3]

Multiple causes of dyskinesis, like Bony causes, include thoracic kyphosis, clavicular fracture non-union and clavicular malunion with shortening, rotation or angulation. Joint-related causes include high-grade AC arthrosis, instability and glenohumeral joint internal derangement. Neurological causes include palsies of the long thoracic or spinal accessory nerves and cervical radiculopathy.[3]

Dyskinesis's most familiar causative mechanisms have soft tissue components involving either inflexibility or inhibition of normal muscle activation or intrinsic muscle pathology. Decreased flexibility of either the pectoralis minor muscle or short head of biceps leads to their pull on the coracoid, which has been shown to create anterior tilt and protraction of the scapula. Loss of posterior tilt and upward rotation is seen when the serratus anterior's reduced activation and strength are reduced in impingement and shoulder pain cases. The Periscapular muscle activation alterations are also seen in patients with dyskinesis. Regardless of the particular cause of dyskinesis, the final result in most cases is a protracted scapula either at rest or with the arm in motion. Protraction is not favourable for optimal shoulder function. It results in decreased subacromial space with increased impingement symptoms and increased extrinsic rotator cuff compression, and rotator cuff muscles strength can also be reduced.[3]

Scapular dyskinesis lead to creating abnormal glenohumeral kinematics. There is evidence of scapular kinematic alterations associated with shoulder impingement, rotator cuff tears, glenohumeral instability, rotator cuff tendinopathy, stiff shoulders, adhesive capsulitis, So the purpose of my study is to find out the prevalence of scapular dyskinesis among patient with shoulder dysfunction and to study the association of scapular dyskinesis and shoulder pain & disability among the patient with shoulder dysfunction.[4]

As scapular dyskinesis is present in a higher percentage of most shoulder injuries, the dyskinesis's exact role in creating or exacerbating shoulder dysfunction has not been clearly defined. No studies have been done on the prevalence of scapular dyskinesis in a patient with shoulder dysfunction, including shoulder impingement, rotator cuff tears, glenohumeral instability, rotator cuff tendinopathy, stiff shoulders, adhesive capsulitis.[6]

In addition, previous literature suggests various treatment strategies to restore scapular position and motion in patients with shoulder disorders in a comprehensive shoulder rehabilitation program.[3]

So the purpose of this study was to determine the prevalence of scapular dyskinesis inpatient with shoulder dysfunction and to determine the association of the presence of scapular dyskinesis with shoulder pain and disability among patients with shoulder dysfunction.

METHODS:

This was an Observational, Cross-Sectional study with a study duration of 6 months total of 55 patients were recruited using the purposive sampling method from the Department of Physiotherapy and Medicine, Dr Vikhe Patil Memorial Hospital. Participants of both genders between 40 – 70 years were medically diagnosed with unilateral shoulder dysfunction. Patients with Post-surgical shoulder dysfunctions, Traumatic Shoulder dislocations, Glenohumeral instability, Cervical pathologies, Neurological conditions – e.g. Hemiplegia, brachial plexus injury, Thoracic outlet syndrome, Circulatory and cardiac disorder, Uncooperative patient, patients with mental/psychological problems were excluded from the study.

PROCEDURE:

Ethical committee approval was obtained from the Institutional Ethical Committee before the commencement of the study. The patients fulfilling the inclusion criteria were selected for the study. All participants were explained about the procedure and importance of the study following verbal informed consent from each participant.

In the present prevalence study, patients were selected through purposive sampling referred to the Department of Physiotherapy from the Orthopedic and Medicine department of Vikhe Patil Hospital. Total fifty-five patients of both genders aged 40 to 70 years (mean: 49.36 ± 6.926) having medically diagnosed unilateral shoulder dysfunction with the duration of symptoms (2.72±1.83 months) were identified. Patients with unilateral shoulder dysfunction were diagnosed with shoulder impingement, rotator cuff tear, rotator cuff tendinopathy, stiff shoulder, adhesive capsulitis were included. In addition, patients with Post-surgical shoulder dysfunctions, Traumatic Shoulder dislocations, Glenohumeral instability, Cervical pathologies, Neurological conditions – e.g. Hemiplegia, brachial plexus injury, Thoracic outlet syndrome, Circulatory and cardiac disorder Uncooperative patient and Participants with mental/psychological problems were excluded.

Demographic information of the participants, including name, age, gender, occupation, chief history, history, and routine shoulder examination, including pain, scapula-humeral rhythm, shoulder mobility, capsular pattern, etc., was documented as per the data collection sheet.

Outcome measures: The outcome measures were the Lateral scapular slide test and shoulder pain and disability index questionnaire (SPADI) to evaluate shoulder pain and disability.

The study was intended to find out the presence of scapular dyskinesia among patients with shoulder dysfunction. Scapular dyskinesis means an alteration in the normal position or motion of the scapula during coupled scapulohumeral movements. Many injuries involving the shoulder joint result in an imbalance of activation pattern in scapular stabilizing muscles. Which may increase the functional deficit associated with a shoulder injury by altering the usual scapular role. [7] Lateral scapular slide test was used to measure the scapular position with arm abduction to 0, 45, 90 degrees. This test determined the stability of the scapula during gleno-humoral movement. And it was a valid and reliable method to assess scapular dysfunction/ dyskinesia. LSST can be reliable in measuring the scapular position. However, a range of error exists while measurements indicated by the standard error of measurement. Therefore, the LSST provides more objective measure than pure observation.

Further, we evaluated shoulder pain and disability inpatient with unilateral shoulder dysfunction by using the shoulder pain and disability scale score. SPADI self-administered questionnaire and helped measure shoulder pain and disability inpatient with shoulder pain and dysfunctions. SPADI scale contains 13 items that assess two domain. Five items subscale that measure pain and eight things subscale that measures disability. We had explained the questionnaire to the patient and told them to answer the questions. Scores recorded accordingly.

RESULTS :

The data were analyzed in an excel sheet. An instant version3 was used to calculate the mean, standard deviation and p & r values. An unpaired "t" test was used to compare shoulder pain and disability with scapular dyskinesis.

Table 1: Baseline characteristics of patients

Age (years)	49.36 ± 6.926
Duration of symptoms (months)	2.72±1.83

The above table shows the baseline characteristics property of the age and duration of symptoms. The total number of patients was 55, with the age of (49.36 ± 6.926 years) having a duration of symptoms (2.72 ±1.83) months.

Fig. 1: Number of shoulder dysfunction patients.

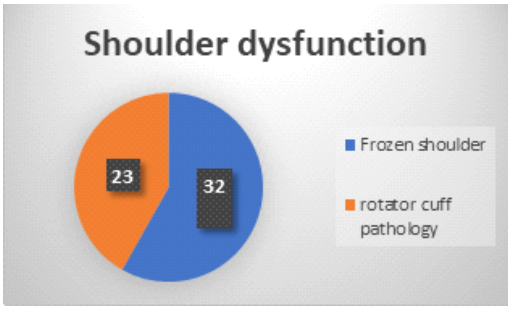
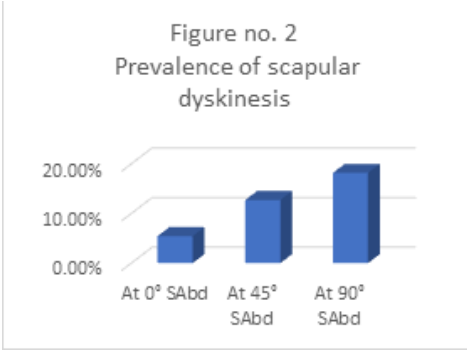


Figure 1: Above figure represents the total number of patients diagnosed with shoulder dysfunction. Out of 55 patients with shoulder dysfunction, 32 were frozen shoulder, and 23 were rotator cuff pathology.

Fig. 2: Prevalence of scapular dyskinesis among the patient with shoulder dysfunction

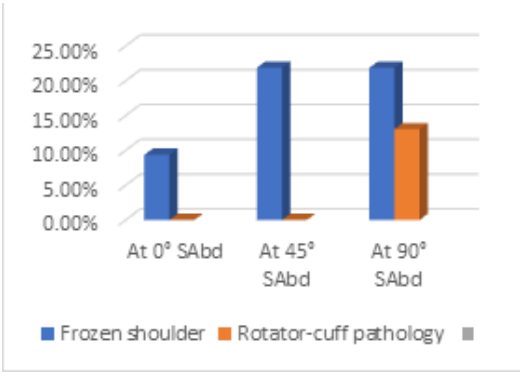


Above **Figure no. 2** shows the prevalence of scapular dyskinesis among the patients with shoulder dysfunction at 0 degrees, 45 degrees and 90 degrees, 5.45%, 12.72%, 18.18%, respectively.

Table 3: Prevalence of scapular dyskinesis among the patients with specific conditions

Shoulder dysfunction	At 0° SAbd	At 45° SAbd	At 90° SAbd
Frozen shoulder	9.37%	21.87%	21.87%
Rotator-cuff pathology	0	0	13.04%

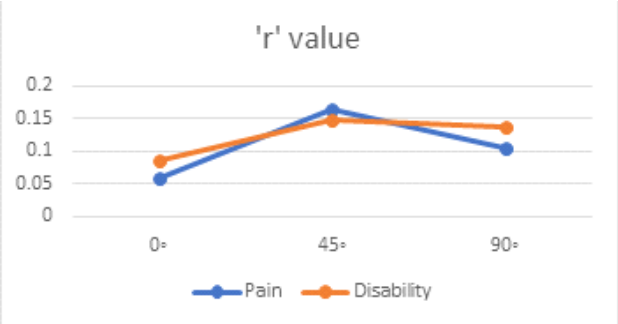
At 0° Abd	5.45%
At 45° SAbd	12.72%
At 90° SAbd	18.18%



Above **Figure no. 3** shows that Out of 55 patients with shoulder dysfunction (23 of Rotator cuff pathology & 32 frozen shoulder), scapular dyskinesis observed in 10 patients (7 of frozen shoulder + 2 shoulder impingement + 1 supraspinatus tear).

Table 4: Association of scapular dyskinesis with shoulder pain and disability (Pearson's coefficient r values) and p value at T8 level in patients with shoulder dysfunction: -

Shoulder abduction	At 0?		At 45?		At 90?	
Values	r	p	r	p	r	P
Pain	0.6743	0.0579	0.2296	0.1647	0.4477	0.1045
Disability	0.5326	0.0859	0.2790	0.1486	0.3154	0.1379



The above Figure no. 4 graph shows the "r" value for shoulder pain and disability with scapular dyskinesis at 0 degrees, 45 degrees and 90 degrees. They are calculated using the correlation (Pearson) test, which shows a non-significant (p-value)

DISCUSSION:

The shoulder joint is a ball and socket type of joint with a closed-chain mechanism that balances the mobility and stability of the joint. The scapula fulfils many roles to encourage the optimal function of the shoulder, and it should be appropriately aligned for the normal function of the shoulder joint.

Anatomically, the scapula is part of both the acromioclavicular (AC) joint the glenohumeral joint. Physiologically, it is the stable base of origin for muscles contributing to the dynamic glenohumeral stability and producing arm motion. Scapular strength is needed for force production from muscles arising from the scapula. Mechanically, the coordinated coupled motion between the scapula and humerus, the so-called scapulohumeral rhythm, is required for efficient arm movement and allows for GH alignment to maximize joint stability.[2,3]relationship between scapular dyskinesis with shoulder pain and disability.

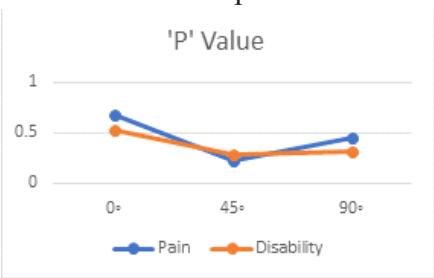


Figure. 5 graph shows the "p" value for shoulder pain and disability with scapular dyskinesis at 0 degrees, 45 degrees and 90 degrees. It is calculated by using the correlation (Pearson) test. The study by Paula M. Ludewig and Jonathan F. Reynolds et al. based on the association of scapular kinematics and glenohumeral joint pathologies segregated that scapular kinematic alterations associated with shoulder impingement, rotator cuff tendinopathy, rotator cuff tears, glenohumeral instability, adhesive capsulitis, and stiff shoulders.[14] Adhesive capsulitis is characterized by initially painful and progressively restricted active and passive glenohumeral joint range of motion. And which may further affect the scapulohumeral rhythm and as per the study by Kazuhiro Endo, Junichiro Hamada et al. on scapular motion restricted in patients with idiopathic frozen shoulder concluded that scapular motion towards depression, downward rotation, external rotation, and a posterior tilt is limited in the idiopathic frozen shoulder group.[18]

The rotator cuff has an essential role in the stability and function of the glenohumeral joint. Rotator cuff tendons are subjected to compressive and tension load, so the upward movement of humeral load compresses the cuff between the humeral head and the coracoacromial arch. Therefore it implies that scapular dyskinesis can be mainly due to the shoulder mentioned above dysfunctions.[16]In my study, I have evaluated 55 patients with shoulder dysfunction and scapular dyskinesis identified by lateral scapular slide test using a vernier calliper. The lateral scapular slide test helped measure the scapular position during gleno-humoral movement with arm abduction at 0, 45, 90 degree[8]. Ten patients have positive scapular dyskinesis out of 55 patients. 07 were with frozen shoulder, and three were with rotator cuff pathology. The rotator cuff pathology included supraspinatus tear & shoulder impingement.

The prevalence of scapular dyskinesis in patients with overall shoulder dysfunction at 0 deg shoulder abduction was 5.45%, at 45 deg it was 12.72%, and at 90 deg shoulder abduction, it was 18.18%. The prevalence of scapular dyskinesis with the specific condition as in frozen shoulder was 0 deg was 9.37%, at 45 deg it was 21.87%, and at 90 deg it was 21.87%. Whereas in rotator cuff pathology, scapular dyskinesis was present only at 90 % as 13.04 %. As prevalence at 0 degree is less than 45 and 90 degree, this may be due to scapula at its setting phase in the initial 30 degree of scapulohumeral rhythm.[20]

A previous study on the Prevalence of Scapular Dyskinesis in Overhead and Non-overhead Athletes by Matthew, Patrick C. McCulloch, et al. suggests that the Scapular dyskinesis, or alterations in dynamic scapular control, is present in as many as 67% to 100% of athletes with shoulder injuries.[19]

The most common causative mechanisms of dyskinesis have soft tissue components, involving either inflexibility or inhibition of normal muscle activation or intrinsic muscle pathology along with multiple factors include bony causes like thoracic kyphosis, or clavicle fracture, non-union or shortened mal union; Joint causes include high-grade AC instability, AC arthrosis and instability and GH joint internal derangement. Neurological causes include long thoracic or spinal accessory nerve palsy etc. [6]

A more recent systematic review has found reliability coefficients of ICC $\geq$ 0.89 in various patient populations (Roy et al., 2009). In addition, the SPADI demonstrates good construct validity, correlating well with other region-specific shoulder questionnaires (Paul et al. 2004, Bot et al. 2004, Roy et al. 2009).

SPADI scale contains 13 items that assess two domain. Five items subscale that measures pain and eight items subscale that measures disability. Verbally explained the questionnaire to patients and asked them to mark the visual analogue scale for each question for pain and disability. Scores recorded accordingly.[9]

Fifty-five patients had administered the SPADI questionnaire on themselves, and at the end, I compared the pain and disability with scapular dyskinesis. The P-value for pain and scapular dyskinesis at 0 degrees 0.6743, at 45degree 0.2296 and 90 degrees 0.4477 and P-value for disability and scapular dyskinesis at 0 degrees 0.5326, at 45 degrees 0.2790 and 90 degrees 0.3154. This shows no significant relationship between pain and disability with scapular dyskinesis. The "r" value for pain at 0 deg, 45 deg, and 90 deg was 0.0579, 0.1647, 0.1045 same for disability was 0.08597, 0.1486, 0.1379, respectively.

In their study done by Hillary Plummer, Jonathan C Sum et al. on scapular dyskinesis: prevalence in patients with shoulder pain indicated that the occurrence of scapular dyskinesis is not influenced by the presence of shoulder pain. [21] So this study suggests that there is less prevalence of scapular dyskinesis among patients with shoulder dysfunction. Out of 32 frozen shoulder patients in 7 patients, scapular dyskinesis was present, and out of 23 patients of rotator cuff pathology in 3 patients, scapular dyskinesis was observed. Another finding is that shoulder pain and disability is not directly linked with scapular dyskinesis. Shoulder pain and disability may be associated with other shoulder joint pathology. Scapular dyskinesis may not necessarily be associated with shoulder dysfunction; it may also be due to other factors like thoracic vertebra dysfunction, serratus anterior muscle weakness or rhomboid muscle weakness etc. A study for altered muscle activation in the shoulder dysfunction population notably reduced serratus anterior and increased upper trapezius activation. Scapular kinematic alterations similar to those found in patient populations have been identified in subjects with a short rest length of the

pectoralis minor, tight soft-tissue structures in the posterior shoulder region, excessive thoracic kyphosis, or with flexed thoracic postures.[4]

Identifying scapular dyskinesis allows for therapeutic intervention, which has been shown to improve shoulder symptoms, shoulder function and decrease the risk of a further shoulder injury.[13,19]

The limitation of our study was the stage of the frozen shoulder not considered. And not homogenous samples (32 frozen shoulder, 23 Rotator cuff pathology).

CONCLUSION:

Scapular dyskinesis was highest at 90 degrees and 45 degrees. And shoulder pain & disability not directly linked with scapular dyskinesis. This suggests that shoulder pain and disability may not be consistently associated with shoulder dysfunction; it may also be due to other factors like thoracic vertebral dysfunction, serratus anterior muscle weakness or rhomboid muscle weakness etc.

CLINICAL IMPLICATION:

Scapular strengthening exercises are considered as part of shoulder rehabilitation protocol in the early stage[22]. However, our study suggests that scapular strengthening exercises can be implemented in the later stage of shoulder rehabilitation protocol.

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REFERENCES:

1. W Ben Kibler, Aaron Sciascia . The role of the scapula in preventing and treating shoulder instability: knee surgery, Sports Traumatology, Arthroscopy: 2016; 24(2): 390-397.
2. W Ben Kibler, Aaron Sciascia. Current concept: scapular dyskinesis; BMJ journal. 2009;44. (5).
3. Simon J Roche, Lennard Funk, Aaron Sciascia, W Ben Kibler . Scapular dyskinesis: the surgeon's perspective: shoulder elbow. 2015; 7(4) : 289-297.
4. Leading PM, Reynolds JF. The association of scapular kinematics and glenohumeral joint pathologies: JOSPT. 2009 ; 39(2) : 90-104.
5. Kibler, Benjamin W.MD; Sciascia, Aaron MS, ATC, NASM-PCS; Wilkes, Trevor MD. Scapular Dyskinesis and its relation to shoulder injury: JAAOS.2012;20. (6):364-372.
6. W Ben Kibler, Paula M Ludewing, Phil W McClure, Lori A Michener, Klause Bak, Aaron D Sciascia. Clinical implication of scapular dyskinesis in shoulder injury: the 2013 consensus statement from the scapular submit: BMJ journal .2013; 47(14)
7. Kibler, Ben W.MD; McMullen, John ATC. Scapular dyskinesis and its relation to shoulder pain: JAAOS. 2003; 11.(2) : 142-151.
8. A Shadmehr et al. Reliability, agreement and diagnostic accuracy of modified lateral scapular slide test: manual therapy. 2016 ; 24 :18-24.

9. Breckenridge JD, McAuley JH. Shoulder pain and disability index (SPADI): journal of physiotherapy.2011;57(3) 197.

10. Kathryn E. Roach, Elly Budiman, Norwarat songsiridej, Yongsuk Lertratanakul. Development of shoulder pain and disability index: Arthritis & Amp; Rheumatism. 1991; 4(4): 143-149.

11. James R Rouse, Thomas Curtis. The lateral scapular slide test: A reliability study of males with and without shoulder pathology: NAJSPT. 2006; 1(3): 140-146.

12. E.M. Gane, Z.A. Michakeff et al. Prevalence, incidence, and risk factors for shoulder and neck dysfunction after neck dissection: A systematic review: European Journal of Surgical Oncology (EJSO).2017;43(7): 1199-1218.

13. S. Bansal et al. Shoulder impingement syndrome among competitive swimmers in India - prevalence, evaluation and risk factors: J Exerc Sci Fit.2007;5(2).102-108.

14. H Robert Tutan, D Christopher Young et al. Adhesive Capsulitis of the Shoulder in Male Cardiac Surgery Patients: Healio orthopedics.2000; 23(7).293-696.

15. Shiva Mausavi et al. The Prevalence and Characteristics of Shoulder Pain in Female Patients with Coronary Artery Bypass Graft (CABG). JRSR. 2017;4(1): 10-14.

16. Oliveiro VMA, Pitangui ACR et al . Shoulder pain in adolescent athletes: prevalence, associated factors, and influence on upper limb function: Braz J Phys Ther. 2017; 21(2): 107-113.

17. Dareen Hickey, Veronica Solving et al. Scapular dyskinesis increases the risk of future shoulder pain by 43% in asymptomatic athletes: a systematic review and meta-analysis: British journal of sports medicine. Vol 52, issue 2.

18. Kazuhiro Endo, Junichiro Hamada et al. Does scapular motion regress with ageing and restricted patients with an idiopathic frozen shoulder? : the open orthopaedics journal. 2016;10 (80)

19. Matthew B. Burn, Patrick C. McCulloch et al. prevalence of scapular dyskinesis in overhead and non-overhead athletes: orthopaedic journal of sports medicine 2016 Feb; 4(2).

20. David J Magee, Orthopedic physical Assessment, fourth edition. Page no. 225, chapter 5.

21. Hillary Plummer, Jonathan C Sum et al. observation scapular dyskinesis: Prevalence in patients with shoulder pain: Orthopedic and Sports Physical Therapy journal. July 2017; 47 (8): 1-25.

22. Edwards P, Ebert J, Joss B, Bhabra G, Ackland T, Wang A. Exercise rehabilitation in the non-operative management of rotator cuff tears: a literature review. International journal of sports physical therapy. 2016 Apr; 11(2):279.