International Journal of Health Sciences and Research
Vol.10; Issue: 11; November 2020
Website: www.ijhsr.org
Original Research Article *ISSN: 2249-9571*

Prevalence of Scapular Dyskinesia in Elite Badminton Players in Pune

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ABSTRACT

Background: Badminton being an overhead sport requires scapular stability and co-ordinated motion at the shoulder complex. It has been proven that muscle imbalance due to the overuse leading to instability is a major factor leading to scapular dyskinesia (SD). Although, SD has been studied in bilateral overhead athletes, badminton being a unilateral overhead sport was not deeply evaluated and no emphasis given on the side of affection and type of SD.
Objectives: 1. To find the prevalence of SD in elite badminton players in Pune
2. To observe the pattern of SD with its relation to the dominant side
3. To find the commonest type of SD
Methods: 100, injury-free, male and female elite badminton players (18-29 years old) playing for 5 to 10 years with regular training of 1.5-2 hours per session with a minimum of 4 sessions per week were included in the study. The SD was measured by performing the lateral scapular slide test (LSST).
Results: The overall prevalence came to 73%. 61% were found to have SD on the dominant (playing) side. Type 1 was more common compared to type 2 SD. There was a statistically significant difference found on the basis of number of years played ($p<0.05$).
Conclusion: This study indicates that SD is prevalent in elite badminton players on the dominant side with type 1 being the commonest. Players who played between 8 to 10 years reported with an increased prevalence.

Keywords: dominant side, elite badminton players, scapular dyskinesia, types

INTRODUCTION

Scapular biomechanics is described on the basis of movements at sternoclavicular (SC), acromioclavicular (AC), scapulothoracic (ST) and glenohumeral (GH) joints. Scapulohumeral rhythm plays a major role to function the shoulder complex in a co-ordinated manner. The ratio of 2^o of GH motion to 1^o of ST motion during elevation of the arm is referred to as scapulohumeral rhythm. [1] A key factor in overhead athletes is normal scapular function. Scapular movements consist of 3 major actions. [2]

SD is defined as a non-specific response to a painful shoulder condition. [3] Three types of SD exist. [4]Alterations in scapular movement can be as a resultant of fatigue, neurologic dysfunctions or inhibition by intra-articular GH or subacromial processes such as subacromial impingement, rotator cuff pathology, internal impingement, labral injury, GH arthritis and adhesive capsulitis. [5] There is a rise in injury and repetitive trauma risk with participation in sports. [6]

The scapula functions as a link between the cervical spine and the shoulder complex. It plays a very major role in

providing both mobility as well as stability of the neck region. [7] The scapular function is often misunderstood in many clinical situations and this lack of awareness translates into incomplete evaluation and diagnosis of shoulder issues. [8] A general term that describes the limitations in functions that exist in symptomatic overhead athletes is called the 'disabled throwing shoulder'.[9] Qualitative evaluation method allowed clinicians to standardize the categorization of patterns of dynamic scapular dysfunction. [10]

SD, or alterations in dynamic scapular control is seen in 61% of the overhead athletes. SD is mostly seen in overhead or throwing athletes due to their heavy demand of work on unilateral upper extremity function. During throwing and overhead sports, the shoulder complex joints have an increased stress acting as a bridge that transfers power from the lower limbs and trunk to the playing arm. [5]

In high-school baseballers, scapular dysfunction identified during preseason screenings was not associated with throwing-related upper extremity injuries. [11] SD puts the players at a higher risk of shoulder pain in the future. [12] Elite badminton players are defined as those who have played the sport at a competitive level with a shuttle velocity of 50-75 $m.s^{-1}$ at an average during the match. These players possess fine technical skills, flexibility, muscle strength and endurance. Elite players have more demand on quick reflexes, visual acuity and anticipation compared to sub-elite players. [13] Shoulder pain affects or had affected over 50% of elite badminton players, with 20% reporting ongoing pain. Most continue to play through the pain but report an impact on training, competition and activities of daily living. Shoulder kinematics were different for dominant and non-dominant shoulders. [14]

Scapular stabilization is necessary for overhead sports as the demand of the sport is for the scapula to move in a co-ordinated manner to play well. The subject may be symptomatic or asymptomatic but the altered scapular motion has chances of shoulder related disorders in the future. [15] EMG activity is reduced in the serratus anterior and trapezius muscles due to the presence of SD. [16] Classically, SD is observed on the basis of scapular winging which is due to serratus anterior weakness. [17] Being in a kinetic chain, scapular muscle endurance can affect core endurance in athletes. This in turn affects performance. [18] SD can be assessed with the LSST, it being a reliable outcome measure. [19] In an asymptomatic athlete, scapular position is asymmetric. [20] The pathophysiology of the dropped SICK scapula is due to the static malposition of the coracoid and the dyskinesia that it produces. [21]

Posterior scapular tipping is responsible for functional narrowing of the subacromial space during an overhead activity, leading to pain in abduction and ER. [22]

Badminton is a racquet sport which has a structure characterized by motions of high intensity and short duration. Biomechanics of badminton is studied on the lines of power strokes, forehand overhead jump smash, backhand overhead strokes and forehand serves. The joint contributions made to the shuttle-cock velocity during the smash contributed to 53% more usage of shoulder rotations. Higher angular velocities were reached by skilled badminton players. [23] SD alters normal scapular role during coupled scapulohumeral motions which is associated with shoulder injury due to functional deficit. [24] Muscle imbalance due to the overuse leading to instability may be a lone factor leading to SD. [25] Males have an enhanced fatigue resistance in comparison with females due to the exacerbation testosterone deficiency. [26] Rehabilitation with an exercise protocol of 12 to 18 months is required to achieve results. In case of non-operative failures, surgical techniques may need to be considered. [27] As a resultant of SD, players may suffer from compromise in performance. [2] Overhead

athletes complain of shoulder pain with an impact on training and competition. [14]
It is necessary to allow better allocation of diagnostic and therapeutic interventions by in order to help athletes optimize functional performance and reduce risk of injuries in the future. [5] In this study, we studied the prevalence of SD in elite badminton players using the LSST.

METHODS

Objectives:

1. To find out the prevalence of SD in elite badminton players in Pune
2. To observe the pattern of SD with its relation to the dominant side
3. To find out the commonest type of SD and its relation to the number of years played

Study design: Cross-sectional observational study

Study Population: 100 elite badminton players from private sports clubs in Pune were studied. Both male and female elite badminton players (23.5 ± 5.5 years old) having an experience of playing at a competitive level for 5 to 10 years and regular training of 1.5-2 hours per session with 4 sessions per week were included in this study. Recreational badminton players, those with previous injuries and restricted shoulder joint range of motion were excluded.

Procedure:

100, injury-free, male and female elite badminton players were recruited for this study. Written consent was taken from the subjects after explaining the need of the study.

Measurement of scapular dyskinesia:

LSST was performed by the player. This test was chosen as the tool of assessment as it is easy to administer, requires minimal assistance, is inexpensive requiring only materials like a standard measuring tape, pen and paper. LSST has a moderate to good reliability and validity. [19,20]
The test was explained and demonstrated to the participants.

1. In neutral position with markings at base of spine of scapula and inferior angle of scapula

2. In 45^{o} scapular abduction (ScA)

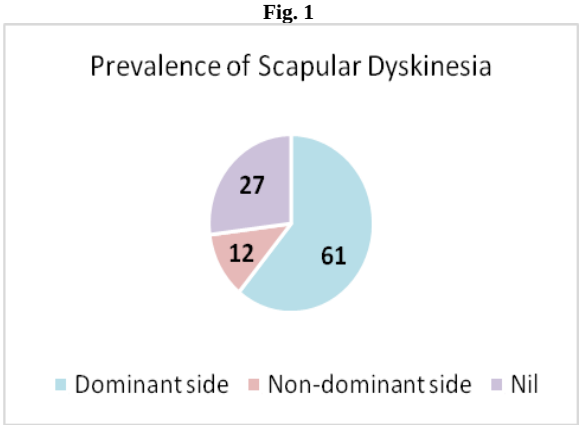
3.In 90^{o} ScA with medial rotation

4. In 120° ScA

5. In 150° ScA

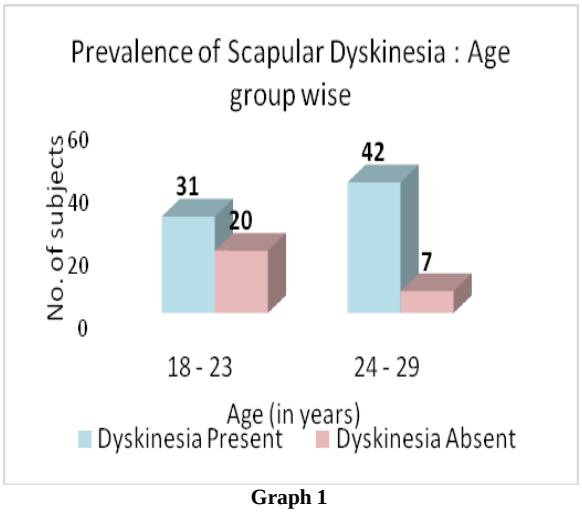
Statistical Analysis: In this study, 100 elite badminton players were studied. The data was analysed using the biostatistics primer software with 95% confidence interval and the level of significance at $p<0.05$. The SD assessment was done by performing the LSST bilaterally on the subject. The results were calculated by the chi-square test with Yate's correction.

Fig. 1



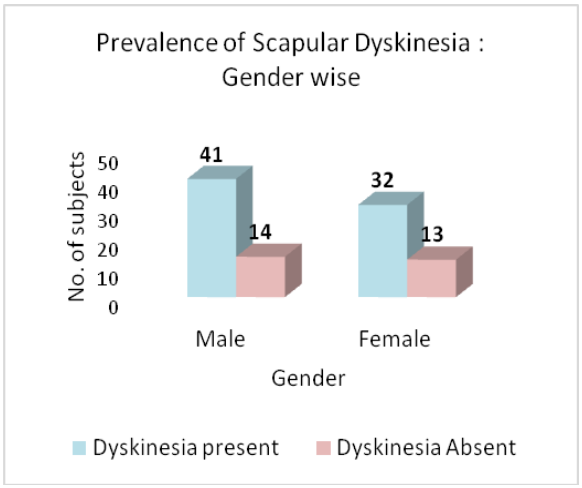
- The overall prevalence came to 73%, with 61% on the dominant (playing) side and 12% on the non-dominant.

The chi-square statistic with Yates correction came to 6.6659 and the p-value was 0.0098. Hence, there was a statistically significant difference in the prevalence of scapular dyskinesia in various age groups.



Graph 1

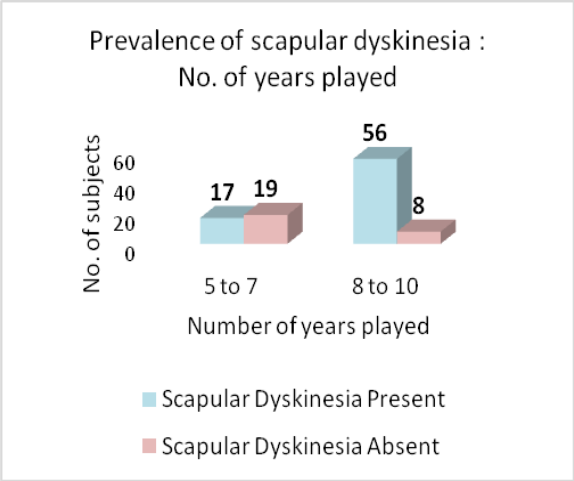
The chi-square statistic with Yates correction was 0.025 and the p-value was 0.874. Hence, there was no statistically significant difference in the prevalence of scapular dyskinesia between males and females.



Graph 2

The chi-square statistic with Yates correction came to 16.9754 and the p-value was 0.000013. As $p<0.05$, there was a

statistically significant difference found in the prevalence of scapular dyskinesia on the basis of number of years played.



Graph 3

Standard deviation (S.D.) and mean values of types 1 and 2 SD are:

Degrees of scapular abduction	Number	Points	Mean ± S.D.
45 degrees	48	1	1.06 ± 0.09
		2	1.22 ± 0.15
90 degrees	48	1	0.94 ± 0.09
		2	1.44 ± 0.16
120 degrees	48	1	0.80 ± 0.09
		2	1.65 ± 0.21
150 degrees	48	1	0.68 ± 0.13
		2	1.80 ± 0.21

Degrees of scapular abduction	Number	Points	Mean ± S.D.
45 degrees	25	1	2.09 ± 0.14
		2	0.79 ± 0.08
90 degrees	25	1	1.82 ± 0.12
		2	0.88 ± 0.09
120 degrees	25	1	1.67 ± 0.07
		2	1.00 ± 0.13
150 degrees	25	1	1.50 ± 0.06
		2	1.14 ± 0.12

RESULTS

The overall prevalence came to 73%. 61% were found to have SD on the dominant (playing) side compared to the non-dominant side. Type I was more common compared to type II SD. When the prevalence was calculated on the basis of the number of years played, a difference was found. There was no difference found between males and females.

DISCUSSION

This study was conducted to find out the prevalence of SD in elite badminton players in Pune. The age groups of 18 to 29 years were taken in this study with those having an experience of playing from 5 to 10 years with regular training sessions. 100 elite badminton players were recruited for this study. The SD was commented upon by performing the LSST bilaterally.

While carrying out the study, as per graph 2 we did not find any statistically significant difference in the prevalence of SD gender wise or in the types of SD as per age and gender. We were hypothesizing to find a difference between males and females because as per a previous study, females were found to have more slower-twitch fibres compared to males which followed the lines of lower contractile velocity. [26] However, we found out that SD occurs as a resultant of usage of the muscles overtime.

According to many studies, scapular stability is important in overhead athletes as it helps in facilitating optimal shoulder complex motions, provides a stable base from which the mobility of GH joint occurs, scapulohumeral rhythm and throwing motions. [18,21,23,25]

As per the results of this study given in fig. 1, we found the overall prevalence of SD in elite badminton players to be 73%. Out of the 100 samples taken, 73 presented with SD. Amongst these 73, 61 players presented with SD on the dominant side (playing side) and 12 were observed to have it on the non-dominant side.

According to a case study on the EMG activity of Serratus Anterior and Trapezius during glenohumeral abduction in a participant with SD, it was concluded that, the ratio of serratus anterior to lower trapezius on involved left side showed less EMG activity compared to the right side. [16]

As per a prior study, SD occurs due to weakness and fatigue of scapular stabilizing muscles, tightness of anterior shoulder, poor overhead mechanics and overuse or repetitive motions such as throwing or serving. [25] As a resultant of

SD, players may suffer from compromise in performance. [2]

In this study, 61% of SD is the relevant percentage as it was found on the dominant side of the elite badminton players. As a result of overuse of the playing side which is the dominant scapula, it causes laxity in the shoulder girdle and scapular muscles. This overuse is due to high recruitment of the musculature leading to instability. [9] An imbalance in the synergistic inner cone (stabilizers) and outer cone (mobilizers) may lead to abnormal shear forces which in turn causes instability. [1] The scapula functions as a link between the cervical spine and the shoulder complex which plays a major role in providing mobility and stability of the neck region. [7] Scapular instability is recognized as a reason for arm and shoulder pain. [25]

A study suggested that, muscle inhibition resulting from SD is a non-specific response to a painful shoulder condition, rather than a specific response to a glenohumeral pathology. Inhibition is seen as diminished ability of the muscles to exert torque and stabilize the scapula as well as disorganize the muscles around the shoulder. [24]

As per studies done in the past, it was noted that the dominant upper extremity exhibits dyskinetic findings as a result of overuse, muscle asymmetry, differences in ROM, and injury. [5]

According to research, overhead athletes complain of shoulder pain with an impact on training, competition and activities of daily living. Shoulder kinematics were found to be different for dominant and non-dominant sides. [14]

In this study as per graph 1, when the results between the age groups of 18 to 23 and 24 to 29 were compared, a statistically significant difference was found in the SD. While calculating the results, we observed that out of the 73 players presenting with SD, 48 had Type 1 and 25 had type 2 SD. This implied that, Type 1 was more common in the elite badminton players as compared to Type 2.

Previous studies have stated that, Type 1 is due to weakness of lower trapezius and serratus anterior. The inferomedial scapular border is prominent. Posterior scapular tipping is responsible for functional narrowing of the subacromial space during an overhead activity, leading to pain in abduction and external rotation. Type 2 presents with the scapular winging pattern where the entire scapular medial border is prominent due to weakness of trapezius and rhomboids. Superomedial scapular border is prominent in type 3 where excessive and early elevation of the scapula is observed during upper extremity elevation. [4,23]

As per a prior study, prevalence of scapular malalignment and its association to shoulder disorder in school aged baseball players was researched upon and 75% presented with shoulder pain which was associated with SD where Types 1 and 2 were commonly seen. [12]

When we compared the results of this study as given in graph 3, between players playing from 5 to 7 years and from 8 to 10 years, there was a statistically significant difference found in the prevalence of SD on the basis of number of years played implying that those who had played for higher number of years had a higher reported prevalence of SD.

According to research, as a result of overuse, muscle imbalance may be a lone factor of contributing to SD or it can be associated with various factors incorrect practice of sports, contractures poor posture, joint and muscular pathologies, adhesions, disuse atrophy or neurological deficits. [25]

Many papers studied SD, but no research was conducted on the types of SD in a unilateral overhead sport. Therefore, this study shows that SD is prevalent in elite badminton players on the dominant side where types 1 and 2 were observed amongst which type 1 was the commonest and the number of years of played had an effect on the prevalence of SD.

Future Scope of Study:

Future research can be done by recording the response in the players after the training period by focusing on the strengthening of the scapular muscles that commonly go into weakness due to overuse.

Additionally, comparative studies of scapular strengthening protocols can be done between types 1 and 2.

Research can also be done to study any significant variations between males and females.

REFERENCES

1. Pamela K. Levangie, Cynthia C. Norkin. Joint structure and function: A comprehensive analysis. 5th ed. New Delhi: Jaypee Brothers Medical Publishers Ltd; 2017. Page numbers 258-261.
2. Preziosi Standoli J, Fratalocchi F, Candela V, et al. Scapular Dyskinesis in Young, Asymptomatic Elite Swimmers. *Orthopaedic Journal of Sports Medicine*. 2018. doi:10.1177/2325967117750814
3. Struyf F, Nijs J, Mottram S, et. al. Clinical assessment of the scapula: a review of the literature. Br J Sports Med. 2014;48(11): 883-90. doi: 10.1136/bjsports-2012-091059
4. Physiopedia contributors. Scapular Dyskinesia [Internet]. Physiopedia: [updated 2020 July 2; cited 2020 Oct. 10]. Available from https://www.physio-pedia.com/index.php?title=Scapular_Dyskinesia&oldid=242215
5. Matthew B. Burn, Patrick C. McCulloch, David M. Lintner, et. al. Prevalence of scapular dyskinesis in overhead and non-overhead athletes. The Orthop J Sports Med. 2016;4(2). DOI: 10.1177/2325967115627608
6. Aytar A, Zeybek A, Pekyavas NO, Tigli AA, Ergun N. Scapular resting position, shoulder pain and function in disabled athletes. *Prosthetics and Orthotics International*. 2015;39(5):390-396. doi:10.1177/0309364614534295
7. Cools AMJ, Struyf F, De Mey K, *et al.* Rehabilitation of scapular dyskinesis: from the office worker to the elite overhead athlete. *British Journal of Sports Medicine.* 2014;48:692-697.
8. Ben Kibler W. The Role of the Scapula in Athletic Shoulder Function. *The American Journal of Sports Medicine*. 1998;26(2):325-337. doi:10.1177/03635465980260022801
9. W Ben Kibler, Stephen J Thomas. Pathomechanics of the throwing shoulder. Sports Med Arthrosc. 2012;20(1):22-29. DOI: 10.1097/JSA.0b013e3182432cf2
10. W Ben Kibler, Tim L. Uhl, Jackson W.Q. Maddux, et. al. Qualitative clinical evaluation of scapular dysfunction: a reliability study. J Shoulder Elbow Surg. 2002;11(6):550-556.
11. Myers JB, Oyama S, Hibberd EE. Scapular dysfunction in high school baseball players sustaining throwing-related upper extremity injury: a prospective study. J Shoulder Elbow Surg. 2013;22(9):1154-9. doi: 10.1016/j.jse.2012.12.029.
12. Kenichi Otoshi, Shinichi Konno, et. al. The prevalence of scapular malalignment in elementally school aged baseball players and it's association to shoulder disorder. Journal of Orthopaedic Science. 2018;23(6):942-947.
13. Cheong Hwa Ooi, Albert Tan, Azwari Ahmad, et. al. Physiological characteristics of elite and sub-elite badminton players. Journal of Sports Sciences. 2009;27(14):1591-1599, DOI: 10.1080/02640410903352907
14. Manit Arora, Sunil H. Shetty, Ravindra G. Khedekar, et. al. Over half of badminton players suffer from shoulder pain: Is impingement to blame? Journal of arthroscopy and joint surgery. 2015;2(1):33-36.
15. Jonathan P. Braman, Sean C. Engel, Robert F. LaPrade, et. al. In Vivo Assessment of Scapulohumeral Rhythm During Unconstrained Overhead Reaching in Asymptomatic Subjects. J Shoulder Elbow Surg. 2009;18(6):960-967.
16. Tyler Bentrup, Byron Flett, Joshua Sorvig. EMG of Serratus Anterior, Upper, Middle and Lower trapezius during glenohumeral abduction in a participant with scapular dyskinesia: A case study. Physical Therapy Scholarly Projects. 2017:658.
17. David J. Magee. Orthopaedic Physical assessment. 6th ed. Kundli. RELX India Private Ltd; 2018. Page numbers 266-268,275.

18. Basavraj Motimath, Manjiri V Mahajan, Dhaval Chitale. Correlation between core stability and scapulohumeral rhythm in badminton player – An observational study. International Journal of Applied Research. 2017;3:328-332.
19. Curtis Thomas, Roush James. The Lateral Scapular Slide Test: A Reliability Study of Males with and without Shoulder Pathology. North American journal of sports physical therapy. 2006;1(3):140-146.
20. Perry A Koslow, Laura A Prosser, Gerissa A Storny, et. al. Specificity of the lateral scapular slide test in asymptomatic competitive athletes. Journal of Orthopaedic and Sports Physical Therapy. 2003;33(6):331-6. DOI: 10.2519/jospt.2003.33.6.331
21. Stephen S. Burkhart, Craig D. Morgan, W Ben Kibler. The disabled throwing shoulder: spectrum of pathology part III: the SICK scapula, scapular dyskinesis, the kinetic chain, and rehabilitation. The Journal of Arthroscopic and Related Surgery. 2003;19(6):641-61. DOI: 10.1016/S0749-8063(03)00389-X
22. Panagiotopoulos AC, Crowther IM. Scapular Dyskinesia, the forgotten culprit of shoulder pain and how to rehabilitate. SICOT J. 2019;5:29. doi: 10.1051/sicotj/2019029.
23. Manan V, Manit A, Digpal R. Biomechanics in Badminton- A Review. Orthop & Spo Med Op Acc J 2(1)- 2018. OSMOAJ.MS.ID.000129.
24. Kibler WB, McMullen et. al. Scapular dyskinesia and its relation to shoulder pain. J Am Acad Orthop Surg. 2003;11:142-151
25. Sanchez HM, Sanchez EGM. Scapular dyskinesis: biomechanics, evaluation and treatment. *Int Phys Med Rehab J*. 2018;3(6):514-520. doi: 10.15406/ipmrj.2018.03.00157
26. Haizlip KM, Harrison BC, Leinwand LA. Sex-based differences in skeletal muscle kinetics and fiber-type composition. Physiology (Bethesda). 2015 Jan;30(1):30-9. doi: 10.1152/physiol.00024.2014.
27. Mark I Allen, James J.Gilhool, Denis P.Rogers. Scapular instability : The scapulothoracic joint. Physical medicine and Rehabilitation clinics of North America. 2000;11(4):755-770.

How to cite this article: Mahale A, Bisen R, Kalra K. Prevalence of scapular dyskinesia in elite badminton players in Pune. Int J Health Sci Res. 2020; 10(11):127-134.

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