Scapula Associated Impairments in Badminton players

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Abstract: Badminton is an individual, non-contact sport requiring jumps, lunges, quick change in direction and rapid arm movements from a wide variety of postural positions. Subjects comprised of 30 male professional badminton players from Mumbai. All participants completed written consent prior to participation. Data collection consisted of a Questionnaire and a Clinical assessment sheet which documented various scapular based assessment. The Outcome measures evaluated were Pectoralis minor length, Posterior soft tissue tightness, Glenohumeral Internal Rotation and External Rotation ROM and Scapular Muscle strength (Serratus anterior bias, Upper trapezius bias, Middle trapezius bias, Lower trapezius bias, Shoulder internal and external rotators strength), Scapular dyskinesia by scapular dyskinesis test (SDT), Close kinetic chain upper extremity stability test & Neural tissue tightness of upper limb. The scapular associated impairments in badminton players were posterior soft tissue tightness, increased external rotation range of motion, decreased internal rotation range of motion and weak scapular musculature.
Key word: Scapula, impairment, badminton

1 Introduction:

Badminton is an individual, non-contact sport requiring jumps, lunges, quick change in direction and rapid arm movements from a wide variety of postural positions.(Kroner) [1] The most common injury sustained by recreational badminton players was pain and stiffness at the shoulder joint.(Muttalib) [2]Badminton is considered a low risk sport compared to other sport. In acute badminton related injuries it has been shown that 11-31% are located in the upper extremities. The majority i.e.74% of injuries in badminton are described as overuse injuries and the upper extremities account for 19-32%. The abnormal scapular biomechanics that occur as a result of this dysfunction create imbalance between the agonist and antagonist muscles and predispose the shoulder to injuries.(Michael 2000)[3]

2. Methods:

Using a cross sectional research design, comprised of 30 male professional badminton players with an experience of 3 months or more in badminton from Mumbai were invited to participate in this study.

Approval was taken for the study by the Ethics Committee. All participants completed written consent prior to participation. Data collection consisted of a questionnaire and a clinical assessment conducted by physiotherapist experienced in sports assessment.

2.1 Subject selection criteria:

Inclusion criteria: Subjects playing since a year
Exclusion criteria:
1. Playing any other sport, especially contact sport, except badminton.
2. Players who had previous injury to an area injured during badminton game

2.2 The following outcome measure were evaluated: Pectoralis minor length (PML,John B 2008) [4] Posterior soft tissue tightness (PST,Lin et al 2006)) [5], Glenohumeral Internal Rotation (IR) ROM and External Rotation(ER) ROM, Scapular Muscle strength (Serratus anterior bias, upper trapezius bias, middle trapezius bias lower trapezius bias and glenohumeral internal and external rotators)(Turner et al 2009) [6], Close kinetic chain upper extremity stability test(Todd 2009)[7],Neural tissue tightness of upper limb.

2.3 Scapular dyskinesis test (SDT)[8]
Participants were asked to simultaneously elevate their arms overhead as far as possible to a 3-second count using the ''thumbs up'' position and then lower to a 3-second count. Tests were performed with athletes grasping dumbbells according to body weight 3 pounds for those weighing less than 68.1 kg and 5 pounds for those weighing 68.1 kg or more. Athletes were viewed while performing weighted shoulder flexion and abduction.(Philip McClure)

3 Results and Observations:

Badminton players when compared against dominant and non-dominant did not show any statistically significant difference in pectoralis minor length.when Scapula dyskinesia test was performed 12% reported obvious abnormality,39% reported subtle abnormality,whereas 49% reported as normal.

Table: 1 Comparison of Pectoralis minor length (PML) in Dominant and Non dominant shoulder

	Badminton players				
	Dominant		**Non Dominant**		
PML	**Mean**	**Standard Deviation**	**Mean**	**Standard Deviation**	**P-Value**
Pectoralis minor length	16.16	1.14	16.2	1.09	0.75(NS)

NS-Not Significant

Table: 2 Comparison of PST and ER and IR ROM in Dominant and Non dominant shoulder

	Badminton players				
	Dominant		Non Dominant		
	Mean	Standard Deviation	Mean	Standard Deviation	P-Value
Horizontal adduction(PST)	27.9	4.40	31.8	6.13	0.0007(ES)
ER ROM	100.25	3.60	99.48	3.61	0.0002(ES)
IR ROM	51.23	10.61	53.2	8.74	0.0202(S)

ES - Extremely significant- Significant

Table: 3 Comparison of Scapular and Glenohumeral rotators strength in Dominant and Non dominant shoulder

	Badminton players				
	Dominant		Non Dominant		
Scapular Muscles	Mean	Standard Deviation	Mean	Standard Deviation	P-Value
Serratus anterior	19.96	5.07	19.66	4.61	0.1436(NS)
Upper trapezius	16.43	3.88	15.73	4.49	0.1349(NS)
Middle trapezius	15.53	3.68	14.13	3.21	0.0043(VS)
Lower trapezius	17.3	4.01	15.9	3.71	0.0125(S)
Internal rotators	10.5	2.59	9.46	2.59	0.0087(VS)
External rotators	9.03	2.38	8.16	1.89	0.0196(S)

Closed kinetic chain upper extremity stability test in badminton players results showed that 19.46 as the mean value suggesting that bowlers have significant endurance and speed in their upper extremity.
Upper extremity neural tissue tightness testing showed normal finding in badminton players with none of the population having any significant abnormality.

4: Discussion:

The statistical analysis of our study showed that there is no statistically significant difference in pectoralis minor tightness (table 1) when compared between dominant side and non-dominant side among badminton players. Decreased pectoralis minor muscle resting length would result in an increase in the muscles' passive tension during arm elevation, restricting normal scapular upward rotation, posterior tipping, and external rotation. This potential effect of pectoralis minor muscle resting length on scapular kinematics has been examined between groups of subjects who were asymptomatic for shoulder pathology(Borstad 2005).[9]

In our study we found extremely significant difference in the horizontal adduction range of motion between dominant and non-dominant side among badminton players(table 2). Many studies have documented that decrease in horizontal adduction leads to shoulder pathologies. Research states that deceleration phase of the throwing motion creates large compressive forces on the shoulder. These repetitive forces have been speculated to result in secondary changes, such as contracture of the posterior shoulder capsule. This contracture may contribute to alterations in shoulder rotation, such as decreased internal and increased external rotation (Kevin 2006)[10].

In our study scapular muscles strength comparison (table 3)between dominant and non-dominant side in badminton players showed middle trapezius and internal rotators having very significant statistical difference, lower trapezius and external rotators having significant statistical difference and serratus anterior and upper trapezius did not show any statistical difference.

The stabilizers of scapular muscles work together to coordinate the balance of movement between the shoulder joints, thereby maintaining scapulohumeral rhythm. When the muscles are weak or fatigued, scapulohumeral rhythm is compromised, and shoulder dysfunction results. This dysfunction can cause micro trauma in the shoulder muscles, capsule, and ligamentous tissue and lead to impingement.
In our study, scapular dyskinesis test in badminton players showed 49% of the population having no abnormality or normal, 39% having subtle abnormality and 12% having obvious abnormality (figure 1)

Normal function of the serratus anterior, trapezius, and rhomboid muscles is required to achieve the necessary scapular positioning. Loss of function due to nerve injury, weakness, and/or fatigue leads to glenohumeral hyperangulation and a relative increase in glenoid anteversion, placing the anterior capsular structures at risk. Associations between scapular

dyskinesia and anterior instability and impingement have been documented by several authors (Sepp 2009)[11].

In our study we found that closed kinetic chain upper extremity stability test in bowlers showed significant endurance and speed which can be attributed to regular practice, professional training and repetition of the same strokes over a prolong period of time.
In our study we found that Badminton players had posterior soft tissue tightness ,decreased external rotation range of motion and increased internal rotation range of motion ,weak scapular musculature specifically (middle trapezius, lower trapezius, internal and external rotators), scapular dyskinesia suggesting (12 percent obvious abnormality). Though 49 percent of badminton players did not have scapular dyskinesia they had other significant scapular impairments such as posterior soft tissue tightness, decreased external rotation range of motion and increased internal rotation range of motion & weak scapular musculature which may predispose them to injury.

These scapular associated impairments need to be identified and well-structured rehabilitation program need to be administered to reduce shoulder injury.

5. Conclusion:

`The scapular associated impairments in bowlers identified were Posterior soft tissue tightness, increased external rotation range of motion, Decreased internal rotation range of motion, Weak scapular musculature and Scapular dyskinesia

6. Clinical Implications:

In our study, with this assessment protocol the scapular associated impairments can be identified in the early stages. So, the impairments can be addressed and early intervention is possible which can help in preventing injury and in thus enhancing performance.

References:

1. A Muttalib,M Zaidi,,C Khoo(2009), A Survey on Common Injuries in Recreational Badminton Players. Malaysian Orthopaedic Journal . Vol 3 No 2
2. Borstad JD, Ludwig PM.(2005) The effect of long versus short pectoralis minor resting length on scapular kinematics in healthy individuals. J Orthop Sports Phys Ther. ; 35:227–238
3. John D. Borstad.(2008) Measurement of pectoralis minor muscle length: validation and clinical application. Journal of orthopaedic and sports physical therapy, April ; 38(4); 169-174
4. Kevin G. Laudner, Justin M. Stanek, Keith Meister.(2006) Assessing Posterior Shoulder Contracture: The Reliability and Validity of Measuring Glenohumeral Joint Horizontal Adduction. Journal of Athletic Training ; 41(4):375–380
5. K. Kroner, S.A. Schmidt, A.B. Nielsen, J. Yde, ., B.W. Jakobsen, B. Moller-Madsen, and J.

1. Jensen, Badminton in juries, Br. J. Sp. Med; Vol 24, No. 2
2. Lin. The intratester and intertester reliability and validity of measuring posterior and anterior structure tightness.(2006) Journal of Orthopaedic research, May ; 24(5); 1044-1051
3. Michael L. Voight, Brian C. Thomson.(2000) The Role of the Scapula in the Rehabilitation of Shoulder Injuries. Journal of Athletic Training; 35(3): 364-372
4. Philip McClure. (2009)Clinical method for identifying scapular dyskinesis. Journal of athletic training; Mar-Apr ; 160-164
5. Todd G. Goldbeck. (2009)Test-retest reliability of the closed kinetic chain upper extremity stability test. Journal of sports rehabilitation, 2009; 35-45
6. Turner. Normative data on scapulothoracic musculature using handheld dynamometer. Journal of sport rehabilitation. ; 502-520
7. Sepp Braun, Dirk Kokmeyer, Peter J. Millett.(2009) Shoulder injuries in the throwing athlete. The journal of bone and joint surgery, April ; 91(4); 966-978