Correlation Between Shoulder Pain And Spinal Mobility In Overhead Racquet Players And Non-Players

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Abstract: Overhead racquet sports place high amount of stress on the dominant shoulder. Over a period of time, to allow for the extra degrees of movement necessary for an effective stroke or serve, the shoulder girdle on the dominant side of such players undergo certain postural adaptations. At the same time, it has to be firm enough to prevent any hyper mobility and injury. Thus, 'throwers paradox' i.e., a fragile balance exists between mobility and stability. [1, 2] If this balance is disturbed it can lead to injuries. Hence, to assess whether lack of spinal mobility, posture and scapular symmetry are being reason for shoulder pain hence the spinal mobility and posture and scapular symmetry needs to be evaluated in the racquet players, especially between players with and without shoulder pain and non-players. Also, comparison between dominant and non dominant side of the players may help us determine the postural adaptations that is likely to occur in these players due to the strenuous, repetitive and biomechanically challenging demands of the game. Present study is a cross-sectional observational study enrolling 150 (50 per group) racquet players with shoulder pain (Group A) and racquet players with no shoulder pain (Group B) and non-players (Group C).

Hypothesis: It is hypothesised that spinal mobility, posture and scapular symmetry in racquet players without shoulder pain will be better than racquet players with shoulder pain and non-players.

Clinical Importance: There is need to improve spinal mobility, posture and scapular symmetry in overhead racquet sports to prevent shoulder injuries.

Future Direction: A similar study but of an interventional study design, comparing the above parameters in the same set of overhead racquet players, will help derive more conclusive results.

Keywords: shoulder pain, spinal mobility, over head racquet sport.

THESIS SUMMARY

Introduction

The most popular overhead racquet sports in Asian countries like India are lawn tennis and badminton. These sports are not only popular but have also been studied to have an increase in the injury rate. Tennis shows an inconsistent injury rate of 0.04 injuries/1000 hours to 21.5 injuries/1000 hours [3] with 25% to 45.7% injuries affecting the shoulder joint. [4] Hence, prevention of injuries in the elite athletes playing these sports has become an integral part.

The transfer of energy in the kinetic chain is said to be "broken" if the characteristics of the chain are not present, or the sequential timing incorrect. In a broken kinetic chain the energy that is normally generated and accumulated by many segments is altered or even not transferred at all to the next segment, hence other body parts must compensate to create the same performance. The USTA states that "if the trunk does not rotate to provide force to the shoulder, it requires a 34% increase in the shoulder velocity to achieve the same ball velocity."[5]

Anatomically shoulder joint is very unstable joint, dynamic stabilization is provided by balance between the agonist and antagonist muscle group.[6,7] The stability of gleno-humeral joint is reliant on the

scapulo-thoracic joint as scapula provides a stable base for movement of humerus during an overhead motion.[8] Scapular asymmetry, in the form of excessive protraction, internal rotation and anterior tilt develops on the striking side of overhead athletes using their dominant shoulder repetitively in a forceful manner. [9] Asymmetry of scapula can be described as the acronym SICK scapula (Scapular malposition, Inferior medial border prominence, Coracoid pain and malposition and dyskinesis).[10] Tennis and badminton have distinctiveness peculiar to the individual game; however, both games subject the dominant shoulder of the player to repetitive overhead movement pattern.[4] A racquet serve/stroke biomechanically can be broken down into five phases: wind up, early cocking, late cocking, acceleration and follow through.[11] The cocking phase maintains the dominant arm in 90° abduction and external rotation which reaches a maximum of 172° to 180° during the late cocking phase.[12,13] This is a combination of true gleno-humeral rotation, scapulo-thoracic motion and trunk hyperextension.[12] It ends with internal rotation and forward flexion of the dominant shoulder along with upper torso and pelvic rotation during the follow through phase. Each phase places an asymmetric load between the two shoulders, and maximum stress is exposed to the dominant shoulder. [8] In tennis activities normal shoulder biomechanical function requires an integral kinetic chain to create energy, produce force and stabilize the joint. [5]

Hypothesis

Shoulder injuries are much more common in overhead racquet professional players and today, they are even seen in junior teenage players who compete regularly, due to the increase in the number of tournaments they have to play around the year, and of course due to the long hours of training they need. They have regular training and specific physical preparation in order to prepare their muscles and bones properly. There is evidence that reduced mobility of upper thoracic segments is related to neck and/or shoulder pain.[14,15] Thus, it becomes necessary to introduce the correlation between shoulder pain and spinal mobility in overhead racquet sports.

The present study is a cross-sectional observational study. 150 subjects will be recruited from different racquet sports tournaments and sports clubs located in Pune, India. The participants will be screened using the following inclusion criteria; Players playing overhead racquet sports (lawn tennis and badminton) at district level and above, minimum 3 years of training, players participating in only one kind of sport, age group 13-19 years, both male and female players, Players with/without shoulder pain, Players with/without a past history of symptoms, Non-players without shoulder and any other musculoskeletal involvement. And recreational players, history of trauma, fracture, or surgery to the scapula, humerus, rib cage, thoracic spine, or abdomen, subjects diagnosed with any upper body, trunk, musculoskeletal problems, and neuromuscular disorder will be excluded. The subjects will be assessed for pain with (Numerical Pain Rating Scale) NRS, spinal mobility of cervical, thoracic and lumbar spine by using dual inclinometer, thoracic and lumbar posture by using flexicurve, and scapular symmetry by doing lateral scapular slide test.

Group A: Racquet players with shoulder pain

Group B: Racquet players with no shoulder pain

Group C: Non-players

Number of badminton and lawn tennis players will be same in Group A and Group B. All the procedure was approved by the Institutional Ethics Committee on Human Research and conducted in conformity with ethical and principles of research.

Paired t- test shall be used for intra-group assessment of all parameters. Unpaired t- test shall be used for inter-group assessment of all parameters. One way ANOVA test shall be used to compare all three groups.

Discussion

Sports like badminton and lawn tennis innately place demands on the dominant shoulder as it requires repetitive and forceful movements of the dominant extremity which render the shoulder vulnerable to injuries. Elite tennis players are observed to have rotational velocities as high as up to 1700 degrees/ second. Increased moment of inertia of the upper extremity from holding a tennis racquet may result in greater stress at the dominant shoulder joint [16]. The stability of an overhead athlete's shoulder is maintained by the active and the passive restraints of the joint [9, 11].

During the follow through phase or deceleration phase of an overhead motion, the shoulder joint undergoes distractive forces of up to 750N or 0.5 to 0.75 times the body weight [7, 19]. This force is primarily resisted by the eccentric contraction of the rotator cuff muscles [7]. However, with repetitive activity, these muscles start to fatigue and convey the load on the posterior capsule to provide further restraint [20]

With such recurring loading, the posterior capsule is said to endure micro trauma [9].The posterior capsule reacts to this trauma with hypertrophy and increased fibroblastic activity during the healing process , leading to contracture and thickening of the capsule [9, 17]. This reduces the capsular pliability causing restriction of internal rotation ultimately leading to GIRD (gleno-humeral internal rotation deficit) in the throwing or serving shoulder. [7, 9, 11, 21]

Several studies have used a regional interdependence examination and treatment approach to demonstrate the effectiveness of including cervicothoracic and upper rib manual physical therapy interventions into the treatment plan for subjects with a primary complaint of shoulder pain. [22, 23]

As there is regional interdependence between spine and shoulder, thus even if spinal mobility is improve the shoulder pain in overhead racquet sports can be minimized.

Clinical Importance

There is need to improve spinal mobility, posture and scapular symmetry to prevent shoulder injuries in overhead racquet sports.

Future Direction: A similar study but of an interventional study design, comparing the above parameters in the same set of overhead racquet

players, will help derive more conclusive results.

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