

UPPER EXTREMITY INJURIES IN PADEL

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INTRODUCTION

Padel is a racket sport, with its origin in Mexico in 1969, adapting a squash court with elements of tennis. In recent years this sport has acquired great importance, as it is practiced in more than 50 countries. A parallel increase has been seen in professional circuits like World Padel Tour, ATP Padel Tour or Premier Padel¹. It is played in a grass court, size of about one third smaller than a tennis court, making the game faster and the displacement shorter, considering it to be a high-intensity intermittent sport. Moreover, the presence of walls and gratings that surround the field that can be hit by the ball extends rally duration and therefore the amount of actions and strokes is greater than in tennis. Additionally, padel provides a short-handled racket with many different variants of shape, weight, thickness and core composition materials, etc. Unlike in tennis, in padel, the serve is performed by bouncing the ball and then hitting it while it is lower than the height of the hip, which is less technical demanding than in tennis. Finally, padel was conceived from the beginning as a doubles game. These facts attract many recreational players with less physical condition and worse technical execution which might result in potential greater number of injuries. The purpose of this paper is to analyze the specific biomechanics of movements in padel and

to better understand possible mechanisms of upper limb injury, its prevention and treatment options.

BIOMECHANICS

Padel is characterized by repetition of unilateral gestures, which can lead to overuse musculoskeletal injuries or to negative adaptations like asymmetries between dominant and non-dominant side after a regular practice. There are plenty of quick direction changes, frontal, lateral, diagonal displacements and turns. Among different strokes performed, the most common shots are volleys, smashes, serves, groundstrokes and backwalls. The fact that the serve is made from below, could potentially prevent a shoulder injury. Stroke types consist of four different phases of motion: racket preparation, acceleration, impact point and follow through². On average a male recreational padel player performs 4-6 strokes per rally, for a total of 300 hits per game. Energy for each stroke is initially generated at the feet and knees and then transmitted sequentially through the legs, trunk, back, shoulder, elbow, wrist and hand, and finally to the racket. Any weakness in this kinetic chain results in dysfunction that creates more reliance on other body segments, leading to tissue overload and injury³. Highly trained players are more efficient at adapting

the kinetic chain to reduce the impact forces transmitted to upper extremity joints. The absence of efficient technique in recreational players often leads to an excessive and uncoordinated use of strength thus overloading the joints and increasing the risk of injury.

In general, there is a difference between genders playing padel since men make more shots closer to the net, developing a more aggressive game, whereas women make more shots from the middle and back of the court, developing a more conservative game. Men usually use heavier rackets and tend to play padel more often.

Most frequently affected specific locations in the upper limb are shoulder and elbow with reported percentage of injuries up to 37,5%⁴.

PREVENTION OF INJURIES

Injuries may occur because of muscle fatigue, muscle weakness and imbalance, alterations in hitting mechanics and ball impact, and/or altered static stability⁵. The scapula plays a key role in stabilizing glenohumeral joint mobility during arm motion by changing positions to promote shoulder movement. In case of periscapular muscle weakness as a result of overload, padel players may develop scapular dyskinesis. This imbalance of the scapula leads to alterations in scapula movement



Illustration

which produces pain and functional deficiency during overhead motions. SICK (Scapular malposition, Inferior medial border prominence, Coracoid pain, and dysKinesis of movement) scapula syndrome is another pathological condition associated with shoulder injuries⁶. Assessment of scapular function is crucial in off-season preparation and in in-season maintenance.

Another principle of injury prevention is maintaining range of motion (ROM). Repetition of abduction-extension motion in overhead strokes can alter the rotational arc of the shoulder, producing an increased degree of external rotation at the expense of posterior capsule tightening. This in turn decreases internal rotation and can eventually lead to development of GIRD (glenohumeral internal rotation deficit). GIRD is quantitatively characterized by a >18° loss of internal rotation in the athlete's dominant shoulder compared with the non-dominant shoulder. The condition is associated with higher risk of SLAP lesion, rotator cuff injury and biceps tendinitis by shifting the center of rotation of the humeral

head in abduction and external rotation movements. The progression of GIRD can be reversed by stretching programs that target posteroinferior capsule.

Technical level of players could be related to the appearance of injuries since players at the highest level have fewer injuries. Hitting the ball earlier (forward impact) or later (backward impact) in the stroke can produce changes in a shot's velocity, direction or accuracy. At the same time, hitting the ball chronically at a dangerous impact point may increase the risk of shoulder and elbow injury. Developing an optimal stroke technique during one's formative and recreational stages can importantly contribute to minimizing the risk of suffering an injury by reducing the loads placed on joints.

Equipment can also play an important role in the prevention of upper limbs injuries in Padel. The correct equipment must be chosen, fitted and adjusted depending on the player's level, physical condition, and size. The equipment should be checked and maintained regularly to ensure that it is in

good working condition and to avoid the risk of injury. The racket, in particular, must have the correct weight, material, balance and grip size.

SHOULDER INJURIES AND TREATMENT

Rotator cuff tear is frequent finding in the general population over 50 years of age. In the younger population, the most common pathology is rotator cuff tendinopathy as a result of repetitive, high-energy loading of the shoulder joint. In overhead athletes, the rotator cuff pathology is most often associated with posterior internal impingement between supraspinatus tendon and posterior superior glenoid and labrum. These chronic repetitive movements can cause fraying and tearing of the inner layer of cuff tendons with eventual retraction and progression to full thickness tendon tears. Additionally scapular dyskinesia has been shown to contribute to rotator cuff pathology, as the rotator cuff muscles synchronicity is disrupted by abnormal scapular range of motion.

Patients with rotator cuff tendinopathy usually complain about the pain on active movements over the level of the shoulder with pain increasing with more forceful overhead movements against resistance. The symptoms get worse with progression of condition to tendon partial and full thickness tears where pain is becoming constant and more intensive during the night. Patients experience loss of strength and athlete's performance drop is substantial.

Conservative treatment of rest, NSAIDs and physical therapy programs to help improve scapular biomechanics, strengthening and stretching of the rotator cuff muscles are utilized at the beginning. In progressive stages with tendon tears and retraction, arthroscopic surgery is indicated. Outcomes of the surgical partial and full thickness repair depend on many factors like tendon condition (retraction, degeneration, etc.) at the time of surgery, patient's health status and an unhealthy lifestyle. The rehabilitation period takes at least 6 months which is usually also time to return to play.

SLAP (superior labrum anterior-to-posterior) lesion is one of the most common labral injuries in overhead athletes. Often it is associated with posterior capsular tightness (GIRD) and scapular dyskinesia condition,

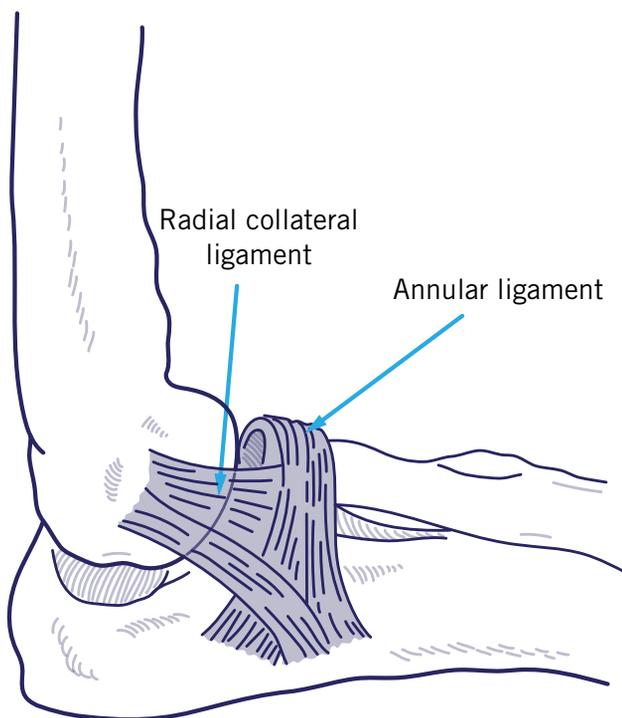


Figure 1: Lateral collateral ligament complex.

Figure 2: The elbow joint.

where the humeral head repetitively pushes against the long head of the biceps anchor, thus progressively disrupting the biceps attachment to the glenoid. The pathology is characterized by pain in overhead movements with loss of strength (dead arm syndrome) and sometimes of a popping sensation. Very common the long head of biceps tenosynovitis is present due to biomechanical alteration of the tendon dynamics inside the bicipital sulcus. This condition produces additional chronic pain in the anterior region of the shoulder.

Treatment is first focused to improve passive ROM by stretching the posterior capsule, gaining control, and strengthening the periscapular muscles and use of NSAIDs. Steroid injection under ultrasound guidance is sometimes needed for persistent tenosynovitis in the bicipital groove. In case of ongoing symptoms after 3-6 months, surgery is indicated. In recent years biceps tenodesis is preferable method of choice in sports active individuals as this is a permanent solution with no chance of re-injury. The return to play period after isolated biceps pathology is possible usually after 4 months of rehabilitation period.

ELBOW INJURIES AND TREATMENT

Lateral epicondylitis, known as “tennis elbow,” typically involves the origin of common extensor tendons, specifically extensor carpi radialis brevis (ECRB),

due to microtrauma from repetitive backhand strokes and overloading the wrist extensors⁷. The reason for this is a difference in backstroke mechanics. Both intrinsic technical skill factors and extrinsic equipment variations contribute to this condition. Skilled players tend to hit the ball keeping the wrist extended throughout impact, while recreational players strike the ball with a flexed wrist and will move the hand into further flexion throughout impact, leading to eccentric loading position of the extensor tendons. In addition, experienced players decrease grip tightness during follow through motions and thus reduce impact force to the lateral epicondyle by nearly 30% compared to amateur players who maintain a tight grip. Overloading of the elbow can also occur as a result of racket weight or quality and incorrect grip size of the racket handle.

The condition presents with pain and tenderness over the lateral epicondyle radiating distally to the forearm. The pain gets worse with resisted wrist extension. Differential diagnoses include radial tunnel syndrome and posterior interosseous nerve entrapment.

Treatment is not standardized. Conservative therapy is recommended in the beginning using nonsteroidal anti-inflammatory drugs (NSAIDs) combined with splinting, stretching and strengthening exercises. If symptoms don't improve,

corticosteroid or platelet-rich plasma injections may be considered. There is lack of evidence supporting the use of injections over other nonoperative treatment. In the majority of cases the symptoms will resolve without treatment within 6-12 months.

In the case of conservative treatment failure or in professional athletes, the surgical release of the ECRB at the lateral epicondyle and excision of degenerated part of the tendon can be performed arthroscopically or an open approach. The return to play period usually lasts up to 6 months after surgery.

Medial epicondylitis involves the tendinopathy of the pronator teres and flexor carpi radialis as a result of repetitive eccentric loading during excessive wrist snapping when performing forehand strokes.

The condition presents with pain and tenderness over the medial epicondyle radiating to the forearm through the flexor-pronator muscle group. The pain gets worse with resisted wrist flexion and forearm pronation.

Differential diagnoses include medial collateral ligament tear, ulnar neuropathy and medial elbow instability.

Conservative treatment is usually effective using the same protocol as for lateral epicondylitis. Surgical treatment can be implemented earlier in case of professional athletes who do not want to

wait 3-6 months of conservative approach or if symptoms persist after this period. Open method of surgical debridement of common flexor tendon is a preferable approach than the arthroscopic one, owing to the close proximity of both the ulnar nerve and the ulnar collateral ligament to the medial epicondyle. The postoperative rehabilitation period is focused on strengthening and stretching the flexor-pronator muscles and lasts up to 6 months.

WRIST INJURIES

Wrist tendinitis is an overuse injury that occurs when the tendons that attach the muscles of the forearm to the bones of the wrist become inflamed. The pain is usually felt on the thumb side of the wrist and can radiate up the forearm. Wrist tendinitis is common in people who play racket sports, such as padel and tennis, but can also occur in people who do repetitive motions with their hands and wrists, such as typing or using tools. Treatment for wrist tendinitis usually includes rest, physical therapy, physical therapy to improve strength and flexibility and medications such as NSAIDs to reduce pain and inflammation. In some cases, a wrist brace may be used to provide support and reduce stress on the affected area.

The Carpal Tunnel Syndrome is a compression of the median nerve as it passes through the wrist. Symptoms include numbness, tingling, and weakness in the hand and fingers. Carpal Tunnel Syndrome is common in people who do repetitive motions with their hands and wrists.

Treatment for carpal tunnel syndrome typically begins with non-surgical options, such as:

- Wrist splinting: A splint can be worn to hold the wrist in a neutral position and relieve pressure on the median nerve.
- Nonsteroidal anti-inflammatory drugs (NSAIDs): These medications can help to reduce pain and inflammation.
- Physical therapy: Exercises and stretches can help to improve range of motion and strengthen the muscles in the hand and wrist.
- Steroid injections: Injecting a corticosteroid medication into the carpal tunnel can help to reduce inflammation and relieve symptoms.

If non-surgical treatments are not effective, a carpal tunnel release may be recommended. This procedure involves

releasing the transverse carpal ligament, which forms the top of the carpal tunnel, to relieve pressure on the median nerve. Recovery from carpal tunnel syndrome varies depending on the severity of the condition and the treatment chosen. Physical therapy is generally recommended after surgery to help regain strength and mobility in the hand.

De Quervain's tenosynovitis, also known as "mommy's thumb" or "gamer's thumb," is a condition that results from inflammation of the tendons that run along the thumb side of the wrist. It is characterized by pain and tenderness at the base of the thumb, along with difficulty gripping or grasping objects.

The condition is caused by repetitive or overuse of the tendons and the synovial sheath that surrounds them. This leads to inflammation, swelling and thickening of the tendons and their sheath, which can cause compression and irritation of the surrounding nerves and blood vessels.

Activities that involve repetitive movements of the thumb, such as gripping, grasping or pinching, are known to cause this condition. It's commonly found in people who use the mouse or controller, or those who play racquet sports such as padel and tennis, and also in people who carry heavy bags or small children can develop de Quervain's tenosynovitis as well.

The treatment typically includes rest, ice, and physical therapy. Anti-inflammatory medications may also be prescribed to reduce pain and inflammation. In severe cases, a corticosteroid injection may be given directly into the affected tendons. Surgery may be necessary if other treatments are not effective.

HAND INJURIES

Hand fractures and sprains are common injuries in racket sports such as padel. This may be due to an impact against the wall or falling down, especially with a racket in the hand or due to repetitive movements which can cause stress type of fracture. The scaphoid or hamate are most common ones.

Symptoms of a hand fracture can include severe pain, swelling, and difficulty moving the affected hand while a sprain can cause these symptoms in the affected joint.

X-rays in different projections are the first line of diagnostics where fracture lines or periosteal reactions are seen. CT or MRI is needed to detect more occult fractures (hook

of hamate or scaphoid) specially when clinical suspicion is high. MRI can identify marrow edema in stress reaction prior to development of a fracture.

Treatment for a hand fracture typically involves immobilizing the affected bone with a splint or cast to allow it to heal properly. In cases when fracture displacement is not acceptable to treat conservatively or in nonunions, surgery may be required. Physical therapy may also be recommended to help regain strength and mobility in the hand. Treatment for a hand sprain typically involves anti-inflammatory modalities and physical therapy. However, careful evaluation is warrant as surgery may be needed to avoid chronic problems.

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