

TENNIS TRAUMA

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TREATMENT, REHABILITATION
AND PREVENTION OF
TENNIS INJURIES

With an estimated 1.2 billion participants worldwide, 'lawn tennis' is the fourth most popular sport behind football, cricket and field hockey. In the UK there are an estimated 1.75 million participants playing on a monthly basis. Given the sport is significantly influenced in the UK by the weather, court availability, access and cost, this is a considerable level of involvement (LTA Annual Review, 2017).

TECHNIQUE, EQUIPMENT AND SURFACES

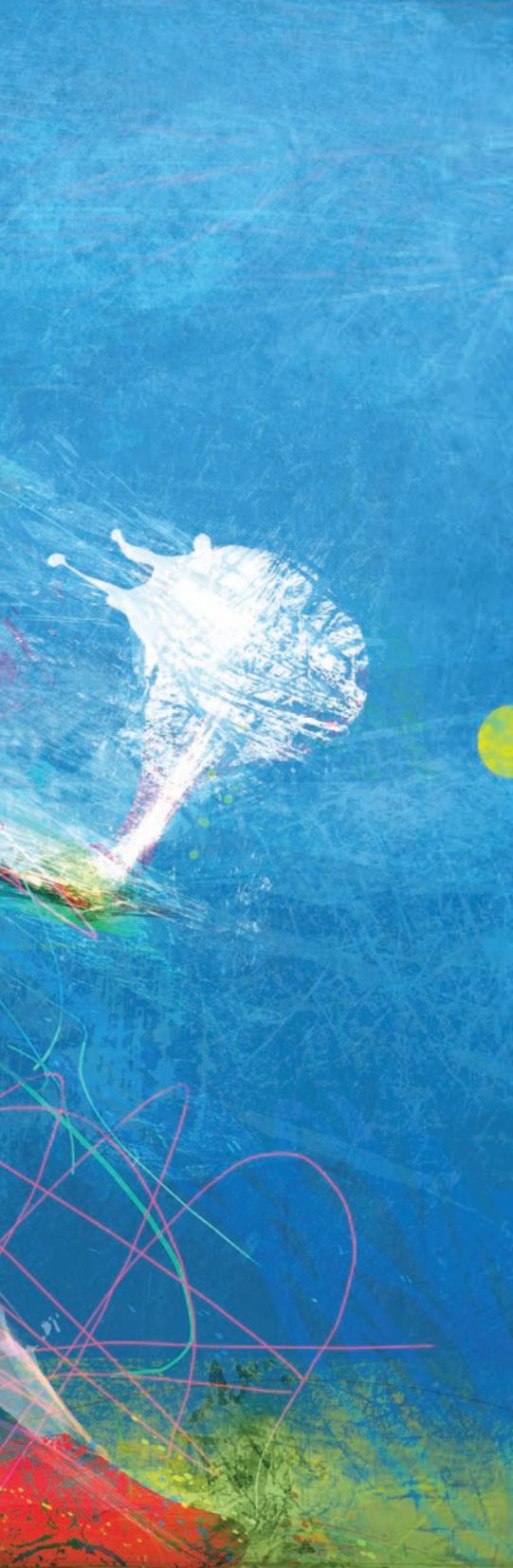
The two key areas of interaction with the body are the playing surface and equipment, and it is these that influence

the onset of injury in both the upper and lower limbs. The interaction between the player and the surface is affected by the type of surface (clay, hard court or grass) and shoe design. Tennis is unique among sports in that there are a variety of playing surfaces ranging from hard court (acrylic) and clay to grass to artificial grass. Hard court has the highest coefficient of friction and lowest shock absorption, which makes sliding much more difficult, leading to shorter stopping distances and, theoretically, higher peak loads (Pluim et al, 2018).

Shoes are not traditionally designed to 'shock-absorb' but to maximise 'energy return'. Therefore, the repeated vertical force on impact, and its rate of loading,

increase the risk of ankle, knee and hip injury, most notably sprains, strains and muscle injury through the high rate of eccentric loading to control knee and hip flexion/extension. There is also considerable risk of injury in both the medio-lateral and anterior-posterior planes of motion associated with deliberate foot-sliding. If the footwear is not suitable for the specific surface type, then the risk of injury onset is much greater.

The introduction of ankle braces, most notably worn by Andy Murray, and of high ankle supports built into the shoe have attempted to reduce this injury risk. However, the cost of such equipment is



often prohibitive to the recreational player and as such the onset of injury remains relatively large. If the player does not address the need for ankle support relatively quickly, severe secondary injury can occur at the knee and hip, again most notably in Andy Murray's case history.

Similar to the impact on the surface is the impact of the ball on the racket, and the grip associated with producing a successful shot. There are two main strokes in tennis, forehand and backhand, but within the stroke there are a range of shot types. The

three types of grip (continental, eastern and western) for practitioners can be categorised by the degree of supination of the wrist. For the continental grip, the starting point can be considered with the thumb in contact with the grip along the bevel and the thumbnail pointing vertically or upwards (supination of approximately 90 degrees). For the eastern grip, the starting degree of supination can be visualised as approximately 100 degrees and the western grip can be as much as 120 to 130 degrees. As a starting point, this is not necessarily an issue; however, at impact with the ball, the wrist is quickly pronated to provide topspin as appropriate for the shot type. The ability to maintain a firm grip at impact, while pronating the wrist up to 100 degrees at impact in a split second (angular velocity and acceleration), is imperative in achieving success, similar in nature to not only other racket sports but also golf (Catlow and Doggart, 2016). Furthermore, this movement of the wrist is then reversed when performing a backhand, with the wrist position starting in a pronated position and sweeping through the angles with wrist supination. Any weakness at impact can cause a multitude of injuries at the wrist and elbow, most notably that of ligament sprain and, if performed repetitively, tennis elbow.

In addition, while there is significant pronation at the wrist on impact, the forearm and elbow must remain firm and stable and still allow internal/external rotation of the shoulder to maximise ball velocity via the follow-through in a forehand or backhand stroke across the body. In a similar way to golf, forearm, upper arm and shoulder strength are imperative to maximise ball velocity through the stroke, and any inadequacies or imbalances on either side of the body will result in muscle and ligament injury. If this was not challenging enough, with significant risk of injury if performed with poor timing and technique, a double-handed shot can lead to double the problems often associated with limited flexibility and range of motion, and non-dominant hand-wrist grip weakness.

One of the common mechanisms of injury in tennis is that of repetitive large impact forces, with a high rate of loading, inadequately dissipated through the body structures. This mechanism is prevalent for both lower limb injury, such as foot strike patterns, and upper limb injury, such as poor or inappropriate grip strength and technique. For the upper limb, the onset of

injury can often be evidenced, and further exacerbated, by the participant when they experience a 'shuddering force' at impact. As in golf, this 'shuddering' or 'vibrating' force felt through the hands and lower arm is due to poor technique, motor coordination and timing, and is experienced when the ball hits the racket outside of the centre of percussion or 'sweet spot' on the racket (Fleisig and Kwon, 2014; Cross, 2004). This resultant vibrating force will exacerbate and increase the risk of upper limb injuries, when added to a weak grip, owing mainly to the greater magnitude of the resultant force experienced through the hands at impact.

A sports therapist, when coupled with the basic information above, can have an immense positive impact on further injury prevention through prescribing conditioning, strength and flexibility practices, and core work for the player for the upper and lower limbs. These could include forearm-strengthening exercises, pronation-conditioning exercises and lower limb squat and lunge exercises.

TENNIS INJURY, TREATMENT AND REHABILITATION

Tennis is a game of repetitive striking; the very nature of the game tends to lead to strength and flexibility imbalances which, in turn, can cause injuries. Lower limb injuries are the most common tennis injuries (31% to 67% of injuries reported or treated by practitioners), caused by the sprinting, stopping, pivoting, and pounding nature of tennis. Lower limb tennis injuries can be both acute (ankle sprain) or chronic (patellar tendinopathy). Of injuries observed, 20% to 49% are upper limb injuries, which are usually caused by the high-velocity and repetitive arm movements that are required in tennis. These injuries tend to be overuse in nature (lateral epicondylitis). Back injuries and back pain are common (3% to 21%) owing to the rotation required to hit groundstrokes, and the combination of rotation, extension and lateral flexion involved in the serve.

INJURIES BY LOCATION

SHOULDER



INJURY: Internal impingement

MECHANISM OF INJURY: Repetitive overhead motions.

TREATMENT AND REHABILITATION: Focuses on restoration

of normal range of motion (particularly internal rotation) and posterior rotator cuff and scapular muscle strength. Correction of associated scapular dyskinesis (alteration or deviation in the normal resting or active position of the scapula during shoulder movement) when present is important.

INJURY: SLAP tears

(SLAP is an acronym for Superior Labral tear from Anterior to Posterior, referring to an injury to the glenoid labrum)

MECHANISM OF INJURY: Repetitive overhead motions.

TREATMENT AND REHABILITATION:

The SLAP tear occurs at the point where the tendon of the biceps muscle inserts on the labrum. Treatment will depend on the type of SLAP lesion and the associated symptoms. Generally, conservative (non-surgical) treatment is tried first, and if this fails, surgery will be considered.

Conservative treatment - exercises to regain the strength, stability and movement of the shoulder, especially working on the rotator cuff muscles.

ELBOW



INJURY: Lateral elbow tendinopathy (tennis elbow)

MECHANISM OF INJURY: Lateral elbow affects recreational players more commonly than it does professionals. Novice tennis players tend to hit their backhand strokes with their wrists in a more flexed position, whereas high-level players have an increase in wrist extension just before ball contact (Blackwell et al, 1994).

TREATMENT AND REHABILITATION:

Ice the elbow to help reduce pain and swelling - 20 to 30 minutes every three to four hours for two to three days or until the pain is gone. Use an elbow strap to protect the injured tendon from further strain. Perform range of motion exercises (wrist, forearm, elbow and shoulder) to reduce stiffness and increase flexibility.

Prevention - make sure the racket is strung properly and the grip technique is correct.

INJURY: Medial elbow tendinopathy (golfer's elbow)

MECHANISM OF INJURY: Medial elbow tendinopathy is more common in high-level tennis players than in novices. Possible causes include excessive wrist snap on serve and forehand strokes, open-stance hitting, and short-arming strokes (Elliott et al, 2003).

PREVENTION MEASURES

Many professional tennis players use some type of supportive brace when playing. Both taping and bracing are effective, but taping has been shown to lose up to 50% of its mechanical strength after 20 minutes of play (Dines et al, 2015). If the therapist uses a multidisciplinary approach, using bracing along with proprioceptive training and muscle recruitment evaluation, it can be an effective prevention programme for tennis players. Other possibilities for prevention include:

- Educating players, parents and coaches about tennis injuries
- Musculoskeletal screening of players to identify problem areas before injuries occur
- Adjustment of equipment - shoes, rackets, strings, balls and court surfaces
- Strength programmes that focus on power and strength but also challenge endurance and coordination
- Mixing up playing surfaces, so leg and hip muscles are used in different ways to help avoid muscle imbalances
- Including cross-training to avoid muscle imbalances
- Core strength programme
- Getting the athlete to listen to their own body.



TREATMENT AND REHABILITATION:

Apply ice to the elbow and inner part of the forearm and perform strengthening exercises to stretch the forearm:

Ball squeezes - place the soft ball in the palm of the affected hand and make a fist around it. Squeezing and releasing in repetition will strengthen the forearm.

Finger extensions - squeeze all five fingertips together and stretch a rubber band around them. Extend the fingers away from each other as far as the rubber band will allow.

Wrist extensions - place the injured forearm on a knee or table, with the hand suspended over the edge. Hold a light weight in this hand, and slowly raise and lower it.

Forearm pronation and supination - put the injured forearm on a table or knee for stability. Hold a small weight so that the palm is parallel to the body. Rotate the hand

so that the palm faces downward. Return to the starting position, and then rotate the hand so that the palm faces the ceiling.

WRIST



INJURY: Extensor carpi ulnaris (ECU) tendinopathy (overuse injury)

MECHANISM OF INJURY: Any repetitive action

from a non-ergonomically correct position that entails twisting or backward flexing of the wrist (returning a tennis ball) or ulnar deviation in non-dominant wrist during two-handed backhand.

TREATMENT AND REHABILITATION: Can be treated with rest and splinting.

INJURY: ECU tendon subluxation (not a true overuse injury - important)

differential diagnosis in athletes with wrist pain)

MECHANISM OF INJURY: Sudden palmar flexion ulnar deviation stress from hitting low forehand.

TREATMENT AND REHABILITATION: Acute injuries should be immobilised with the wrist pronated and dorsiflexed (Rettig, 2004).

BACK



INJURY: Lumbar strain

MECHANISM OF INJURY: Change in intensity or duration of play, or change in stroke technique.

TREATMENT AND

REHABILITATION: Bottom to heels stretches - client kneels on all fours, with their knees under their hips and hands under their shoulders. Keep the back and neck fairly straight, without locking the elbows. Slowly move the bottom back towards the heels. Hold the stretch for one deep breath and return to the starting position. Repeat eight to 10 times.

Knee rolls - client lies on their back, keeping knees bent and together. Keep the upper body relaxed and the chin gently tucked in. Roll the knees to one side, keeping both shoulders on the floor. Hold the stretch for one deep breath and return to the starting position. Repeat eight to 10 times, alternating sides.

HIP



INJURY: Femoroacetabular impingement (FAI)

MECHANISM OF INJURY:

Tennis players subject their bodies to extreme forces; the hip joint may experience forces up to five times their body weight during activities such as running, jumping, and twisting. The forehand stroke requires greater hip external rotation, which may increase the risk for anterior rotational instability and posterior impingement.

TREATMENT AND REHABILITATION:

Monster walks - these build strength in the muscles on the lateral side of the hip, providing stability and help with lateral movement. Place a Thera-Band around the ankles, knees bent slightly, body upright and facing forward, and feet slightly wider than shoulder width apart. Maintaining this position, slowly step laterally six inches with the right foot. While controlling the band, lift the left foot and step in toward the right foot six inches, and repeat.

Figure 4 stretches - these help maintain flexibility as the hip is externally rotated. To perform this stretch, cross the right ankle over the left knee. Grab behind the left knee with both hands and pull it towards the chest. The client will feel a stretch deep in the right hip. Now reverse the legs and stretch the left ankle over the right. Perform the stretch two or three times on both sides. Hold the stretch on each side for 20 to 30 seconds.

KNEE



INJURY: Patellar tendinopathy (jumper's knee)

MECHANISM OF INJURY:

Common injury in tennis due to the explosive muscle contractions needed for the sprinting, jumping and quick changes of direction. Intrinsic factors - such as strength imbalance (quadriceps and hamstrings), postural alignment, reduced ankle dorsiflexion and lack of muscle strength or flexibility - may play a role. However, the primary cause appears to relate to the extrinsic factor of overuse.

TREATMENT AND REHABILITATION:

Stretch quadriceps and hamstrings.

Swaying lunges - place the feet shoulder-width apart. Bend the leg until the knee is bent at a 90-degree angle. Do not let the knee protrude in front of the foot. Keep the back straight. Sway gently back and forth, transferring weight, but do not step backwards. Complete two to three sets of 10 to 15 repetitions.

ANKLE



INJURY: Inversion ankle sprains (lateral ankle sprains)

MECHANISM OF INJURY:

This is the most common ankle injury seen within tennis. The lateral ligaments include the anterior talofibular ligament, calcaneofibular ligament, and posterior talofibular ligament. Inversion sprains are graded I to III in order of increasing ligamentous disruption, laxity, and functional impairment.

TREATMENT AND REHABILITATION:

Treatment of acute lateral ankle sprains is governed by the grade of sprain. Grade I and II sprains are best managed in three phases.

Phase 1 - rest, ice, compression and elevation (RICE)

Phase 2 - brief period of immobilisation and protected weight-bearing with external stabilisation (for example, bracing or taping).

Phase 3 - stretching, proprioception and peroneal muscle strengthening.

SUMMARY

Although injuries seen in tennis are often common in other sports, its year-round nature, combined with the different playing surfaces, different types of rackets, footwear, technical demands and biomechanics can lead to a unique diversity of tennis-specific injury, affecting both upper and lower limbs. Acute injuries occur more frequently and often affect the lower extremity. Chronic injuries also occur, but these tend to affect the upper extremity. Understanding how tennis equipment, the kinetic chain, and the strokes affect the pathophysiology of common injuries can help you treat them successfully. Tennis is a physically demanding sport requiring a high level of coordination in the movements and timing of both the upper and lower limbs. Players can experience injury in the upper limbs as a result of poor lower limb movement, foot placement and shoe type.

The practitioner, as always, has a huge part to play in helping the player remain injury-free and providing advice, guidance and injury-specific rehabilitation, as well as preventative exercises to reduce further injury. The practitioner's expertise and understanding of the sport are core components in this respect.



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REFERENCES

For full references, go to fht.org.uk/IT-references

