CHAPTER **11**

TURF TOE

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INTRODUCTION

Turf toe is a relatively common injury that occurs primarily in professional, collegiate, and high school football players. Turf toe is a general sports medicine term that refers to a variety of injuries of the plantar first metatarsophalangeal (MTP) joint capsule, plantar muscles and tendons, and the sesamoid complex usually resulting from a hyperextension injury to the first MTP joint.

The increasing prevalence of artificial turf in the late 1960s has led to a significant increase in the incidence of first MTP joint injuries. Garrick in 1975 originally suggested the relationship between first MTP joint sprains and the use of synthetic playing surfaces.[1] One year later, Bower's and Martin introduced the term turf toe to describe a plantar capsuloligamentous sprain of the first MTP joint related to 2 predisposing factors: hard athletic surfaces and soft-soled shoes.[2]

Several early studies originally documented the incidence of turf toe among collegiate football players. At West Virginia University there were 27 reported cases of turf toe among a population of 500 football players between 1970 and 1974, averaging 5.4 cases per year. The University of Arkansas football program sustained 18 cases of turf toe between 1972 and 1974, averaging 6.0 cases per year. At the same time there were 24.7 ankle sprains per year however during the same period the players with turf toe injuries accounted for 7 missed games whereas the players with ankle sprains accounted for only 6 missed games.[3] Although this injury is most commonly seen in football players, it has been reported among soccer, basketball, rugby, and tennis players as well as gymnasts. Swimmers who use a short board without ventral fins, called a skimboard, are also vulnerable to turf toe injuries. A related though opposite first MTP hyper-plantarflexion injury that occurs primarily in beach volleyball players as well as dancers has been termed a "sand toe" injury.[4]

The prevalence of a history of turf toe in a group of 80 professional football players was reported to be 45% in a 1990 article by Rodeo.[5] The majority of the players with a turf toe injury, (83%), sustained the injury on artificial turf. More recently, Brophy documented a 30% prevalence of turf toe in professional football players.[6] He attributed the underlying factors to be increased body mass index, decreased first MTP range of motion and increased plantar hallucal pressures. Turf toe ranks as the third most common injury, (after knee and ankle trauma) causing loss of playing time among university athletes. Ankle injuries may be up to four times more prevalent than turf toe injuries however turf toe injuries may account for a significantly greater proportion of missed playing time.

ANATOMY

Anatomically, the first MTP ligaments provide the majority of the stability about the joint. These include the medial and lateral metatarsosesamoid ligaments, the medial and lateral phalangeosesamoid ligaments, and the medial and lateral collateral ligaments. The plantar plate provides significant stability as well and connects the base of the proximal phalanx to the more flexible attachment at the metatarsal neck via the joint capsule. The plantar plate blends with the sesamoids and tendons of the flexor hallucis brevis to provide structural support.

The sesamoid bones play a crucial role in providing stability to the first MTP and enhancing the lever arm of the FHB. The FHB functions to provide significant push-off strength for the hallux. Finally the abductor and adductor hallucis tendons contribute additional stability by their insertions on the medial and lateral plantar portions of the capsuloligamentous complex.

The actual turf toe injury is most commonly seen when an axial load is delivered to a foot that is fixed in equinus, an external force such as another player falls on the back of the leg and drives the first MTP into exaggerated dorsiflexion, causing capsular tears at the weakest site of attachment. In the short term, running and push-off are compromised. In more severe injuries the joint capsule tears off of the metatarsal head since the attachment is weaker at this site than at the proximal phalanx. There is increased compression of the articular cartilage and subchondral bone associated with extreme or excessive hyperextension of the first MTP. This more severe injury may lead to long-term sequelae, which may include hallux limitus/rigidus, hallux abducto valgus, hallux malleus, osteochondral lesions, and failure to regain normal push-off strength. As many as 50% of individuals who have sustained a serious turf toe injury have persistent symptoms after 5 years.[7]

Another mechanism of injury to the plantar capsule is hyperflexion. This occurs when the athlete is tackled from behind as the ankle is plantarflexed causing a hyperflexion injury. This mechanism of injury injures the dorsal capsule and associated structures. A third less common mechanism of injury is a valgus injury. This occurs when a player suddenly accelerates, such as a lineman pushing off from his stance. There may be a predisposing structural malalignment that stresses the medial aspect of the joint causing a chronic medial capsular or ligamentous sprain resulting in a hallux valgus or hallux limitus deformity.

A fourth variant that has apparently not been previously reported in the literature is when the athlete sustains a significant sprain to the plantar first MTP capsule by themselves, untouched by another player. The mechanism of injury is a sudden, powerful propulsive step in a flexible shoe on a hard surface such as a tennis court. In a similar yet reversed mechanism a sudden deceleration or change of direction under similar circumstances can cause a turf toe injury. This explains why some patients sustain the injury in non-contact sports like tennis, gymnastics, and track and field.

EVALUATION

A detailed history is the first step in the treatment of all turf toe injuries. A prior history of first MTP joint symptoms or treatment may alert the examiner to a more chronic problem. The specific series of events leading to the injury should be uncovered. Examination should be performed with attention to the presence of pain, swelling, and ecchymosis. All structures should be palpated including the first MTP, the collateral ligaments, sesamoids, plantar plate, dorsal capsule, and muscle-tendon function.

Range of motion testing should be performed initially looking for instability, mechanical blockage or hypermobility. A positive Lachman's test is suggestive for a plantar plate or capsuloligamentous tear. A positive transverse plane, varus, or valgus stress test may represent a collateral ligament injury. Comparison with the contralateral structures may help in determining how much flexibility or instability is considered to be normal. Ultrasound may be of some initial use in screening for a potential soft tissue ligamentous or capsular injuries.

Radiographs are the best initial modality for evaluation of the acute turf toe. Scout radiographs should initially be obtained in the AP, lateral, and oblique planes in all suspected cases. Sesamoid views should also be obtained to evaluate for fracture, proximal migration, avulsions, separated bipartite sesamoids, or displacement. A distal sesamoid to joint distance should be no greater than 3 mm (tibial) and 2.7 mm (fibular) when compared with those on the contralateral side. A separation of 10.4 mm or more on the tibial side or 13.3 mm on the fibular side is 99% predictive of a rupture of the plantar plate according to Ohson.[8]

Ultimately, computed tomography (CT) or magnetic resonance imaging (MRI) are warranted in more severe injuries. A CT may be more appropriate when an osseous injury such as a sesamoid fracture or avulsion is suspected. However MRI is useful in evaluation all structures of the forefoot. High-resolution MRI of the metatarsophalangeal joint often allows for a more specific diagnosis to be made. With small field of view images, fine detailed anatomy of the first MTP can be discerned including disruption of the soft tissue structures, capsulitis and strains, marrow edema, and bone contusions and articular defects.[9]

Clanton and Ford originally proposed a grading system for turf toe.[10] Grade 1 sprains involve a stretch injury or slight tearing of the capsule and ligaments of the first MTP. Symptoms include local plantar or medial tenderness to palpation, mild swelling, no bruising, and minimal restriction of the range of motion. The athlete is able to bear full weight with minimal symptoms and able to continue athletic participation with mild pain.

Grade 2 sprains involve a partial tear of the capsule and ligaments of the first MTP. There is moderate swelling and bruising of the first MTP with more intense and diffuse tenderness than in a grade 1 sprain. There is a mild to moderate restriction of joint motion. The patient has a moderate limp upon weight-bearing and symptoms worsen over the first 24 hours. The patient cannot function at a normal level.

Grade 3 sprains entail a more complete tear of the capsule and ligaments. This may include a complete tearing of the plantar plate from its origin on the first metatarsal neck. An impaction injury of the proximal phalanx into the dorsal aspect of the metatarsal head may occur. There may be an associated sesamoid facture of separation of a bipartite sesamoid. Occasionally a significant tear of the capsule can result in proximal migration of the sesamoids. Clinical symptoms include severe pain and tenderness to both the plantar and dorsal aspects of the joint. There is marked swelling and ecchymosis. There is severe restriction of the first MTP range of motion and the athlete cannot bear weight on the medial forefoot or play sports.

TREATMENT

Initial treatment of first MTP sprains includes conservative modalities starting with the typical RICE acronym consisting of rest, ice, compression and elevation. Cryotherapy is best delivered for 20 minutes 2 or 3 times per

day for the first 48 to 72 hours after the acute injury. Progression to contrast treatment starts thereafter. Early joint mobilization is crucial because loss of motion is a sequela of the injury. Rest is the key component of treatment and usually the most difficult to control and enforce. This difficulty in compliance comes from the misassumption of the player and the coach that this is a minor injury.

Nonsteroidal anti-inflammatory drugs are prescribed. Compression is provided by taping the toe; caution should be exercised in taping the toe after an acute injury because it is possible to theoretically restrict circulation as swelling continues. A CAM boot may be used to partially immobilize the foot and provide a more comfortable gait for the first week or 2 following the injury.

Other treatments include equipment modification, stiffer shoes, or the use of graphite plates that extend to the toes or incorporate a Morton's extension distally to protect the first MTP from excessive motion. The prolonged use of forefoot-limiting plates and soles should be limited to only the recovery phase as long-term deleterious frontal and sagittal plane compensations of the ankle, knee and hip may develop. Taping of the hallux may continue to be used to restrict movement. A generalized rehabilitation program is incorporated as soon as a decrease in symptoms allow. Rehabilitation includes foot and ankle active and passive range of motion exercises, both nonweight bearing and weight bearing. The patient may return to sports when pain and swelling have decreased and motion improves. Return to the field is considered acceptable when the athlete can achieve painless dorsiflexion of 50-60 degrees of the first MTP.[11] The use of anesthetic or corticosteroid injections to allow athletes to continue playing is not indicated and may cause potential for further joint deterioration.

An athlete with a grade 1 injury may immediately be able to return to competition with the supportive treatment and incorporation of a shoe plate and/or taping. Players with a grade 2 injury may expect to be out of action for 3 to 14 days. Players who experience a grade 3 injury will initially need crutches and a walking boot over the first few days to weeks and will usually miss 2-6 weeks of playing time. In patients with significant soft-tissue injury or pain a short-leg cast with a toe spica extension in slight plantar flexion may be used.

Surgical treatment is rarely indicated in the vast majority of turf toe injuries. However operative treatment for turf toe is warranted when conservative treatment fails or specific surgically correctable conditions are identified. The athlete usually exhibits persistent pain and difficulty with pushing off and with cutting and pivoting. These conditions include large capsular avulsions with an unstable joint, diastasis of a bipartite or sesamoid fracture, traumatic bunion, and retraction of the sesamoids or a loose body. Coker et al discuss capsular repair in both the acute and chronic settings for turf toe.[3]

Surgical incisions may include a plantarmedial, medial, dorsal, or plantarlateral approach depending on the specific pathology and intended procedure. The work-horse incision is however a J incision that begins medially and curves laterally along the flexor crease at the base of the hallux. This approach provides extensive exposure to the plantar aspect of the joint including both sesamoids. The plantarmedial digital nerve is encountered and must be carefully mobilized and retracted. The degree of injury to the soft-tissue structures may then be assessed. Another incisional option is to use incisions. The medial approach and exposure is performed exactly as the traditional approach without the J extension across the flexion crease. The second incision is made plantarly, just lateral to the fibular sesamoid.

Regarding the repair of complete plantar ruptures the location of the tear determines the technique to be employed. For a rupture near the distal pole of the sesamoid, a stump of distal tendon should be used for primary repair to the proximal portion of the FHB tendon. More distal ruptures mandate the use of small suture anchors or drill holes in the base of the proximal phalanx.

Diastasis or fracture of the sesamoids should be treated with total or partial resection and primary soft tissue repair. Anderson recommends using the abductor hallucis tendon in situations where primary repair is not possible to reinforce the plantar plate following a complete tibial sesamoidectomy.[12] This reconstruction also resists dorsiflexion. Another option for tibial and fibular diastasis with relatively large sized fragments is to reduce the diastasis and fixate with a small, headless screw.

Surgery in more late stage, neglected turf toe is much more difficult than a primary repair. A plantar reconstruction may require significant soft tissue releases with fasciotomies and lengthening of the FHB and abductor hallucis tendon. A traumatic bunion may require a modified McBride procedure with soft tissue rebalancing of the joint. A cheilectomy or first metatarsal osteotomy may also be necessary. A flexible hallux malleus may require a flexor to extensor tendon transfer, (Girdlestone procedure). Pinning across the joint may be necessary in cases of a complete plantar plate rupture. A more rigid deformity requires an interphalangeal arthodesis in a slightly flexed position. The more complicated the reconstruction and prolonged the joint pinning, the more likely there will be excessive swelling and prolonged stiffness. A return to competitive sports is never guaranteed in these cases. A first MTP arthrodesis is the ultimate salvage procedure however this is also career ending for the competitive athlete.

The postoperative rehabilitation following most turf toe cases can be quite protracted. After approximately 3-4 months most patients are able to return to athletic activity. Equipment modification is essential. Patients should use a stiff orthosis or insole in the forefoot or full length insert with some central flexibility. These devices were previously made from stainless steel but now carbon graphite is more commonly used. Some insoles may be custom made from cast impressions and incorporate a Morton's extension to limit first MTP joint motion. Patients who undergo complex reconstruction should understand that it may take 6-12 months before preinjury level of function is achieved.

SUMMARY

Turf toe and related injuries to the first MTP are common injuries that occur in several sports. Early diagnosis and appropriate treatment should significantly decrease morbidity and minimize loss of playing time. Often this condition is clinically diagnosed although advanced imaging can assist in grading the severity of the sprain and evaluate for associated or unsuspected injuries. Once the correct diagnosis is made, proper treatment can be implemented to avoid long term complications or instability. Operative treatment is uncommon, but usually successful in returning a high-level elite athlete to their sport.

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