

How To Treat Turf Toe Injuries

Turf toe injuries can have a significant impact upon the playing time of professional athletes. Accordingly, this author reviews the etiology of these injuries and assesses the available literature. He also offers key tips on diagnosis and effective treatment.

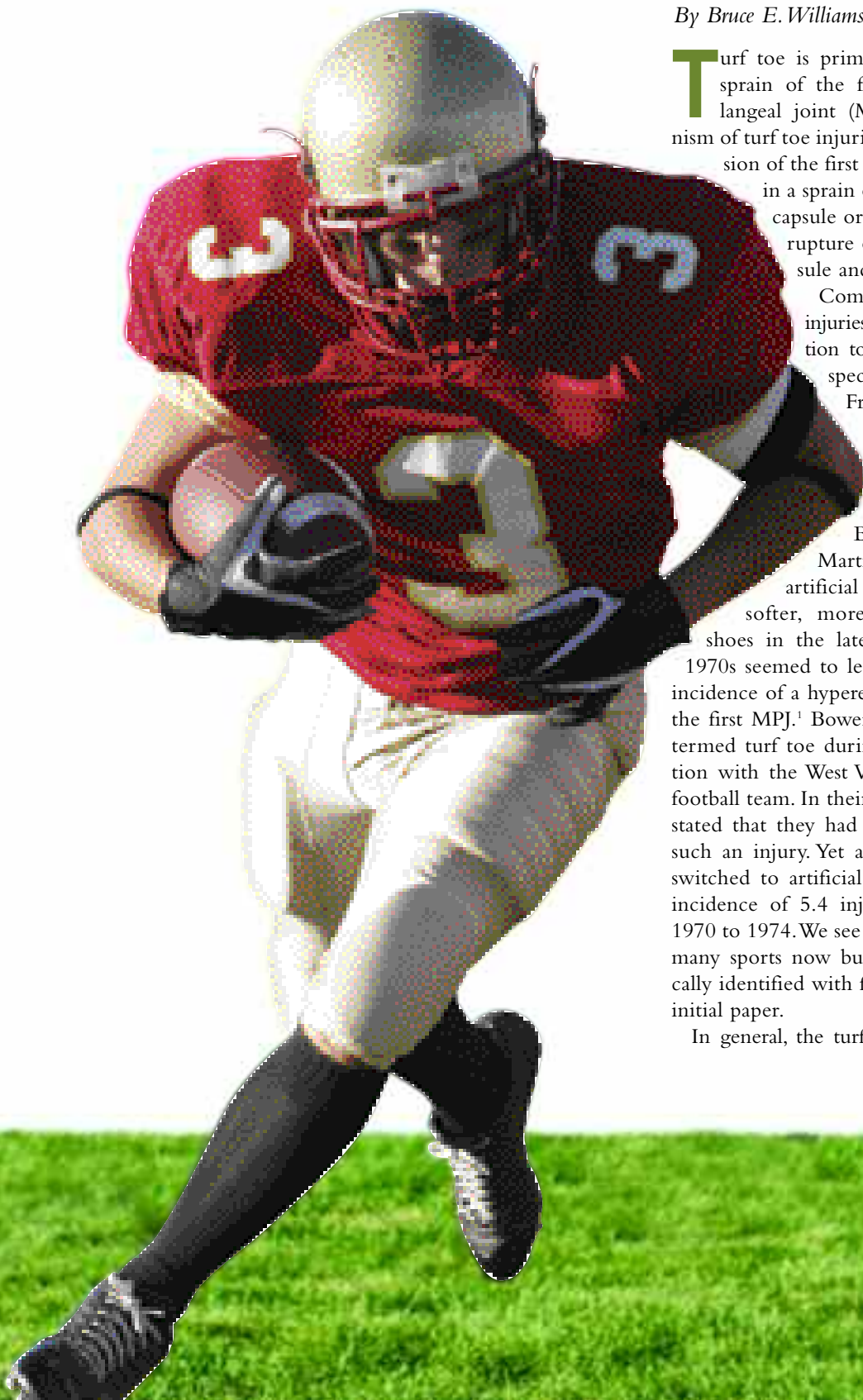
By Bruce E. Williams, DPM

Turf toe is primarily considered a sprain of the first metatarsophalangeal joint (MPJ). The mechanism of turf toe injuries is a hyperextension of the first MPJ, which results in a sprain of the plantar joint capsule or a potential tear or rupture of the plantar capsule and ligaments.

Common forefoot injuries similar in presentation to turf toe are non-specific trauma, Freiberg's infraction, sesamoiditis, arthritis and soft tissue injury.

According to Bowers and Martin, the advent of artificial grass or turf, and softer, more pliable football shoes in the late 1960s and early 1970s seemed to lead to an increased incidence of a hyperextension injury of the first MPJ.¹ Bowers and Martin first termed turf toe during their participation with the West Virginia University football team. In their initial paper, they stated that they had never before seen such an injury. Yet after the university switched to artificial turf, they saw an incidence of 5.4 injuries a year from 1970 to 1974. We see turf toe injuries in many sports now but they are historically identified with football due to this initial paper.

In general, the turf toe injury occurs





Here one can see a hyperextension of the first MPJ. Researchers have linked the advent of artificial grass or turf and softer, more pliable football shoes with an increased incidence of hyperextension injuries.



Here one can see a hyperflexion injury of the first MPJ. These injuries may occur if a ball carrier gets tackled from behind and his knee gets pushed forward while the foot plantarflexes and the body continues moving over the fixed plantarflexed foot.

when a player lands or falls on the back of the lower leg of another player whose foot is plantarflexed at the ankle while the great toe is fully extended. This creates a hyperextension injury. Hyperflexion has been associated with turf toe as well though it is more commonly called “sand toe” as referenced in an article by Frey and Anderson.²

Hyperflexion of the first MPJ occurs less commonly. These injuries may occur when a ball carrier gets tackled from behind and his knee is pushed for-

ward while the foot is plantarflexed and the body continues moving over the fixed plantarflexed foot.

Finally, a valgus or varus injury of the first MPJ occasionally occurs in players. A strenuous push-off has been related to a sprain of the first MPJ. Coker and Arnold saw this mechanism of injury occurring because of a chronic problem in the first MPJ. They felt that pes planus may increase the stress on the medial aspect of the foot and predispose players to a valgus mech-

anism of injury.³

Roukis and Scherer concurred when they described the exact mechanism involved whereby a decrease in first MPJ dorsiflexion, coupled with an increase in first ray dorsiflexion and/or abduction, will result in hallux abducto valgus and or hallux rigidus deformity. Therefore, this may predispose some athletes to chronic medial capsular or ligamentous sprains of the first MPJ, or traumatic hallux abducto valgus.⁴

Other Pertinent Considerations With The First MPJ

The first MPJ consists of the head of the first metatarsal, the base of the proximal phalanx, and the tibial and fibular sesamoids. The sesamoids are connected by the intersesamoidal ligament and rest within the flexor hallucis brevis tendon. The abductor hallucis tendon inserts into the medial base of the proximal phalanx and has a slip to the medial sesamoid as well. The adductor hallucis tendons insert into the lateral base of the proximal phalanx and the first MPJ lateral capsule. The extensor hallucis longus spans the dorsal aspect of the first MPJ.

The ligamentous connections about the first MPJ provide the majority of the stability about the joint. The ligaments are 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 loose attachment at the metatarsal neck by way of the joint capsule. The plantar plate is weaker proximally at the metatarsal neck than it is distally at the base of the proximal phalanx.⁵

The first MPJ allows motion to occur between the hallux and the metatarsal through a sliding mechanism at the surface of the joint. With full extension of the first MPJ, the sliding mechanism resorts to compression at the dorsum of the MPJ. These rotating positions of the first MPJ put various stresses on the joint capsule and supporting structures of the joint during range of motion.

What Research Reveals About The Impact Of Turf Toe On Athletes

According to Coker and Arnold, the primary difficulty of a turf toe injury is in

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Here one can see a sesamoid separation. Many grade 3 injuries will be associated with a sesamoid fracture or a separation of a bipartite sesamoid that is already present.

relation to the number of missed games the athlete suffers.³ From 1972 to 1974 at the University of Arkansas, they compared first MPJ injuries with ankle sprains. They compared the number of injuries sustained and the number of missed games and practices. They found 74 ankle sprains over the three-year period and 18 turf toe injuries. The number of missed practices and games for ankle injuries were 152 and six respectively while the number of missed practices and games for turf toe injuries were 92 and seven respectively. They concluded from this study that turf toe injuries were indeed significant and more disabling than ankle sprains.

In 1990, Rodeo and O'Brien surveyed 85 professional football players from two different teams regarding foot types and injury history.⁵ One team had natural grass on the home field and the other team had artificial turf. Out of the players surveyed, 83 percent reported an initial first MPJ injury on artificial turf and 85 percent of those injuries involved hyperextension. Rodeo and O'Brien also determined that there was a statistical relationship between increased ankle joint dorsiflexion (13.33 degrees) in injured players as opposed to 7.87 degrees in uninjured players.⁵

However, I do take issue with the range of motion reported in regard to ankle joint dorsiflexion in this study. It is my opinion that a first MPJ injury will rarely compensate via an increase in ankle joint dorsiflexion. It is much more likely that the overall range of motion increase recorded in the injured players was skewed by a midtarsal joint compensation that falsely leads to a reported increase in ankle joint range of motion.

Other related findings from players examined during the Rodeo and O'Brien study showed a potential relationship among player age, the number of years playing professional football and a decreased range of motion in dorsiflexion and plantarflexion of the first MPJ. The authors identified pes planus as numerically greater in injured athletes but this finding was not statistically significant. Two studies have suggested that offensive players, mainly running backs, wide receivers and linemen, have the greatest risk of turf toe injuries.^{3,4}

Why You Should Be Cautious Of Long-Term Use Of Forefoot-Limiting Shoes And Insoles

A study by Hall and Nester shows that a decrease in first MPJ dorsiflexion motion leads to sagittal plane compensations at the ankle joints, knee joint and hip joints.⁷ Hall and Nester did find an increase in ankle joint dorsiflexion in this study but I feel that the kinematic evaluation system the authors used in the study did not register the midtarsal joint separately of the ankle joint range of motion. This may have skewed the overall range of motion calculations of the ankle joint.

I believe there is usually a decrease in ankle joint range of motion in patients with ankle joint compensations due to functional hallux limitus, subtalar joint pronation and/or midtarsal joint compensation. The study by Hall and Nester had the participants walk with a rigid insole under the first ray to restrict first MPJ dorsiflexion range of motion. The researchers noted an increase in ankle joint dorsiflexion during late midstance and a reduction in ankle joint plantarflexion during the propulsion phase, which led to increased knee flexion and decreased hip extension. Over time, this could lead to instability of the knee, increased tension on the ankle joint structures, particularly the Achilles tendon, and the possible development of positional symptoms at the hips.

One should take all this quite seriously when considering prolonged use of stiffened shoes at the forefoot or the use of a stiffened insole to protect the foot from painful first MPJ extension. Further, many shoes that have stiffened forefoot areas at the MPJs may not have enough shank or outsole material to fully resist midfoot deformation. This can have a potential for further problems by encouraging midtarsal joint compensation, which can lead to both a decrease in first ray dorsiflexion and ankle dorsiflexion.

Keys To Evaluating And Grading Turf Toe Injuries

Clanton and Ford set up a grading system for turf toe.⁸ Grade 1 sprains involve a stretch injury or slight tearing of the capsule and ligaments of the first MPJ. Symptoms would include local plantar or medial tenderness, minor swelling, no bruising, minimal loss of range of motion,

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the ability to bear weight with minimal symptoms, and some pain on continuation of play. Clanton and Ford also felt that these were the usual symptoms one would see for chronic turf toe sprains as well.

Grade 2 sprains reflect a partial tear of the capsule and ligaments of the first MPJ. Clinicians will note moderate swelling and bruising as well as moderate restriction of first MPJ range of motion. The tenderness of the joint will be increased over a grade 1 sprain and the patient will usually limp on weightbearing. Most of the symptoms will become worse over the first 24 hours and the athlete cannot play at a normal functioning level.

Grade 3 sprains will display a complete tear of the capsule and ligaments. Physicians may also detect a tear of the plantar plate of the first MPJ where it originates at the metatarsal head and neck. An impaction injury of the proximal phalanx into the metatarsal head dorsally is also usually present. Many of these injuries will be associated with a sesamoid fracture or a separation of a bipartite sesamoid that is already present. Sometimes the tear of the capsule can result in proximal migration of the sesamoids. These patients will display severe pain, swelling and bruising. These patients will also have severe restriction of range of motion. The athlete cannot perform or bear weight on the medial aspect of the first MPJ.

An X-ray is the best initial modality for evaluation of turf toe. When viewing the X-ray, note the position of the sesamoids on comparison views of the opposite foot. Watch for proximal migration of both or individual sesamoids, and/or separations medially to laterally within the sesamoid complex. One can also use X-rays to rule out sesamoid fractures, capsule avulsions, separated bipartite sesamoids and impaction injuries of the first metatarsal head.

Computed tomography (CT) scans are fantastic when physicians suspect a sesamoid injury or separation as the three-dimensional reconstruction detail is truly unique. Bear in mind that MRIs and/or ultrasound may provide more detail regarding a potential soft tissue ligamentous or capsular injury, especially of the

What You Should Know About Athletic Shoes And Turf Toe

Coker and Arnold also concluded that football shoes can contribute to turf toe due to fitting issues.³ At the time of their study, most football shoes were sized primarily by length. Athletes who needed wider shoes were in general forced to wear longer shoes that created the potential for excess shoe length in the toe box. This created more of a lever during dorsiflexion of the forefoot, leading to potential turf toe injury.

Nigg and Segesser studied an increase in friction between the fixed forefoot and the artificial turf in turf toe injuries.⁶ Bowers and Martin wrote another paper commenting on the relationship between the shoe and the surface relationship causes of turf toe.¹

Unfortunately, I feel the evaluation test that Bowers and Martin used to determine shoe stiffness was flawed. In their study, the midfoot and posterior aspect of the football shoe was clamped down while researchers tested the flexibility of the forefoot. However, this is a flawed test because the flexibility of many shoes can and will continue into the midfoot portion of a shoe.

The American Academy of Podiatric Sports Medicine utilizes a shoe evaluation process that evaluates both the forefoot and midfoot stiffness of running and athletic shoes as two of the three most prominent components in athletic shoe function. From my perspective as well as the the academy's perspective, it is important to have some flexibility of the forefoot in a shoe so the MPJs are allowed to pivot in late midstance and early propulsion. Loss of this important portion of the gait cycle can lead to significant negative compensations throughout the foot, ankle and lower extremities.

plantar plate.

Research suggests utilizing MRI for grade 2 and 3 turf toe injuries as this will show the severity of soft tissue damage and allow evaluation of the articular and bony injury as well.⁹ Magnetic resonance imag-

ing is a great adjunctive diagnostic technique for differentiating these conditions.^{10,11}

A Pertinent Guide To Treatment Options

Rest, ice, compression and elevation (RICE) are best when it comes to initiating treatment for turf toe. Some authors caution against the use of taping to limit first MPJ range of motion during the first few days after injury as it could lead to restriction of arterial and venous circulation. After the acute stages of injury, taping can be a reasonable treatment for this type of injury.

Other treatments include equipment modification, stiffer shoes or the use of steel or graphite plates with full width at the digits or with just a Morton's extension. With a grade 1 injury, a shoe plate and/or taping will usually get an athlete back in the game. The average loss of playing time for grade 2 injuries is three to 14 days. Players with grade 3 injuries will usually miss two to six weeks of playing time. These grade 3 players will need crutches as well during the first few days or weeks after the injury has occurred.

For most of these problems, if one diagnoses the injuries early and treats them correctly, athletes will have alleviation of turf toe in three to four weeks. Do not use corticosteroids as they can make the problem worse or mask acute symptoms, causing potential for further injury.

A return to play is considered acceptable when one can achieve painless dorsiflexion of 50 to 60 degrees of the first MPJ.⁹ Early joint mobilization is key according to Clanton and Ford.⁸ Consider the Dananberg manipulation technique for increasing the first MPJ range of motion.¹² Returning too soon to play will almost always prolong the convalescence of this injury.

Operative treatment of turf toe is rarely indicated except when it comes to the removal of large capsular avulsions or for bipartite or sesamoid fractures. Occasional repair of a traumatic bunion may be necessary as well as loose body removal or fixation of retracted sesamoids. Physicians have used the abductor hallucis to reinforce the plantar plate when necessary.⁹

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In Summary

One may consider turf toe to be a sprain or partial tear of the plantar ligaments or plate of the first MPJ. It is primarily a hyperextension injury of the first MPJ. However, some have documented it as a hyperflexion injury (sand toe) and, at times, one may see it as a varus or valgus injury as well.

Turf toe is a significant injury given its ability to keep athletes out of practice and games. Turf toe injuries have grades of 1, 2 and 3. One can best evaluate them via X-ray initially and subsequently by CT or MRI, depending on whether you consider soft tissue or bony injury as a primary cause.

Treatment for turf toe starts with RICE, taping, protection of the affected joint and partial or non-weightbearing as determined by the grading system. One can utilize steel or graphite insoles to limit first MPJ extension or motion once weight-bearing and return to play commence. A stiff soled shoe can be effective as well.

Beware of the prolonged use of forefoot-limiting shoes and insoles as this could lead to sagittal and frontal plane compensations of the ankle, knee and hip. Also feel free to access the American Academy of Podiatric Sports medicine Web site (www.aapsm.org/crishoe.html) for athletic shoe recommendations. ■

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