Turf Toe and Disorders of the Sesamoid Complex

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KEYWORDS

• Turf toe • Sesamoid fracture • Osteochondral injury • Traumatic hallux valgus

KEY POINTS

- Turf toe injuries are common in athletes.
- The incidence of turf toe injuries has been decreasing since the 1970s because of an improvement in playing surfaces and shoe wear.
- Most turf toe injuries are mild; however, severe injuries can occur, resulting in sesamoid fractures, cartilage injury, and traumatic hallux valgus.
- Nonoperative treatment is generally sufficient in the treatment of mild and moderate turf toe injuries.

INTRODUCTION

A functional first metatarsophalangeal joint (MTPJ) is an important factor in the normal biomechanics of bipedal gait. In normal walking gait, it has the ability to transfer large forces over a small area, with McBride and colleagues[1] calculating that on barefoot walking, 0.8 × body weight passes through the MTPJ on toe-off. This value increases to 200% to 300% of body weight with athletic activity and can increase to 800% of body weight with running and jumping.[2] Injury to the first MTPJ complex is common, although often underappreciated. Clanton and Ford[3] reported that foot injuries were the third leading cause of missed time in University athletes, with a significant proportion of these involving the first MTPJ. If undiagnosed and not appropriately managed, the injury can have severe detrimental effects on the foot function in athletes, such as persistent pain, weakness in push-off, stiffness, deformity, and development of joint

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arthritis. Significant delays in return to sporting activities have been reported in the literature following first MTPJ injury.[4]

BACKGROUND

Turf toe is an umbrella term applied to a variety of injuries of the plantar aspect of the first MTPJ. The term was coined by Bowers and Martin[5] in 1976, describing the injury in collegiate football players. Rodeo and colleagues[6] subsequently reported an incidence of 45% in professional football players, with 83% of cases occurring on artificial turf. Later studies have seen a reduction in the rate of reported turf toe injuries, with Kaplan and colleagues[7] reporting an incidence of 11% in the National Football League. This reduction in incidence has also been seen in soccer.[8] The perceived decline in the incidence of turf toe injuries in football has been hypothesized to be secondary to improved artificial surfaces and/or new shoe designs with increased forefoot stiffness.[9] An investigation of the National Collegiate Athletic Association Injury Surveillance System identified several risk factors associated with turf toe injury (**Table 1**).

Most turf toe injuries are sustained as a result of contact with the playing surface or contact with another player. A combination of hyperdorsiflexion and axial load with the foot fixed in equinus is the most commonly described mechanism.[10] Garcia and colleagues[11] found that extension of the MTPJ had a profound effect on increasing forefoot plantar soft-tissue stiffness and decreasing plantar soft-tissue thickness, which leaves the joint vulnerable to rapid increases in joint extension and thus injury. Others believe forced hyperextension of the first MTPJ to be the primary mechanism of injury.[3–6] Rodeo and colleagues[6] reported a 12% incidence of MTPJ injury due to plantarflexion, which Frey and colleagues[12] differentiated from turf toe by calling it sand toe. A valgus force can be associated with turf toe injuries causing disruption of the plantar medial capsuloligamentous structures or the tibial sesamoid, resulting in a traumatic hallux valgus deformity.

ANATOMY

The first MTPJ is a ginglymoarthrodial joint that works with a combined movement as a hinge and a sliding joint. Joseph[13] reported that normal active dorsiflexion of the first MTPJ approximates 80°. The joint has no inherent bony stability because of the shallow articulation between the convex metatarsal head and concave base of the proximal phalanx articular surface. It therefore relies on the complex attachments of

Table 1
Risk factors related to turf toe injury

Risk Factor	Description
Playing surface	85% higher risk of turf toe injury on artificial surfaces than on natural grass
Time of season	More common in regular season than in preseason or postseason More common in game time than in practice sessions
Team position	More common in running backs, quarter backs, and line receivers
Player activity	Most common in general play than in other set plays (ie, blocking drill, kick-off coverage)

Adapted from George E, Harris AH, Dragoo JL, et al. Incidence and risk factors for turf toe injuries in intercollegiate football: data from the National Collegiate Athletic Association injury surveillance system. Foot Ankle Int 2014;35(2):108–15.