

# Ligamentous Lisfranc Injuries in the Athlete



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Ligamentous injuries to the midfoot during athletic endeavors are becoming more common and more troublesome as they can take significant time before the athlete is able to return to play. Late changes in alignment or posttraumatic arthritis are complications of inadequate treatment. The mechanism of injury is either direct impact to the dorsal midfoot or a twisting injury to the hindfoot with a plantar-flexed, fixed forefoot. Examination reveals ecchymosis and pain in the midfoot. Rarely is there enough instability to allow detection on physical examination. Provocative tests such as external rotation stress of the midfoot or physical activity (single leg hop or walking on tip toes) can recreate symptoms if the patient's pain allows for it. Weight-bearing anteroposterior and lateral radiographic examination of both feet focusing on the midfoot is essential, allowing comparison between the injured and uninjured extremity. Diastasis between the proximal first and second metatarsal is a classic radiographic finding, but proximal extension between the cuneiforms can also be present. A more severe injury shows loss of the longitudinal arch or subluxation of the midfoot that is identified on a lateral radiograph. A tear or an avulsion of Lisfranc ligament along with other midfoot ligaments is the underlying pathology. Advanced imaging modalities including computed tomography and magnetic resonance imaging are useful in these more subtle injuries or when more specific anatomical detail is required. Nondisplaced injuries are typically treated conservatively with a period of non-weight bearing followed by a gradual return-to-play protocol. Injuries with diastasis or loss of arch height, in addition to cases subluxation or dislocation of joints or displaced fractures require surgical intervention to restore normal anatomical relationships—the most significant factor suggestive of a good result. Arthrodesis of the affected joints is advocated for severe intra-articular injury and has been proposed for purely ligamentous injuries, although this is controversial in an athlete as a primary repair technique. Oper Tech Sports Med 22:313-320 © 2014 Published by Elsevier Inc.

**KEYWORDS** Lisfranc injury, midfoot injury, midfoot sprain, tarsometatarsal joint

## Overview

Subtle injuries to the midfoot first drew attention following an article by Faciszewski et al.<sup>1</sup> Before this, most midfoot injuries involved severe trauma such as seen in motor vehicle collisions or falls from a height, resulting in obvious fractures and dislocations. There is still very little literature about the incidence and treatment of ligamentous Lisfranc injuries that occur as the result of athletic endeavors.<sup>3,2,1,5,8</sup>

The modern definition of a ligamentous Lisfranc injury in the athlete is an injury to the ligaments of the tarsometatarsal joints that may extend to the intertarsal joints. These injuries

can range from a sprain to avulsion fractures but are usually not the dislocations and fractures seen in higher-energy injuries. A 1992 study of collegiate football players noted an incidence of 4% annually and found that most injuries occurred in offensive lineman.<sup>2</sup> Reviewing the literature on Lisfranc injuries sustained in sports shows that most patients were treated non-operatively and that the average time to return to play was 3 months.<sup>1-5</sup> Proper diagnosis is critical for these injuries as a delay in treatment can potentially compromise the result and prolong the time to return to play.

## Mechanism of Injury

Midfoot injuries in athletes usually occur as subtle diastases or small avulsion fractures. Higher-energy sports injuries can occur and need to be treated with appropriate consideration

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**Figure 1** Transverse injury to the Lisfranc complex with arrows pointing to incongruity of the second metatarsal base-middle cuneiform and third metatarsal base and lateral cuneiform.

for the soft tissue envelope and the use of standard fracture fixation techniques.

The most common mechanism of injury is the indirect mechanism. This occurs when the hindfoot is twisted on a fixed forefoot, when the forefoot is planted in the turf. A force concentrated distally creates a midfoot sprain whereas a force concentrated more proximally produces a syndesmosis injury to the ankle.

Another mechanism of injury is direct force applied to the heel of the foot while the forefoot is fixed. This can happen with the forefoot extended or with the athlete in the “tip-toe”-type position. If the first metatarsal phalangeal joint is extended at the time of injury and if the force is sufficiently distal, a “turf-toe” injury can occur. If the force is concentrated over the midfoot, the tarsometatarsal and intermetatarsal ligaments can be injured, causing diastasis. The common radiographic appearances of the misalignment can be classified as transverse or longitudinal.<sup>6</sup>

## Clinical Decision Making

The midfoot has substantial bony and soft tissue structural support making this region relatively stable and infrequently injured. Understanding the anatomical relationships is helpful in diagnosing and treating this commonly missed injury.

In the foot, 4 large tendons (anterior and posterior tibial tendons, peroneus brevis, and longus) attach in the midfoot. The Lisfranc ligament traverses the area from the medial cuneiform to the base of the second metatarsal on the plantar aspect of the joint. The first and second metatarsal bases do not possess intermetatarsal ligaments as do the other adjoining metatarsals. This fact helps explain why midfoot injuries most often occur between the first and second metatarsals. Transverse injury patterns involve disruption of the tarsometatarsal capsule and ligamentous structures and are seen as displacement of the metatarsal bones in relation to the cuneiforms. Longitudinal injury patterns involve injury to the capsuloligamentous structures between the medial cuneiform and the second metatarsal base plus injury to the intercuneiform ligaments between the medial and middle cuneiform bones (Figs. 1 and 2). This may even extend to injury at the joint between the navicular bone and the medial cuneiform.

Clinical decisions are aided by understanding the mechanism of injury. Athletic midfoot injuries present with varying degrees of severity from the minor sprain, which commonly produces pain with only exertional activity, to the athlete being unable to bear weight. Ecchymosis in the arch suggests a more significant midfoot injury.<sup>7</sup> Tenderness is usually maximal at the base of the first and second metatarsals. Provocative tests can be done at the bedside by compressing the foot in a medial or lateral direction and producing pain. Clinical tests also



**Figure 2** Longitudinal injury to the Lisfranc complex with extension to the medial-middle cuneiform joint (arrows point to diastasis).

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