Careful clinical assessment is needed to provide appropriate care.

High ankle sprains require a high index of suspicion

ABSTRACT: High ankle sprains are not as common as low ankle sprains, but they are a significant injury, and the diagnosis may be challenging. The primary role of the syndesmosis is to maintain the relationship of the talus to the tibia under physiological loads. To accomplish this, the distal tibiofibular joint must maintain its stability. The syndesmosis is injured most often with external rotation at the ankle joint while the foot is dorsiflexed and pronated. On physical examination, tenderness is located in the area of the anterior syndesmosis. There are several special tests for syndesmosis injuries. Radiographic assessment is helpful. The usefulness of classification systems is not well defined. The optimal rehabilitation program is unknown. Rehabilitation generally is divided into phases. (J Musculoskel Med. 2008;25:564-569)

Although high ankle (syndesmosis) sprains are not as common as low ankle (medial or lateral) sprains, they are a significant injury. Differentiating between the types of sprains, understanding the anatomy and biomechanics of the ligaments that provide stability to the ankle and distal tibiofibular joint, and applying this knowledge to the physical examination are essential to making the diagnosis. Syndesmosis injuries are a diagnostic challenge—a high level of suspicion and careful clinical assessment are needed to provide appropriate care.

In this 2-part article, we provide the salient points of clinical evaluation of ankle sprains to differentiate between low and high sprains and, as a result, provide patients with proper treatment. The first part ("Differentiating low and high ankle sprains," The Journal of Musculoskeletal Medicine, September 2008, page 438) focused on low ankle sprains. In this second part, we discuss diagnosis and management of high ankle sprains.

FREQUENCY OF INJURY
Syndesmosis injuries are seen most frequently in athletes and soldiers. Athletes who participate in American football, lacrosse, rugby, skiing, basketball, and hockey are at highest risk for these injuries. Injuries to the syndesmosis represent 10% to 20% of ankle sprains among athletes. The extent of injury ranges from a simple sprain (soft tissue injury only) to frank disruption of the syndesmosis with a concomitant ankle fracture.

ANATOMY AND BIOMECHANICS
The primary role of the syndesmosis is to maintain the relationship of the talus to the tibia under physiological loads. To accomplish this goal, the distal tibiofibular joint must maintain its stability, which is provided by both osseous congruity between the distal tibia and fibula and the integrity of the syndesmotic ligaments.

The distal-medial aspect of the tibia has an anterior and a posterior process. The groove between these processes provides a resting place for the distal fibula and confers bony stability between the 2 bones. During plantar flexion and dorsiflexion of the ankle joint, the talus and malleoli must maintain congruity. Otherwise, a lateral shift of the talus, as little as 1 mm, results in a 42% decrease in contact.
area at the tibiotalar joint, leading to an increase in forces across the joint.5,6
There are 4 syndesmotic ligaments: the anterior inferior tibiofibular ligament (AITFL), posterior inferior tibiofibular ligament (PITFL), inferior transverse ligament (ITL), and interosseous ligament (IOL).6,7 Cadaveric studies on the syndesmotic ligaments revealed that the AITFL, ITL, IOL, and PITFL provide 35%, 33%, 22%, and 8%, respectively, of ankle stability.8 In addition, sectioning of the AITFL, PITFL, and IOL allows for a mean of 4.7° of pathological external rotation at the ankle joint.7
The deep portion of the deltoid ligament also contributes to the stability of the syndesmosis. More important, however, it is the primary ligamentous stabilizer of the ankle joint.7,9 Therefore, assessing the competence of the deltoid ligament is a critical component of the clinical evaluation.10,11
Based on biomechanical studies, isolated injuries to the syndesmotic ligaments are not critical to ankle stability.10,11 However, a concomitant tear of the deep deltoid ligament creates an unstable ankle joint that requires more than nonoperative management.1

MECHANISM OF INJURY
The syndesmosis is injured most often with external rotation at the ankle joint while the foot is dorsiflexed and pronated, such as in football and skiing. Biomechanical studies have supported this mechanism of injury, showing that as the ligaments are sequentially torn, the talus and fibula assume an externally rotated position with respect to the tibia.4

Assessing the competence of the deltoid ligament is a critical component of the clinical evaluation.

More specifically, the AITFL is first stretched when the foot is externally rotated from a neutral position. As the AITFL ruptures, the force of injury is transmitted through the talus. The talus externally rotates and pushes against the fibula, causing it to assume a more posterior position. As the talus externally rotates, the deep portion of the deltoid ligament also may be injured. The posterior position of the fibula stretches the IOL and the PITFL, and they eventually rupture.
Sometimes a fibula fracture occurs with the ligament injury. Similarly, hyperdorsiflexion causes increased stress in the AITFL as the talus is pushed into the mortise. In addition to external rotation and dorsiflexion, the syndesmosis may be injured by excessive eversion, inversion, plantar flexion, pronation, and internal rotation.5
Overall, the magnitude and duration of force at the time of injury determine the extent of damage to the syndesmosis. In some instances, the injury may extend to the proximal level of the fibula and cause a fracture (Maisonneuve fracture). The level of the fracture on the fibula represents the exit route of energy that caused the injury.

CLINICAL ASSESSMENT
Assessment of a patient with an injury to the syndesmosis begins with a high index of suspicion. The mechanism of injury should be reviewed with the patient. Pain usually is localized to the anterior syndesmosis or posteroomedially at the level of the ankle joint or both. Weight bearing is painful.

Physical examination
On physical examination, tenderness is located in the area of the anterior syndesmosis. The deltoid ligament is assessed for tenderness, ecchymosis, and swelling. Tenderness length is the measure of the most proximal extent of tenderness between the tibia and fibula; it is useful for defining the extent of injury and the time to return to sports activity.12
Special tests for injuries of the syndesmosis include the Cotton test (Cotton), crossed-leg test, external rotation stress test, fibula translation (drawer) test, stabilization test (Amendola), and squeeze test.13-17 Results of biomechanical studies evaluating these tests suggested that they cannot accurately predict the degree of mechanical instability associated with syndesmosis injury.17,18 Overall, only the external rotation test correlates with the presence of a syndesmotic sprain and is associated with a longer return to preinjury activities.14

Imaging studies
X-ray films should be obtained in all cases in which a syndesmotic injury is suspected. Radiographic assessment of an injured ankle includes an anteroposterior (AP), mortise, and lateral view of the an-
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kle, as well as full-length AP and lateral x-ray films of the tibia and fibula. The radiographs are evaluated for an ankle fracture, a proximal fibula fracture, and any abnormal relationships between the distal tibia and fibula indicating a syndesmotic injury.

The critical relationships are the medial clear space, the tibiofibular clear space, and the tibiofibular overlap. The medial clear space should measure 4 mm or less. The tibiofibular clear space should be less than 6 mm on the AP and mortise views. The tibiofibular overlap should be more than 6 mm on the AP x-ray film and more than 1 mm on the mortise view.

If the results on static radiographs appear normal, stress radiographs are used to identify an occult injury of the syndesmosis. Stress mortise and stress lateral views are obtained while an external rotation force is applied to the ankle. If there is an injury to the syndesmosis, the stress mortise and stress lateral views reveal lateral and posterior displacement of the fibula, respectively.19

Recent studies suggested that physical examination is inaccurate in assessing the competence of the deltoid ligament. Therefore, stress radiographs also should be used to evaluate this ligament and to help make decisions about appropriate treatment. Interosseous calcification between the distal tibia and fibula is a sign of a chronic syndesmotic injury.

CT scanning and MRI are additional studies that can be used to define injury to the syndesmosis. Although CT scanning can reveal diastasis not visible on plain radiographs,20 MRI has a higher sensitivity and specificity for the injury.21 Indeed, the sensitivity and specificity for ATFL tears on MRI are 100% and 93%, respectively.22 For PITFL tears, the sensitivity and specificity on MRI are 100%.22 The correlation among MRI findings, clinical outcome, and need for operative treatment is not yet defined.

CLASSIFICATION OF INJURY
There are 2 classification systems for syndesmotic injuries. The West Point Ankle Grading System, more applicable to athletes, classifies syndesmotic injuries into 3 grades based on edema, tenderness, ability to bear weight, stress testing, and abnormal radiographic relationships between the distal tibia and fibula.23 The other classification system is based on whether the diastasis between the tibia and fibula is acute or latent.19

The usefulness of these classification systems is not well defined in the literature. Although patients can be categorized into a particular grade of injury using these systems, there is no reliable correlation with appropriate treatment or with clinical outcome.

PRINCIPLES OF TREATMENT
Nonoperative
The optimal rehabilitation program for syndesmotic injuries is unknown. No results from level 1 studies (prospective, randomized clinical trials) are available to guide rehabilitation. As a result, there are controversial issues about nonoperative management of this injury, including immobilization, weight-bearing status, functional progression, and return to play.

Rehabilitation for syndesmotic injuries generally is divided into 3 phases. Whether progression through these phases should be based on time or patients’ functional capacity is debatable.23 Regardless, patients should not progress from phase 2 to phase 3 until they are able to ambulate and hop repetitively without pain or dysfunction.12,23

Phase 1 (the acute phase). This includes protecting the ankle joint and controlling inflammation as well as pain. The extent of pain, muscle activation, and injury help determine the type of immobilization. If there is severe pain, poor muscle activation, and a clinical impression of severe injury, then immobilization in a splint, cast, or boot is appropriate. If these factors indicate a mild to moderate injury, then an ankle brace, tape, or a stirrup is acceptable. In the acute phase, patients usually benefit from ambulating with an assistive device, such as a crutch. Progressive weight bearing is appropriate based on the patient’s symptoms and neuromuscular control. Control of pain and edema is achieved by ice, compression, elevation, NSAIDs, and therapeutic modalities (eg, joint mobilization, massage, electric stimulation).

Phase 2 (subacute phase). Here the focus is on restoring range of motion, strength, and function with simple tasks, such as walking. Mobility exercises in this phase are performed within the patient’s range of comfort. Strengthening progresses from low-intensity, high-repetition sets to high-intensity, low-repetition sets. Closed chain functional tasks, aquatic therapy, and balancing exercises also are helpful in this phase.

Phase 3 (advanced training). (continued on page 569)
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(continued from page 568)

This phase prepares the athlete to return to sports by focusing on neuromuscular control, strength, and sport-specific tasks. Plyometrics may be used toward the end of this phase. Factors that must be considered before the patient returns to his or her preinjury level of activity include symptoms, physical examination results, and results of functional testing.

Studies based on the natural history of syndesmotic injuries reveal that this injury is unpredictable in terms of time to return to sports participation, as well as rate of reinjury and long-term ankle dysfunction.\(^{25-28}\) Athletes may take 18 to 56 days to return to preinjury activities.\(^{16,25-28}\)

Operative

Indications to operate on a syndesmotic ankle injury include frank diastasis or diastasis on stress x-ray films, arthroscopic evidence of syndesmotic ankle instability, and fibula fracture located at least 4.5 mm above the ankle joint in the presence of a deltoid ligament tear.\(^{29}\) Boden and associates\(^{31}\) suggested that operative treatment is not indicated in a stable fibula fracture with a rigidly fixed medial malleolus fracture and in a rigidly fixed fibula fracture within 3 to 4.5 cm of the ankle joint with a concomitant deltoid ligament injury.

Some surgeons suggest that the ankle joint should be in maximum dorsiflexion during screw insertion. The talar dome is trapezoidal. The posterior part of the talus is 2.5 mm narrower than the anterior part. Therefore, if the syndesmosis is fixed with the ankle in planter flexion, the syndesmosis may be overtightened. As a result, dorsi-

flexion may be limited postoperatively because the wider anterior part of the talar dome must be accommodated in the mortise.\(^{30}\)

A variety of surgical techniques are used to stabilize the ankle syndesmosis. These trans-syndesmotic fixation techniques include the use of metal (3.5 mm or 4.5 mm) or bioabsorbable screws, heavy (#5) suture ± suture button, and EndoButton suture technique.\(^{31-34}\) Patients can expect to return to their preinjury level of activity within 12 to 14 weeks of surgery. Recent evidence suggests that in select cases, athletes with grade 3 injuries that are managed early with screw fixation and aggressive rehabilitation can return to play as early as 6 weeks after surgery.\(^{21}\)

References


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