Syndesmotic Injury

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Anatomy:

Much of the ankles stability is provided by the mortise, formed around the talus by the tibia and fibula. The Anterior and Posterior inferior tibiofibular ligaments, the interosseous ligament and the interosseous membrane act to statically stabilize the joint.

The DTFS is stabilized by 4 ligaments collectively known as the syndesmotic ligaments. The ligaments are, the inferior interosseous ligament, the AITFL, the PITFL, and the inferior transverse tibiofibular ligament. The AITFL is the weakest and most vulnerable to injury. It is a flat ligament that originates from the longitudinal tubercle on the anterior aspect of the lateral malleolus, and the fibers course superiorly and medially, attaching on the anterolateral aspect of the tibia. In addition to holding the fibula tight to the tibia, it prevents excessive movement of the fibula and external rotation of the talus.

The posterior inferior tibiofibular ligament has superficial and deep components. The superficial component originates on the posterior tubercle of the tibia and run obliquely, distally and laterally to the posterior lateral malleolus. The deep component is the inferior transverse tibiofiular ligament. This ligament is a strong thick structure with twisting fibers. It passes from the posterior tibial margin to the posterior, medial, distal fibula. The ligament lies below the posterior tibial margin and helps prevent posterior translation of the talus. This ligament creates a posterior labrum which deepens the articular surface of the distal tibia.

Biomechanics and Mechanism of Syndesmosis Injury:

A variety of mechanisms individually or combined can cause syndesmosis injury. The most common mechanism individually and particularly when in combination are external rotation and hyperdorsiflexion. Both cause a widening of the mortise resulting in disruption of the syndesmosis and talar instability.

The closed packed position of dorsiflexion approximates the articular surfaces of the talocrural joint and provides congruency and joint stabilization. However, if the foot is forced into external rotation and the leg is internally rotated while the foot is dorsiflexed, calcaneal eversion will force the talus against the distal fibula creating a widening stress at the tibiofibular mortise. The DTFS ligaments encounter maximal tension when the ankle undergoes dorsi or plantarflexion in combination with forceful external rotation of the foot with internal rotation of the leg.

Evaluation of syndesmotic sprains and Prognosis:

Careful palpation should be performed to differentiate specific structures involved. The most painful area will be the anterior, distal aspect of the DTFS. This tenderness may extend several inches proximally indication injury to the interosseous membrane. ROM will be limited with minimal swelling. Gait

evaluation will reveal avoidance of normal heel-toe pattern. There is usually toe-heel progression instead, with hip circumduction or steppage gait to help unload the ankle.

Special tests should include anterior drawer and talar tilt to help rule out ATFL and CFL involvement. The tests specific to the DTFS include 1) External rotation stress test 2) palpation 3)Dorsiflexion and 4) Squeeze test.

Detection of this injury is impostant because it has been reported to cause both longer recovery times and greater disability than the more common lateral ankle sprains.

A study by **Hopkins et al** found that patients sustaining incomplete injuries to the DTFS as diagnosed by the squeeze test had recovery times as almost twice that of 3rd degree lateral ankle sprains (28 vs 55 days).

1) Palpation test involves careful palpation directly over the AITFL with a +ve test indicated by pain reported directly under the pressure produced by palpation.
2) External roation stress test is performed with the patient seated with the knee bent to 90 degrees and applying a passive external rotational stress to the foot and ankle. This is considered +ve if pain is produced over the anterior or posterior tibiofibular ligaments and the interosseous membrane.
3) The Squeeze test is performed by manually compressing the fibula to the tibia slightly above the midpoint of the calf. This test is generally considered +ve when pain is produced in the DTFS.
4) Dorsiflexion test is performed with the patient standing and actively dorsiflexing the ankle both unassisted and with the examiner compressing the malleoli. A +ve test is when pain is reduced or ROM is increased with pressure applied to the malleoli.

Reliability of Syndesmosis Testing:

The external rotation stress test was shown to have the best reliability of the 4 tests between different examiners. When the stress is applied, the rotation causes the talus to to press against the fibula resulting in tibiofibular joint widening and subsequent stretch of the syndesmosis ligaments and therefore is indicative of damage. **Olgilvie-Harris** found external rotation was positive before arthroscopic resection of a torn syndesmotic ligament and negative after surgery, therefore the test infact does stretch the syndesmosis ligament and is therefore indicative of damage.

The squeeze test, was only found to have moderate reliability. The biomechanical mechanism of the test may only be sensitive to major disruption and may not detect minor or partial injuries and therefore should not be used as a sole diagnostic test.

The Dorsiflexion-compression test was evaluated as having fair reliability between examiners. Dorsiflexion serves to stress the syndesmosis ligaments

as the wider anterior part of the talus becomes wedged into the tibifibular mortise, causing the fibula to externally rotate and the mortise to widen.

The palpation test is often described as a diagnostic tool for syndesmosis ligament injury yet, like the dorsiflexion compression test, it was only shown to have fair reliability. The problem is that pain is a subjective entity and the examiner must make a decision about its representation in order to classify the test as positive.

Therefore there is no strong support for using the tests as a group. However a weak but significant correlation was found with the external rotation test and palpation test combined or the external rotation test and the dorsiflexion test combined.

It maybe that the tests are not sufficiently specific DTFSL injury and are therefore detecting injuries to other structures or, the tests are detecting different severities of syndesmosis injury.

Palpation is more likely to elicit a positive result because it involves the direct application of pressure over the AITFL which will cause pain due to the inflammation associated with most ankle injuries. This test should be considered a sensitive test but its specificity is questionable.

The Squeeze test may only be able to detect more severe syndesmosis injury as found by **Hopkins et al.**

In conclusion, subjects with extended recovery times were detected as having positive test results on palpation, external rotation and dorsiflexion testing. The tests were shown to pick up patients with longer recovery times than normal. If a subject had 1 or 2 positive test results they were significantly more likely to take longer to return to sports than subjects with negative results. Therefore the research supports the continued use of these tests in clinics.

Rehabilitation:

It is important to recognize that the ankle has a significant neural component and responds well to early activity, particularly proprioceptive training.

Acute Phase: (0-4days)

-Goals of this stage include decrease in pain and inflammation and an increase in pain free active range of motion.
-Progressive pain free weight bearing.
-Cryotherapy, compression and elevation to decrease swelling and increase cellular healing.
-Active ROM exercises with in pain free limits
-Horse shoe strip taping with an open basket weave.

Subacute Phase: (4-14 days)

-Abolishment of pain, inflammation and swelling
-Restore passive ROM and non-antalgic gait.
-AROM exercises with progressive weight bearing
-Gastroc-Soleous muscle complex stretch with strap.

-OKC resistance exercises with rubber tubing
-stationary cycling
-Proprioceptive training is emphasized (progress from seated to standing)

Advanced Healing Phase: (2-4weeks)

The goals of this phase are restoration of normal AROM, normal gait, painfree performance of CKC functional activites and enhancement of ankle proprioception.

-single leg standing with wedge under heel.
-mini tramp single leg stance, eyes open, eyes closed.
-carioca drills
-bosu ball activities
-medicine ball catch and throw on rocker/wobble board.
-Strengthening: Squats, progress from 2 – 1 leg with 60 degrees on knee flexion until full body weight can be performed easily then add weight and lunges.
-high intensity anerobic intervals
-CKC functional activites against resistance: AP step, Lateral shuffle, Lateral slides, Figure 8 walk-jog-run.

Return to Activity Phase: (4-8 weeks)

Goals are to restore pre-injury strength with pain free running-cutting-jumping.
-Ballistic movements: 1 and 2 foot jump rope on padded surface. Mini tramp hopping with acuity turns, box jumps.

To return to sport the athlete must be able to perform a single leg standing broad jump, single leg vertical jump and a single leg cross over hop. The athlete must also be able to perform all activities required for their sport with no pain.

Signs and symptoms of pain, swelling and instability should be monitored continuously throughout the program. Proper technique takes precedent over other exercise variables. Ice after exercise. All athletes should be ready for sport by 8 weeks post injury. Bracing and taping are recommended for 1-1.5 years post injury. Standard taping with additional 2-3 circumfrential strips across the DTFS will be helpful.

Special Imaging:

Radiographic analysis involves neutral AP, lateral and stress views. The tests are considered positive if the clear space between the tibia and fibula (lateral boarder of posterior tibial malleolus to the medial boarder of the fibula) is more than 5mm or the overlap between the lateral boarder of the tibia and the medial boarder of the fibula is less than 10mm or 42% of the width of the fibula. Recent studies have shown these numbers to be unreliable for definitive diagnosis due to large variations found in different age groups and between men and women. Stress radiography is regarded to show instability when there is widening of the joint on the AP view or if there is posterior fibular migration on the lateral view. However, these views are not sensitive to minor disruption to the DTFS.

MRI diagnosis has been shown to be far more reliable to make a diagnosis. The diagnosis is based on 1) ligament discontinuity or 2) a wavy/curved contour or non-visualization of the ligament. When either or both criteria are present, the injury is diagnosed.

When AITFL injury was diagnosed from criteria 1) = 100% sensitivity
70% specificity

When AITFL injury was diagnosed from criteria 1&2) = 100% sensitivity
93% specificity

When PTFL injury was diagnosed from criteria 1) = 100% sensitivity
94% specificity

When PTFL injury was diagnosed from criteria 1&2) = 100% sensitivity
= 100%specificity

MR imaging with use of both criteria was shown to be highly accurate for the diagnosis of tibiofibular syndesmotic disruption

Radiological confirmation of syndesmosis ligament injury is difficult to achieve, largely because techniques are not sensitive to minor disruptions of the ligaments and may fail to detect injury. MRI is more sensitive as a diagnostic tool, however it is not practical as a routine test because of its expense. Therefore, emphasis should be on the use of manual orthopedic tests for detection of DTFS injury.

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