Syndesmotic Ankle Sprains in Professional Football Players: Correlating MRI Appearance With Time of Disability

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Ankle Injuries

• Ankle most commonly injured joint during athletic endeavors
• Highest incidence of sprains occur in sports with frequent jumping and cutting maneuvers
  • Football
  • Soccer
  • Basketball
Ankle Sprains

• Often classified by severity and location
• Severity
  – Pain
  – Swelling
  – Ability to bear weight
• Location
  – Lateral
  – Syndesmosis
  – Medial
Ankle Sprains

• Lateral ankle injuries predominate
• Knowledge and appreciation of syndesmosis injuries has increased over last 20 years
• Studies of ankle sprains show wide range in incidence of syndesmosis sprains
  – No mention – Jackson, et al. – military cadets
  – 17% - Gerber, et al. – military cadets
  – 18% - Boytim, et al. – NFL players
Syndesmosis Injury

Various authors have noted ankle syndesmosis injuries without fracture may be associated with:

– Prolonged recovery
– Recurrent sprains
– Chronic ankle pain
– Formation of heterotopic ossification
### Sprain Type vs. Time Loss

<table>
<thead>
<tr>
<th></th>
<th>Syndesmotic</th>
<th>Lateral</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatments</td>
<td>19.5</td>
<td>7.8</td>
</tr>
<tr>
<td>Missed practices</td>
<td>6.3</td>
<td>1.1</td>
</tr>
<tr>
<td>Missed games</td>
<td>1.4</td>
<td>0.04</td>
</tr>
</tbody>
</table>

Boytim et al., AJSM 19:294-298, 1991
Anatomy

• Bone
  – Fibular notch
  – Tibial tubercles

• Ligaments
  – Anterior Inferior Tibiofibular Ligament (ATFL)
  – Posterior Inferior Tibiofibular Ligament (PTFL)
  – Transverse Tibiofibular Ligament
  – Interosseous Ligament

• Interosseous Membrane
Anatomy
Anatomy

Posterior view with ligaments:
- Tibia
- Fibula
- Interosseous membrane
- Posterior tibiofibular ligament
- Posterior talofibular ligament
- Calcaneofibular ligament
- Deltoid ligament
- Posterior talocalcaneal ligament
- Peroneal tendons in inferior peroneal retinaculum
Anatomy

Right foot: lateral view

- Anterior and Posterior tibiofibular ligaments
- Tibia
- Fibula
- Superior peroneal retinaculum
- Calcaneal (Achilles) tendon (cut)
- Inferior peroneal retinaculum
- Posterior talofibular ligament
- Calcaneofibular ligament
- Anterior talofibular ligament
- Interosseous talocalcaneal ligament
- Dorsal talonavicular ligament
- Calcaneonavicular part
- Calcaneocuboid part
- Dorsal cuboideonavicular ligament
- Dorsal cuneonavicular ligaments
- Dorsal intercuneiform ligaments
- Dorsal tarsometatarsal ligaments

Components of lateral collateral ligament
Posterior Tibiofibular Ligament Insertion Avulsion
Mechanism of Syndesmosis Injury

• Not firmly established
• Two proposed mechanisms:
  – Forced external rotation of the foot with simultaneous internal rotation of the leg
  – Hyperdorsiflexion of the foot
• High energy
Mechanism of Injury

Figure 5. Mechanisms of external rotation sustained during football. A, direct blow to the leg of a downed player whose foot was held in external rotation. B, force applied to the lateral aspect of the knee while the player’s foot was planted in external rotation.
Stages of Injury

- ATFL
- PTFL
- Anteromedial joint capsule
- Proximal fibula
- Deltoid ligament or medial malleolus

Pankovich, JBJS, 58A: 337-42, 1976
Purpose of Study

To determine whether the extent of injury on MRI correlated with time loss.
Methods

• Training room records of the Minnesota Vikings professional football team reviewed for the last ten years

• Inclusion criteria
  – Diagnosis of acute ankle syndesmosis injury
  – Ankle radiographs and MRI completed within 48 hours of injury
Physical Examination

- Inspection for swelling
- Palpation for areas of tenderness
- Active range of motion assessment
- Motor and sensory exam
- Passive anterior ankle drawer
- External rotation stress test
External Rotation Stress Test

• With the knee at 90 degrees of flexion, external rotation stress is applied to the involved foot with the ankle in neutral position.

• A positive test produces pain over the anterior and/or posterior tibiofibular ligaments and over the interosseous membrane.

Boytim et al., AJSM, 19:294-8, 1991
External Rotation Stress Test

Figure 1. External rotation stress test is applied to the ankle in a neutral position with the knee flexed 90°.
Syndesmosis Sprain

- History of external rotation injury
- Tender over anterior tibiofibular ligament
- Tender over the interosseous membrane region and/or posterior tibiofibular ligament region
- Swelling not prominent
- All players had a positive external rotation stress test
- Ecchymosis proximal to ankle joint +/-
Subjects

- 15 NFL players
- Injured 1993 - 2000
MRI Analysis

- ATFL (anterior tibiofibular ligament)
- IOL (interosseous ligament)
- IOM (interosseous membrane)
- PTFL (posterior tibiofibular ligament)

- All scans interpreted by musculoskeletal radiologist
Normal Anterior Tibiofibular Ligament
Normal Interosseous Ligament
Normal Interosseous Membrane
Normal Posterior Tibiofibular Ligament
Torn Anterior Tibiofibular Ligament
Torn Interosseous Ligament
Interosseous Membrane Tear
Mild Posterior Tibiofibular Ligament Sprain
Severe Posterior Tibiofibular Ligament Sprain
## MRI Groups

Focus on PTFL

<table>
<thead>
<tr>
<th>PTFL grade</th>
<th>Number players</th>
<th>Practices missed</th>
<th>Games missed</th>
</tr>
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<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>5.0</td>
<td>2.0</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>5.0</td>
<td>0.8</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>13.5</td>
<td>1.8</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>10.8</td>
<td>2.3</td>
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</table>
## IOM Tear vs. PTFL Grade

<table>
<thead>
<tr>
<th>PTFL grade</th>
<th>IOM tear length Average</th>
<th>Range</th>
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<tbody>
<tr>
<td>0</td>
<td>0.0 cm</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>8.5 cm</td>
<td>0-12</td>
</tr>
<tr>
<td>2</td>
<td>8.0 cm</td>
<td>5-12</td>
</tr>
<tr>
<td>3</td>
<td>7.3 cm</td>
<td>4-12</td>
</tr>
</tbody>
</table>
# Time Missed vs. IOM Tear Length

<table>
<thead>
<tr>
<th>IOM Tear Length</th>
<th>Practices Missed</th>
<th>Games Missed</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 cm</td>
<td>4.0</td>
<td>1.5</td>
</tr>
<tr>
<td>4-6 cm</td>
<td>9.0</td>
<td>1.5</td>
</tr>
<tr>
<td>7-10 cm</td>
<td>13.3</td>
<td>2.0</td>
</tr>
<tr>
<td>11-12 cm</td>
<td>10.4</td>
<td>1.6</td>
</tr>
</tbody>
</table>
## Player Groups

<table>
<thead>
<tr>
<th>Position</th>
<th>Number</th>
<th>Practices</th>
<th>Games</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linebacker</td>
<td>3</td>
<td>11.7</td>
<td>2.0</td>
</tr>
<tr>
<td>Lineman</td>
<td>4</td>
<td>2.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Tight end</td>
<td>2</td>
<td>15.0</td>
<td>2.5</td>
</tr>
<tr>
<td>Quarterback</td>
<td>3</td>
<td>3.3</td>
<td>0.3</td>
</tr>
<tr>
<td>Wide receiver</td>
<td>2</td>
<td>17.5</td>
<td>3.0</td>
</tr>
<tr>
<td>Running back</td>
<td>1</td>
<td>11.0</td>
<td>2.0</td>
</tr>
</tbody>
</table>
Findings

• Trend toward more time missed with higher grade of posterior tibiofibular ligament injury.
• No significant correlation between degree of PTFL injury and length of interosseous membrane injury.
• No significant correlation between length of interosseous membrane injury and time missed.
• Lineman and quarterbacks tended to miss fewer practices and games than linebackers, receivers, and running backs.
Findings

• Although suggestive, we were unable to find a statistically significant correlation between extent of injury on MRI and time loss.

• MRI appearance should not be relied upon for projections on how long a player will be disabled.

• More important factors include subjective complaints and functional symptoms.
Thank You