Foot and Ankle Injuries in Athletics

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Today’s lecture can be viewed at the following URL address:

http://sites.udel.edu/chs-atep/lectures/
“All of life should be a learning experience, not just for the trivial reasons but because by continuing the learning process, we are challenging our brain and therefore building brain circuitry”

Arnold Scheibel
A First State Fact!

Delaware is 96 miles long and varies from 9 to 35 miles in width.

Capital of DE is?
Athletic Training & Sports Health Care: The Journal for the Practicing Clinician

http://www.healio.com/journals/atshc
Laboratory Manual
to accompany
Rehabilitation Techniques in Sports Medicine and Athletic Training
6th Edition
A New Way of Assessing Ankle Proprioception
Hey, Chuck... you ready for another great football game?

Well, I don't know... our best pass receiver has a concussion, a sprained wrist, a bruised elbow, and two broken legs...

Put some ice on it...
Anatomical Review

Cyriax- “Diagnosis is only a matter of applying one’s anatomy”
Lower Extremity ~ Foot

(a) Superior view

(a) Superior view, right foot

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Lower Extremity ~ Foot

(b) Medial view

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Clinical PEARL: Navicular Palpation

- Palpated 2-3 cm anteroinferior to the medial malleolus
- More prominent with foot adducted
Lower Extremity ~ Foot

Facet for lateral malleolus
Navicular
Intermediate cuneiform
Lateral cuneiform
Talus
Calcaneus
Cuboid
Fifth metatarsal

(c) Lateral view

Copyright © 2001 Benjamin Cummings, an imprint of Addison Wesley Longman, Inc.
Radiographically Viewed

Ankle Joint (Medial View)

1. Fibula
2. Tibia
3. Ankle joint
4. Promontory of tibia
5. Trochlear surface of talus
6. Talus
7. Posterior tubercle of talus
8. Calcaneus
9. Sustentaculum tali
10. Tarsal tunnel
11. Navicular
12. Cuneiforms
13. Cuboid
Articulations

talocrural joint

subtalar joint

transartarsal joint
The Ankle Mortise
Major Lateral Ligaments

Right foot: lateral view

Components of lateral collateral ligament
- Posterior talofibular ligament
- Calcaneofibular ligament
- Anterior talofibular ligament
- Interosseous talocalcaneal ligament
- Dorsal talonavicular ligament
- Calcaneonavicular part
- Calcaneocuboid part of bifurcate ligament
- Dorsal cuboideonavicularticular ligament
- Dorsal cuneonavicularticular ligaments
- Dorsal intercuneiform ligaments
- Dorsal tarsometatarsal ligaments
- Dorsal metatarsal ligaments
- Dorsal cuneocuboid ligament
- Dorsal calcaneocuboid ligament

Anatomical structures:
- Tibia
- Fibula
- Anterior and posterior tibiofibular ligaments
- Superior peroneal retinaculum
- Calcaneal (Achilles) tendon (cut)
- Inferior peroneal retinaculum
- Lateral talocalcaneal ligament
- Long plantar ligament
- Peroneus longus tendon
- Peroneus brevis tendon
- Cuboid bone
- Dorsal calcaneocuboid ligament
The Medial “Deltoid” Complex
Ankle Syndesmosis

IOM = Interosseous membrane

IOL = Interosseous ligament

AITFL = Anterior inferior Tibiofibular Ligament

PITFL = Posterior inferior Tibiofibular Ligament
The Subtalar Joint

- **Tibia**
- **Fibula**
- **Talus**
- **Calcaneus**

**Views:**
- Lateral (Side) View
- Anterior (Front) View

**Joint:**
- Subtalar Joint
- True Ankle Joint
The Ligaments of the Subtalar Joint
LUCKILY, I'M NOT INJURY PRONE.

WHOMP!

I'M PRONE PRONE.
WOW!
Muscular Anatomy
Compartments of the Leg

- **Anterior**
  - Medial (Tibial Bone)
  - Lateral (Peroneal/Fibularis Region)

**Posterior**

- Superficial
- Deep
# Lower-Leg Compartment Contents

<table>
<thead>
<tr>
<th>Lower-leg Compartment</th>
<th>Muscle</th>
<th>Nervous</th>
<th>Vascular</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anterior</td>
<td>Extensor hallucis longus, extensor digitorum communis, tibialis anterior, peroneous tertius</td>
<td>Deep peroneal nerve</td>
<td>Anterior tibial artery</td>
</tr>
<tr>
<td>Lateral</td>
<td>Peroneous brevis and longus</td>
<td>Superficial peroneal nerve, proximal portion of deep peroneal nerve</td>
<td>Peroneal artery</td>
</tr>
<tr>
<td>Posterior superficial</td>
<td>Gastrocnemius, soleus, plantaris</td>
<td>Tibial nerve branches</td>
<td>Posterior tibial artery, popliteal artery, peroneal artery, sural arteries</td>
</tr>
<tr>
<td>Posterior deep</td>
<td>Popliteus; tiblis posterior, flexor hallucis longus, flexor digitorum longus, popliteus</td>
<td>Tibial nerve</td>
<td>Posterior tibial artery, peroneal artery</td>
</tr>
</tbody>
</table>

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Lower Leg Musculature

Anterior

- Peroneus Longus Muscle
- Tibialis Anterior Muscle
- Gastrocnemius Muscle
- Soleus Muscle
- Extensor Digitorum Longus Muscle
- Extensor Hallucis Longus Muscle
- Lateral Malleolus (Fibula)
- Medial Malleolus (Tibia)

Posterior

- Plantaris Muscle
- Gastrocnemius Muscle
- Soleus Muscle
- Flexor Retinaculum
- Calcaneal (Achilles) Tendon
- Calcaneus
Tibialis Anterior
Extensor Digitorum Longus
At what bony landmark do they bifurcate?

Peroneals

Can you tell which one?
Posterior Compartment (S)

Plantaris
Posterior Compartment (S)

Soleus
Posterior Compartment (D)
Posterior Compartment (D)

Note we have excised the T&D.
Talocrural and Subtalar Joint Motion

Talocrural Joint

Subtalar Joint

Ankle Motion

Dorsiflexion

Plantar Flexion

Eversion

Inversion

Subtalar Function
HAS ANYONE SEEN FERRIS???

Can anyone name this voice?

Ben Stein!

Circa 1986
Selected Injuries involving the Ankle Region
Achilles Tendon Injuries

- common tendon of the triceps surae (2 heads of gastrocnemius & soleus) inserting into the calcaneus
- receives its greatest stress during knee extension/ankle dorsiflexion
- *Tendinitis* (aka tendonitis)
  - most common form of tendinitis seen in athletics
  - **Et:**
    - overuse
  - **Sx:**
    - crepitus
    - inflammatory rxn
  
  Can you think of a MOI?
Triceps Surae
Achilles Tendon Injuries

• **Tendinitis** (con’t)
  – **Tx:**
    • cryotherapy
    • NSAID’s
    • heel lifts
    • decrease/modify activity
    • stretching/strengthening of gastroc/soleus
    • orthotics
    • gradual return to activity

• **Ruptures**
  – 75% seen in males 30 - 40 yr. old who participate in intermittent activities

Chauncey Billups NBA ----
______________
https://www.youtube.com/watch?v=qGwnFAbDOZ8
Clinical PEARL:
Gastrocnemius/Soleus Stretch

Gastrocnemius Stretch (Straight Knee)

Soleus Stretch (Bent Knee)
Achilles Tendon Injuries

- **Ruptures** (con’t)
  - **Sites:**
    - calcaneal insertion
    - 2-6 cm above insertion pt (poor vascularity)
      - most common site of injury
    - M-T junction
  - **MOI:**
    - forced pf during knee extension
      - common move during propulsion activities
    - sudden, forced df of an already pf foot
      - return from a jumping movement
      - most common mechanism
Achilles Tendon Injuries

- **Ruptures** (con’t)
  - Factors Contributing to Ruptures
    - microtrauma/inflammation
    - dominant extremity?
    - age
    - steroid usage
  - **Signs/Sx:**
    - painful, swollen calf
    - ecchymosis
    - palpable deformity
    - pf MMT = weakness
  - **Tx**
    - pf splint 10°-15°, NWB, transport, surgery
Achilles Tendon Rupture (Repaired!)
Inversion/Lateral Sprains

- 85-95% of all ankle sprains
  - lateral malleolus extends further
    - medial acts as a fulcrum
  - weaker lateral ligaments

- **MOI:**
  - inversion (CF lig)
  - inv + pf (ATF/CF/TibFib lig)
    - most common mechanism

- **R/O:**
  - “push-off” fx’s of medial malleolus
  - other associated fx’s & nerve injury
Risk Factors

Internal risk factors:
- Age: females 10-14 years, males 15-19 years
- Sex: no sex differences in NCAA sports
- Body composition: increased body mass & BMI
- Health: history of previous ankle sprain
- Physical Fitness: reduced hip & ankle strength
- Anatomy: ?
- Skill level: impairments in postural balance
- Psychological factors: ?

External risk factors:
- Sports factors: court sports

Inciting event:
- Biomechanics: inverted position of foot/ankle at ground contact

Susceptible athlete

Predisposed athlete

Injury
An Interesting Take on an Old Practice

POLICE = Protection, Optimal Loading, Ice, Compression, and Elevation

PRICE needs updating, should we call the POLICE?
C M Bleakley, P Glasgow, D C MacAuley

The acronym PRICE (protection, rest, ice, compression and elevation) has been central to acute soft tissue injury management for many years despite a paucity of high-quality, empirical evidence to support the various components or as a collective treatment package. Treatment paradigms in sports medicine must be updated based on contemporary research evidence. As a recent example, the widespread use of non-steroidal anti-inflammatory drugs in acute soft tissue injury management has been challenged, particularly with ligament and muscle injuries.

Ice compression and elevation (ICE) is the basic principle of early treatment. Most research has focused on the analgesic effect of icing or the associated skin or intramuscular temperature changes; a recent randomised controlled trial by Prins and colleagues, which examined the effectiveness of ice on recovery from acute muscle tear, is the first of its kind. Clinical studies into compression are also lacking, and much of its rationale is extrapolated from research relating to deep venous thrombosis prophylaxis and lymphoedema management; there is little clinical research on elevation.

Protection and rest after injury are supported by interventions that stress shield, unload and/or prevent joint movement for various periods. Recent animal models show that short periods of unloading are required after acute soft tissue injury and that aggressive ambulation or exercise should be avoided. But, rest should be of limited duration and restricted to immediately after trauma. Longer periods of unloading are harmful and produce adverse changes to tissue biomechanics and morphology. Progressive mechanical loading is more likely to restore the strength and morphological characteristics of collagenous tissue.

Indeed, early mobilisation with accelerated rehabilitation is effective after acute ankle strain. Functional rehabilitation of ankle sprain, which involves early weight-bearing usually with an external support, is superior to cast immobilisation for most types of sprain severity. Functional rehabilitation aligns well with the principles of mechanotherapy, whereby mechanical loading prompts cellular responses that promote tissue structural change. There are consistent findings from animal models that demonstrate how mechanical loading upregulates mRNA expression for key proteins associated with soft tissue healing. The difficult clinical challenge is finding the balance between loading and unloading during tissue healing. If tissues are stressed too aggressively after injury, the mechanical insult may cause re-bleeding or further damage. Protection of vulnerable tissues therefore remains an important principle. But, too much emphasis creates a default mindset that loading has no place in acute management. Rest may be harmful and inhibits recovery. The secret is to find the 'optimal loading'.

Optimal loading means replacing rest with a balanced and incremental rehabilitation programme where early activity encourages early recovery. Injuries vary so there is no single one size fits all strategy or dosage. A loading strategy should reflect the unique mechanical stresses placed upon the injured tissue during functional activities, which varies across tissue types.

REFERENCE
What Is the Evidence for Rest, Ice, Compression, and Elevation Therapy in the Treatment of Ankle Sprains in Adults?

Michel P.J. van den Bekerom, MD; Peter A.A. Struijs, MD, PhD; Leendert Blankevoort, PhD; Lieke Welling, MD, PhD; C. Niek van Dijk, MD, PhD; Gino M.M.J. Kerkhoffs, MD, PhD

Academic Medical Center, Amsterdam, The Netherlands

**Context:** Ankle sprains are common problems in acute medical care. The variation in treatment observed for the acutely injured lateral ankle ligament complex in the first week after the injury suggests a lack of evidence-based management strategies for this problem.

**Objective:** To analyze the effectiveness of applying rest, ice, compression, and elevation (RICE) therapy begun within 72 hours after trauma for patients in the initial period after ankle sprain.

**Study Selection:** Eligible studies were published original randomized or quasi-randomized controlled trials concerning at least 1 of the 4 subtreatments of RICE therapy in the treatment of acute ankle sprains in adults.

**Data Sources:** MEDLINE, Cochrane Clinical Trial Register, CINAHL, and EMBASE. The lists of references of retrieved publications also were checked manually.

**Data Extraction:** We extracted relevant data on treatment outcome (pain, swelling, ankle mobility or range of motion, return to sports, return to work, complications, and patient satisfaction) and assessed the quality of included studies. If feasible, the results of comparable studies were pooled using fixed- or random-effects models.

**Data Synthesis:** After deduction of the overlaps among the different databases, evaluation of the abstracts, and contact with some authors, 24 potentially eligible trials remained. The full texts of these articles were retrieved and thoroughly assessed as described. This resulted in the inclusion of 11 trials involving 868 patients. The main reason for exclusion was that the authors did not describe a well-defined control group without the intervention of interest.

**Conclusions:** Insufficient evidence is available from randomized controlled trials to determine the relative effectiveness of RICE therapy for acute ankle sprains in adults. Treatment decisions must be made on an individual basis, carefully weighing the relative benefits and risks of each option, and must be based on expert opinions and national guidelines.

**Key Words:** ankle ligament injury, cryotherapy, bandages
The Future of Acute Ankle Sprain Treatment Intervention?

**MECHANISM OF ACTION**

1. Peak perfusion burst
2. Endothelial wall scouring
3. Evacuates metabolic waste
4. Reoxygenates cells
5. Hydrates tissues
6. Augments fibrinolysis
7. Enhances vasodilation
Footbeat in Action
OTTAWA ANKLE RULES

• Developed to reduce the use of unnecessary radiographs in the diagnosis of acute foot and ankle injuries in emergency departments

• Estimated only 15% of foot/ankle injuries presenting to emergency departments are fractures

• Use of these diagnostic rules have significantly reduced unnecessary x-rays
OTTAWA ANKLE RULES

A series of ankle x-ray films is required only if there is any pain in malleolar zone and any of these findings:

- Bone tenderness at A
- Bone tenderness at B
- Inability to bear weight both immediately and in emergency department

A series of foot x-ray films is required only if there is any pain in mid-foot zone and any of these findings:

- Bone tenderness at C
- Bone tenderness at D
- Inability to bear weight both immediately and in emergency department
MODIFIED OTTAWA ANKLE RULES

- Change in palpation zone on tibia and fibula

Leddy et al., AJSM 1998
Clinical PEARL: Ottawa Ankle Rules Palpation Points

- Medial
- Lateral
Ankle Instability
Overview – Ankle Instability

- Inversion ankle sprains are a frequent orthopedic injury

- The majority of appropriately rehabilitated ankle sprains will do well . . . , but saying “they all do well” is a misnomer!

- **Symptoms:**
  - pain
  - feeling of giving way
  - swelling
  - recurrent injury
Chronic Ankle Instability

Mechanical Insufficiencies
- Arthro-kinematic Restrictions
- Degenerative Changes
- Synovial Changes
- Pathological Laxity

Functional Insufficiencies
- Impaired Proprioception
- Impaired Neuromuscular Control
- Impaired Postural Control
- Strength Deficits

Recurrent Ankle Sprain

Hertel, J Athletic Training, 2002
Now this takes some coordination!
Ankle Instability (Mechanical)

- **Definition:**
  - lateral ligament laxity (Freeman et al. - 1965)
  - joint motion that exceeds physiologic motion (Tropp - 1985)

- **Assessment Tools:**
  - anterior drawer test
  - talar tilt
  - roentgenographic studies (Telos Stress)
  
  A fancy name for x-ray!
Telos Stress X-Ray
Instrumented Ankle Arthrometry
Ankle Instability (Functional)

• **Definition:**
  – disability to which patients refer when they say the foot tends to “give way” (Freeman et al. - 1965)
  – joint motion beyond voluntary control, but not necessarily exceeding physiologic ROM (Tropp - 1985)
Ankle Instability (Functional)

• **Assessment Tools:**
  – muscular strength
    • isometric
    • isokineti
  – stabilometry
  – peroneal reaction times
Cumberland Ankle Instability Tool (CAIT)

The Cumberland Ankle Instability Tool: A Report of Validity and Reliability Testing
Claire E. Hiller, MAppSc, Kathryn M. Refshauge, PhD, Anita C. Bundy, ScD, Rob D. Herbert, PhD, Sharon L. Kilbreath, PhD Arch Phys Med Rehabil Vol 87, September 2006

- Designed to measure functional ankle instability
- 9 questions related to subjects’ perception of ankle stability during various activities
- Shown to be valid and reliable
- How do you score?
  - Maximum score = 30
  - Scores < 25 = ankle instability
APPENDIX 1: THE CAIT QUESTIONNAIRE

Please tick the ONE statement in EACH question that BEST describes your ankles.

<table>
<thead>
<tr>
<th></th>
<th>LEFT</th>
<th>RIGHT</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. I have pain in my ankle</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>⬜</td>
<td>⬜</td>
<td>5</td>
</tr>
<tr>
<td>During sport</td>
<td>⬜</td>
<td>⬜</td>
<td>4</td>
</tr>
<tr>
<td>Running on uneven surfaces</td>
<td>⬜</td>
<td>⬜</td>
<td>3</td>
</tr>
<tr>
<td>Running on level surfaces</td>
<td>⬜</td>
<td>⬜</td>
<td>2</td>
</tr>
<tr>
<td>Walking on uneven surfaces</td>
<td>⬜</td>
<td>⬜</td>
<td>1</td>
</tr>
<tr>
<td>Walking on level surfaces</td>
<td>⬜</td>
<td>⬜</td>
<td>0</td>
</tr>
</tbody>
</table>

| **2. My ankle feels UNSTABLE**       |      |       |       |
| Never                                | ⬜   | ⬜     | 4     |
| Sometimes during sport (not every time) | ⬜ | ⬜ | 3 |
| Frequently during sport (every time) | ⬜   | ⬜     | 2     |
| Sometimes during daily activity      | ⬜   | ⬜     | 1     |
| Frequently during daily activity     | ⬜   | ⬜     | 0     |

| **3. When I make SHARP turns, my ankle feels UNSTABLE** |      |       |       |
| Never                                                   | ⬜   | ⬜     | 3     |
| Sometimes when running                                 | ⬜   | ⬜     | 2     |
| Often when running                                     | ⬜   | ⬜     | 1     |
| When walking                                            | ⬜   | ⬜     | 0     |

| **4. When going down the stairs, my ankle feels UNSTABLE** |      |       |       |
| Never                                                   | ⬜   | ⬜     | 3     |
| If I go fast                                            | ⬜   | ⬜     | 2     |
| Occasionally                                            | ⬜   | ⬜     | 1     |
| Always                                                  | ⬜   | ⬜     | 0     |

| **5. My ankle feels UNSTABLE when standing on ONE leg**  |      |       |       |
| Never                                                   |     | ⬜     | 2     |
| On the ball of my foot                                  |     | ⬜     | 1     |
| With my foot flat                                       |     | ⬜     | 0     |

| **6. My ankle feels UNSTABLE when**                     |      |       |       |
| Never                                                   | ⬜   | ⬜     | 3     |
| I hop from side to side                                 | ⬜   | ⬜     | 2     |
| I hop on the spot                                       | ⬜   | ⬜     | 1     |
| When I jump                                             | ⬜   | ⬜     | 0     |

| **7. My ankle feels UNSTABLE when**                     |      |       |       |
| Never                                                   | ⬜   | ⬜     | 4     |
| I run on uneven surfaces                                | ⬜   | ⬜     | 3     |
| I jog on uneven surfaces                                | ⬜   | ⬜     | 2     |
| I walk on uneven surfaces                               | ⬜   | ⬜     | 1     |
| I walk on a flat surface                                | ⬜   | ⬜     | 0     |

| **8. TYPICALLY, when I start to roll over (or “twist”) on my ankle, I can stop it** |      |       |       |
| Immediately                                             | ⬜   | ⬜     | 3     |
| Often                                                   | ⬜   | ⬜     | 2     |
| Sometimes                                               | ⬜   | ⬜     | 1     |
| Never                                                   | ⬜   | ⬜     | 0     |

| **9. After a TYPICAL incident of my ankle rolling over, my ankle returns to “normal”** |      |       |       |
| Almost immediately                                      | ⬜   | ⬜     | 3     |
| Less than one day                                       | ⬜   | ⬜     | 2     |
| 1–2 days                                                | ⬜   | ⬜     | 1     |
| More than 2 days                                        | ⬜   | ⬜     | 0     |
| I have never rolled over on my ankle                    | ⬜   | ⬜     | 3     |

**NOTE.** The scoring scale is on the right. The scoring system is not visible on the subject’s version.
Selection criteria for patients with chronic ankle instability: A position statement of the IAC

BJSM
JOSPT
JAT
Eversion/Medial Ankle Sprains

- less common (5 - 15% prevalence)
  - strong deltoid complex
  - bony structure of ankle mortise

- **MOI:**
  - eversion + df (ruptures deltoid + tibfib ligs.)
    - R/O associated fx’s
  - rotation + eversion (fx fibular shaft + sprain of deltoid complex)
Syndesmotic Ankle Sprains

- uncommon injury, the “high ankle sprain”
- more disabling with prolonged recovery time
- **MOI:**
  - forced df
    - talus located between malleoli forces bones apart
      - damage to syndesmosis (fibrous sheath)
  - forced rotation with a fixed foot
    - shape of the talus acts as a fulcrum forcing the tibia and fibula apart

17% - 74% of ankle injuries among young athletes!
Syndesmotic Ankle Sprains

• **Sx:**
  - point tenderness and swelling localized over the anterior + posterior tibiofibular ligaments
  - bilateral compression increases pain
  - walk on toes
  - inability to push off

• **Tx:**
  - ICERS²
    - immobilization usually for a period of 2-3 weeks
      - depends on the severity of mortise separation
  - NSAID’s
Clinical PEARL: Syndesmosis Palpation

- Anterior Inferior Tibiofibular Ligament
- Interosseous Membrane
- Posterior Inferior Tibiofibular Ligament
Radiological View

Radiograph showing widening of the tibiofibular "clear space" (arrows) as a result of disruption of the syndesmosis. The clear space is normally less than 5 mm wide.
Ankle Fractures

Alecia Bell UD
WBB Player 11-2014
Did this really happen?
Ankle Fractures

- Ankle fractures are usually defined as single malleolar, bimalleolar, or **trimalleolar**.

  Trimalleolar involves med/lat and posterior tibial malleolus.

- Isolated fibular fractures are the most common type of fracture and, without displacement, usually require 4-6 weeks to heal.
Posterior Malleolar Fracture
Ankle Dislocation

- Ankle dislocation results from complete disruption of articular elements in the ankle.
- An isolated ankle dislocation without associated fracture is quite rare.
Acute Ankle Dislocation
Os Trigonum Syndrome (Posterior Ankle Impingement)

- **Os Trigonum** - Δ bone, posterior stylus of the talus
  - 7% of population has a free os trigonum (non-union)

- **Path:**
  - traction apophysitis during early childhood caused the separation
    - FHL irritates the bone as it passes by
    - PF motions impinge the posterior process
Os Trigonum Syndrome

- **Sx:**
  - painful & limited pf
  - pain on great toe flexion

- **Dx Tests:**
  - bilateral x-rays (feet pf)
  - bone scans or MRI

- **Tx:**
  - symptomatic therapy (conservative)
  - surgical intervention in some cases

Figure 3. An os trigonum forms when the talar lateral posterior tubercle fails to fuse with the body of the talus (a), as shown in this superior view. Repetitive plantar flexion, as in soccer or football, can cause impingement of the os trigonum between the calcaneus and the distal tibia, leading to pain. This syndrome can also lead to inflammation of the flexor hallucis longus tendon and to avulsion injuries of the posterior talofibular and posterior talocalcaneal ligaments (b).
Differential Diagnosis

A Shepherd's fracture (avulsion fracture of the posterolateral process of talus), which is often difficult to differentiate radiographically from an os trigonum.
Every Athletic Trainer’s Worst Nightmare
England’s Physiotherapist (Gary Lewin) Dislocates Ankle during 2014 World Cup --- Ughhhhh!

Landed on a water bottles celebrating a goal!)}
Foot Injuries
Arch Injuries

• **Longitudinal Arch**
  – know anatomy
  – **sprain** - intertarsal ligaments
  – **pes planus** - flat foot

• **Transverse Arch**
  – know anatomy
  – **sprain** - intertarsal ligaments
    • look for callosities under 2nd metatarsal head
Morton’s Neuroma

• **Definition** - a type of metatarsalgia (pain in the metatarsals) associated with a localized thickening (neuroma) at the point where the medial & lateral branches of the plantar nerve join between the 3rd & 4th metatarsal heads

  – **Sx**
    • pinpoint tenderness between 3rd & 4th meta heads
    • decreased sensation in 3rd and 4th toes
Morton’s Neuroma
Morton’s Neuroma

• **Hx**
  – complain of sprained transverse arch, sharp-shocklike pain during activity that is relieved when the shoe is removed, numbness in the 3rd & 4th toes

• **Tx**
  – transverse arch pad
  – proper shoes
  – NSAID’s
  – RICE
Plantar Fasciitis

• **Definition** - inflammation of the fascia covering the plantar aspect of the foot, most common site is from the attachment off the medial tubercle of the calcaneus
Plantar Fascitis
Clinical PEARL: Plantar Fascia Palpation

- Passively extend hallux
- Palpate starting at the medial tubercle of calcaneus
Lisfranc Injury

- The injury is named after Jacques Lisfranc de St. Martin, a French surgeon and gynecologist who described the injury in 1815.

- **Lisfranc Ligament**
  - ligament between the 2nd metatarsal and the medial cuneiform (oblique fashion)

- **MOI:**
  - axial load of pf foot
    - usually traumatic

- **Sx:**
  - swelling & tenderness midfoot
  - ecchymosis late
  - pain on stress of 1st/2nd met bases
Lisfranc Fracture

AP radiograph of the forefoot. There is homolateral Lisfranc fracture-dislocation.
Lisfranc Injury

- **Tx:**
  - no flattening of long. arch
    - NWB cast 6 wks
    - walking cast 2 wks
  - flattening of long. arch
    - ORIF
    - poor prognosis

- 14.5 wks return to sports on average!
Are You Still Awake?
DID YOU SEE THAT?????
Fractures

• neck of talus (forced DF)
• calcaneus (crush injury/compression)
• avulsion of base of 5th metatarsal (strong contraction of peroneus brevis)
• metatarsal fractures (direct trauma)
• Jones fracture (just distal to the base of the 5th metatarsal)
Calcaneal Fracture

Lateral radiograph of the ankle. There is a hatchet injury to the calcaneus.
5th Metatarsal Tuberosity Fracture

- most common
- “tennis fracture”
- **MOI:**
  - inversion force with pull by lateral plantar fascia
- **Tx:**
  - undisplaced
    - wooden sole shoe
    - symptomatic care
    - union in 8 wks
  - > 2 mm displacement = ORIF
5th Metacarpal Fracture
Jones Fractures

- 1902 Sir Robert Jones described 4 cases

**Definition** -
- Transverse fx @ the junction of the diaphysis and metaphysis
  - Intraarticular fx (between 4th & 5th)
  - Distal to base of 5th
    - @ a pt. between insertions of peroneus brevis & tertius

**MOI:**
- Pf ankle with a large adduction force to forefoot

**Tx:**
- SLC for 6-8 wks.
- ORIF in competitive athletes
Classification Scheme

Characterization of Proximal 5th Metatarsal Fractures by Location

- Green: Avulsion fracture
- Red: Jones fracture
- Yellow: Stress fracture
Jones Fracture

Lateral radiograph of the foot. A patient stepped off a curb and sustained a fracture of the proximal aspect of the fifth metatarsal.
Turf Toe

• **Definition** -
  – sprain of plantar capsuloligamentous complex of the great toe

• **MOI:**
  – hyperextension
  – hyperflexion + valgus stress (uncommon!)

• **Predisposing Factors:**
  – artificial turf
  – flexible footwear
  – pes planus
  – decreased ankle or MP joint motion
Turf Toe

• graded according to sx’s (I, II, III)

• **Sx:**
  – inflammatory signs
  – ecchymosis
  – tenderness

• **Tx**
  – ICERS$^2$
    • rigid foot insole
    • taping
    • restricted activity
    • crutches NWB in severe cases
Neuropathies and Compartment Syndromes
Definitions

- **Neuropathy** - any disorder affecting the nervous system.
- **Radiculopathy** - disorder of the spinal nerve roots
- **Compartment Syndrome** - condition in which increased intramuscular pressure in a confined anatomical space brought on by overactivity or trauma impedes blood flow and function of tissues within that space.
LE Neuropathies – Foot

- **Tarsal Tunnel Syndrome**
  - Tunnel formed by the flexor retinaculum (lacinate ligament), medial wall of the calcaneus, posterior talus, distal tibia and medial malleolus
  - Structures include:
    - Posterior tibial nerve
    - PT tendon
    - FDL tendon
    - FH tendon
    - Posterior tibial artery & vein

Lacinate mean rough edges!
LE Neuropathies – Foot

- **Tarsal Tunnel Syndrome:**
  - Uncommon in athletes
  - Etiology:
    - Vascular compromise of the nerve (sensory)
    - Direct compression neuropathy (sensory + motor)
      - Abnormalities of the tunnel
      - Extrinsic factors that compress
Clinical PEARL: Tarsal Tunnel Palpation

- Passively dorsiflex the ankle and extend the toes
- Palpate between the medial malleolus and Achilles tendon
- Tinel’s Sign – tapping over the tarsal tunnel
LE Neuropathies – Lower Leg

- **Entrapment of the SPN:**
  - **Etiology:**
    - Facial impingement as it exits the deep fascia approx. 6 cm above the lateral malleolus
    - Chronic ankle sprains subject the nerve to recurrent stretching
LE Neuropathies – Lower Leg

- **Sural Nerve Entrapment:**
  - Secondary to 5\(^{th}\) met fx’s
  - Recurrent sprains (PF/inv)
  - Ganglions
  - Extrinsic compression (tight ski boot)
National Athletic Trainers’ Association Position Statement: Conservative Management and Prevention of Ankle Sprains in Athletes

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Objective: To present recommendations for athletic trainers and other allied health care professionals in the conservative management and prevention of ankle sprains in athletes.

Background: Because ankle sprains are a common and often disabling injury in athletes, athletic trainers and other sports health care professionals must be able to implement the most current and evidence-supported treatment strategies to ensure safe and rapid return to play. Equally important is initiating preventive measures to mitigate both first-time sprains and the chance of reinjury. Therefore, considerations for appropriate preventive measures (including taping and bracing), initial assessment, both short- and long-term management strategies, return-to-play guidelines, and recommendations for syndesmotic ankle sprains and chronic ankle instability are presented.

Recommendations: The recommendations included in this position statement are intended to provide athletic trainers and other sports health care professionals with guidelines and criteria to deliver the best health care possible for the prevention and management of ankle sprains. An endorsement as to best practice is made whenever evidence supporting the recommendation is available.

Key Words: ankle instability, syndesmotic ankle sprains, cryotherapy, immobilization, compression, sensorimotor system, taping, bracing
Recommendations

The purpose of this position statement is to present recommendations for certified athletic trainers and other allied health professionals in the conservative management and prevention of ankle sprains in athletes. Our recommendations will be reinforced by relevant scholarly evidence currently available in peer-reviewed publications and graded according to the Evidence Category Taxonomy (SORT) Evidence Based Scale.
Recommendations from Five (5) Different Categories

• Diagnosis
• Treatment and Rehabilitation
• Return-to-Play Considerations
• Prevention
• Special Considerations
What is Evidence-Based Practice
Current State of AT Practice

Best Research

Clinical Experience

Patient Values
Evidence Categories
SORT Taxonomy

**Strength of Recommendation Taxonomy (SORT)**

In general, only key recommendations for readers require a grade of the “Strength of Recommendation.” Recommendations should be based on the highest quality evidence available. For example, vitamin E was found in some cohort studies (level 2 study quality) to have a benefit for cardiovascular protection, but good-quality randomized trials (level 1) have not confirmed this effect. Therefore, it is preferable to base clinical recommendations in a manuscript on the level 1 studies.

<table>
<thead>
<tr>
<th>Strength of recommendation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Recommendation based on consistent and good-quality patient-oriented evidence.*</td>
</tr>
<tr>
<td>B</td>
<td>Recommendation based on inconsistent or limited-quality patient-oriented evidence.*</td>
</tr>
<tr>
<td>C</td>
<td>Recommendation based on consensus, usual practice, opinion, disease-oriented evidence,* or case series for studies of diagnosis, treatment, prevention, or screening.</td>
</tr>
</tbody>
</table>
## Evidence Categories Made Simple

<table>
<thead>
<tr>
<th>Level of Evidence</th>
<th>SORT Grade</th>
<th>Clinical Practice Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A</strong></td>
<td>Based on consistent and good evidence</td>
<td>No brainer! You should be doing this in clinical practice</td>
</tr>
<tr>
<td><strong>B</strong></td>
<td>Based on inconsistent or limited-quality evidence</td>
<td>Should <em>probably</em> include in our clinical practice!</td>
</tr>
<tr>
<td><strong>C</strong></td>
<td>Based on consensus or usual practice</td>
<td>Flip a coin --- it is up to you to decide!</td>
</tr>
</tbody>
</table>
Implementing the Position Statement Recommendations
Helpful Resources

- Section I Risk and Risk Reduction of Ankle Sprains
- Section II Diagnosis
- Section III Treatment and Rehabilitation
- Section IV Surgical Considerations
Thank You

Former VP Joe Biden

Joe Flacco – QB Baltimore Ravens

NJ Governor – Chris Christie

Bill Prentice – Principles of Athletic Training

Our Famous Delawareans!
Wake Up!
Today’s lecture can be viewed at the following URL address:

http://sites.udel.edu/chs-attep/lectures/
Review of the Clinical Foot and Ankle Assessment
Range of Motion Testing

• AROM
• PROM
• RROM
  – MMT
  – “Break Test”
• Plantar Flexion

Note that PF is two words!!
AROM

• Dorsiflexion
AROM

- Inversion
AROM

- Eversion
Weight Bearing AROM

Plantar and Dorsiflexion
Weight Bearing AROM

Inversion and Eversion
RROM

- Plantar Flexion

Any UNF students in the audience? Who is this?
RROM

- Dorsiflexion
RROM

- Inversion
RROM

- Eversion
Show Me the Evidence!

- **Sensitivity** – those people correctly identified by the test as having the condition of interest (Positive (+) Predictive Value)
- **Specificity** – those people correctly identified as NOT having the condition of interest (Negative (-) Predictive Value)
Special Tests for Ligamentous and Capsular Laxity
Anterior Drawer Test

Sensitivity 32% - 80%
Anterior Drawer Schematic

Positive drawer sign
Anterior Drawer Schematic

Anterior translation is > when the ankle is in 15° of plantar flexion
Anterior Drawer Test (variation)
Talar Tilt
(Inversion Stress)

Sensitivity 52%
Talar Tilt Schematic

Figure 5. The Talar Tilt Test

Torn anterior talofibular lig.

Torn calcaneofibular lig.

Talar Tilt
(Eversion Stress)
Kleiger Test (1974)
(External Rotation Test)
Externally rotate the foot while holding the lower leg in a neutral position (can be performed either seated or supine)
Crossed Leg Test for Syndesmotic Ankle Sprains

- Kiter E. Foot Ankle Int. 2005
  Feb;26(2):187-8
What Does the Evidence Suggest?

• None of the syndesmotic stress tests could distinguish which ligaments were sectioned. Furthermore, the small displacements measured during the stress tests (with the exception of the external rotation test) suggest it is unlikely that the displacement induced in injured syndesmoses can be clinically differentiated from normal syndesmoses. Therefore, pain, rather than increased displacement, should be considered the outcome measure of these tests.

Cotton Test

Used to evaluate lateral translation of the talus in the ankle mortise — syndesmosis sprains
Fibular-Translation Test

Performed by translating the distal fibula anteriorly and posteriorly on the tibia

(+): test results when pain is produced at the syndesmosis or when fibular displacement is > the uninvolved limb.
Medial Subtalar-Glide Test

Used to assess laxity of the subtalar joint resulting from lateral ligament injury.

Test is performed by translating the calcaneus medially on the talus in the transverse plane. Excessive laxity is a (+) test.
Special Tests - Fracture Identification

Freshman athletic trainers.
Squeeze Test
(Potts Compression Test)

Pott’s Fx = fx distal fibula and medial malleolus, Sir Percival Potts identified this compound fx in 1756
Bump Test
(Heel Tap or Percussion Test)
Special Tests - Thompson Test (Achilles Tendon Rupture)

(-)  (+)
Special Tests -
Thompson Test
(Achilles Tendon Rupture)
Dr. Homan (of "Homan's sign" fame) discredited his own test as being useless in the evaluation of DVT and admitted he was sorry he ever published its description.
On-Field Assessment Review

• **History**
  – MOI, location, pain
  – Unusual sounds/sensations
  – Information from others

• **Observation/Inspection**
  – Deformity, swelling, ecchymosis
  – Positioning
  – Skin color
On-Field Assessment Review

- **Palpation**
  - Tenderness, crepitation, deformity:
    - distal tibia
    - distal fibula
    - ligamentous structures
    - syndesmosis
    - Achilles tendon
    - foot region
On-Field Assessment Review

• **Neurovascular**
  – Dorsalis pedis pulse
  – Sensation over foot (dorsum and lateral border), calcaneus

• **Special Tests**
  – Pott’s Compression Test
  – Anterior Drawer Test

• **AROM Tests**
A Cool Web Site

http://ahn.mnsu.edu/athletictraining/spata/