

# Evaluation and Treatment of Ankle Sprains

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Rady Children's Hospital



## Hank Chambers, MD Disclosures

- **Personal Disclosures:**
  - Consultant: Orthopediatrics, Merz Pharmaceuticals
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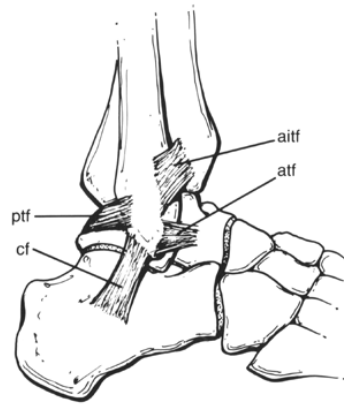
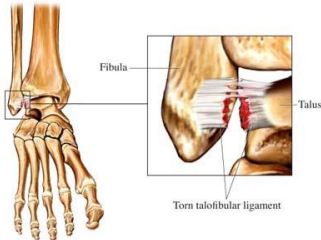


## Craig Powers, PT; Susan Collins, PT Disclosures

- None



## Ankle Sprains in Children

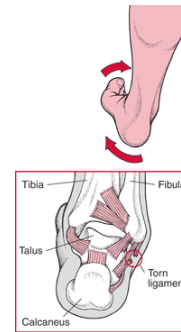


*DeLee & Drez, 1994*



## Evaluation

- Tenderness: Location, especially the interosseous ligament
- Efficymosis
- Instability
- Other structures



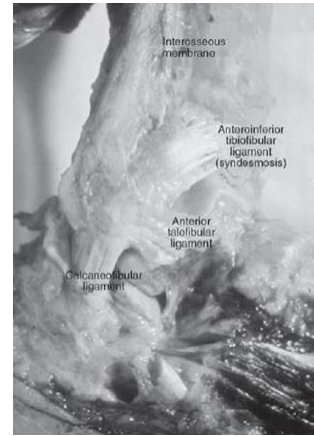
## Differential Diagnosis

- Salter Harris Fracture of distal fibula
- Peroneal Tendon Injury or subluxation
- Talus Fracture
- Recurrent ankle sprains
  - Think of Tarsal Coalitions



## Instability

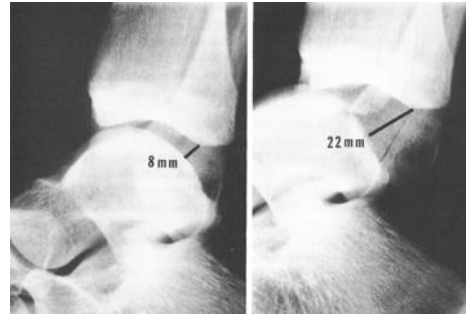
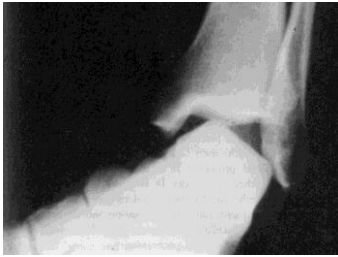
- Static restraints
  - Bony mortise
    - Increased stability in DF
  - Lateral ligamentous structures
    - ATFL—weakest, taut w/ PF
    - CFL—taut in neutral & DF, spans tibiotalar & subtalar joints
    - PTFL—strongest
- Dynamic restraints
  - PB, PL



## Instability

- Ankle is least stable in Plantar flexion & inversion
  - Position of most ankle sprains
- Arc of injury progresses laterally
  - Failure begins in anterolateral joint capsule → rupture of the ATFL → CFL rupture
- ATFL is injured in 85% of lateral ankle sprains
- CFL is injured in 20% to 40%
- PTFL injury is rare

## Stress Radiographs

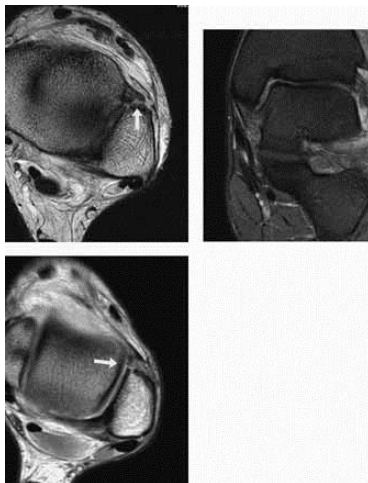


*DeLee & Drez, 1994*

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## Magnetic Resonance Imaging



- Soft tissue injuries
- Bone contusions
- Osteochondral or chondral fractures

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## Instability

- Grading
  - I → stretching of ATFL
  - II → complete tear of ATFL
    - Frequently partial tear of CFL
  - III → complete ruptures of both ATFL & CFL
    - Difficulty with WB
  - “IV” Anterior Syndesmosis injury



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## Instability

- Treatment (Acute Injury)
  - Surgical
    - No recent literature proving surgery superior to conservative tx, even for G-III
      - *OKU Sports Medicine IV*
    - RCT comparing surgery vs non-op found significant differences in pain, giving way and recurrent sprains w/ surgery having better outcomes
      - Still recommended surgery for only the most elite athletes due to cost, risks, and similar results with delayed repair
        - *Pijnenburg JBJS Br 2003*

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## Instability

- Treatment (Acute injury)

- Non-op → *functional treatment*

- Preferred initial management of all lateral ankle sprains
- Provide external support while instituting early controlled motion
  - Elastic bandage, short-term casting, CAM boot, Air-stirrup brace
    - » Air-stirrup brace w/ an elastic bandage shown to return patients with GI & II faster to preinjury function
  - ROM, strengthening & proprioception are key components to rehab
- G/E outcomes in regards to motion, return to work and physical activity



## Treatment of Sprains in Children

Grades 1 & 2

early motion

splint immobilization

Strengthen and Proprioception

Grade 3 and syndesmosis injuries

- cast for 2-3 weeks

- splint immobilization

- Strengthen and Proprioception

- ? Ankle Brace





## Physical Therapy – Ankle Instability

- Evaluation
  - Screening Tools
- Treatment
  - Top Down Approach
  - Bottom Up Approach



## Evaluation – Screening Tools

- 1-Leg Postural Sway
  - Eyes open (balance)
  - Eyes closed (proprioception)
- Star Excursion Balance Test
- Single-Leg (SL) Heel Raise





# 1-Leg Postural Sway

## Procedure:

- Eyes open/eyes closed
  - SL balance for 15 seconds
  - Two practice trials prior to testing

## Assessment:

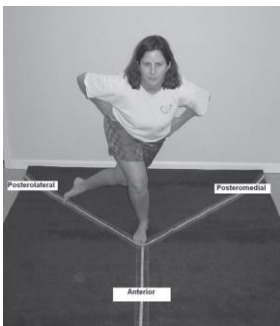
- Positive test results
  - Increased ankle excursion medial/lateral and/or forward/backward
  - Increased upper extremity (UE) sway
  - Medial displacement of the knee

## Evidence to support positive test:

- Basketball players who demonstrated poor balance experienced 7x more ankle sprains than those with good balance
  - Wang et al. *Phys Med Rehabil* 2006
- 1-leg postural sway test can be used as a screening tool to indicate the need for balance training prior to basketball season
  - McGuire et al. *Clin J sport Med* 2000



# Star Excursion Balance Test



Plisky et al.

## Procedure:

- Measure furthest distance reached in all 3 directions
  - 6 practice trials per leg
  - 3 test trials per leg

## Assessment:

- Positive test results
  - Anterior reach variance > 4cm
  - Composite reach distance < 94% of limb length

## Evidence to support positive test:

- Athletes with an anterior reach difference > 4cm were **2.5x** more likely to sustain a lower extremity injury
- Female athletes with a composite reach distance less than 94% of limb length were **6.5x** more likely to have a lower extremity injury
  - Plisky et al. *JOSPT* Dec 2006



## Single-Leg Heel Raise

### Procedure:

- SL heel raise for 10 repetitions each leg

### Assessment:

- Distance of heel from surface (right versus left)
- Degree of postural sway
- Excessive ankle inversion



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## Treatment – Top Down Approach



By Keith Allison from Hanover, MD, USA (Stephen Curry) [CC BY-SA 2.0 (<http://creativecommons.org/licenses/by-sa/2.0/>)], via Wikimedia Commons

### Stephen Curry

What you already know!!!

What you do not know???

What led to his success???

# Treatment – Top Down Approach

## Primary Focus

- Core
- Glutes

## Intervention

-Activation and strength exercises



### Top Down Exercise

- SL bridge
- Pelvic drop
- Side plank
- SL squat
- SL deadlift/airplane

### Muscle Group(s)

- Glutes/Core
- Glute Med
- Glute Med/Core
- Glute Max/ Med
- Glutes/Core



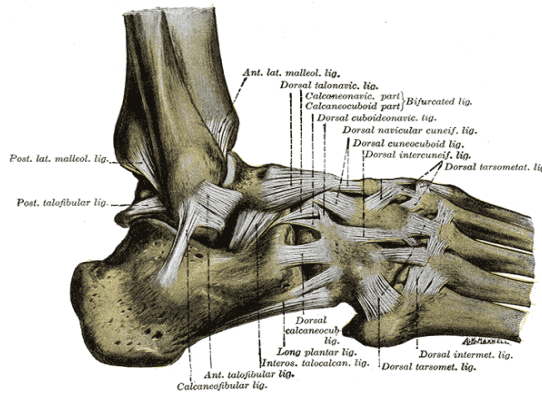
# Treatment – Bottom Up Approach

## Primary Focus

- Evaluating how structure influences function
  - 26 Bones
  - 33 Joints
  - >100 Tendons, Ligaments, Muscles

## Intervention

- Stabilization
- Motor control & timing



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## Stabilization

### Understanding your assessment

- Taping vs Orthotics
  - Foot appearance weight-bearing and non-weight-bearing
  - Subtalar joint:
    - End-feel: restricted, normal, loose
    - Motion: 2-to-1 inversion/eversion ratio
  - Forefoot : varus versus valgus
  - 1st ray position : plantarflexion (PF) vs dorsiflexion (DF)
  - Hallux Dorsiflexion : rigid, semi-rigid, average
  - Tibial torsion influence
  - Gait, pain, endurance , diagnosis



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## Motor Control & Timing

### Exercises

- Dip with towel roll under arch
- Single-leg push off with band
- Timing drill for push off



## Instability

- Prevention
  - Taping and bracing have been shown to decrease incidence of ankle sprains
    - Taping loses 50% of its strength in the first 20m
  - Provide direct mechanical support for an unstable ankle
    - Also suggested that the beneficial effect is explained by enhancement of proprioception through skin pressure
    - Decreases peroneal reaction time to firing
  - Proprioceptive exercise programs have also shown to decrease rates of sprains
  - Should be a multidisciplinary approach
    - bracing, balance training, rehabilitation, and muscle recruitment evaluation for the entire lower extremity



## Chronic Instability

- Residual instability after ankle sprains in 32-76%
- C/o residual swelling, pain, instability
- Dx'd with a combination of PE, stress radiographs, MRI, ankle arthroscopy
- DDx must include OLT, peroneal tendon pathology, base of the 5<sup>th</sup> MT fx, fx of the lateral or posterior process of the talus, anterior calcaneus fx, syndesmosis injury



## Chronic Instability

- Treatment varies based on residual disability
- *Functional instability* → sensation of instability without ligamentous laxity
- *Mechanical instability* → laxity of medial or lateral ligamentous structures
  - 10mm of anterior translation of talus (or >3mm)
  - PF/inversion stress of >9°



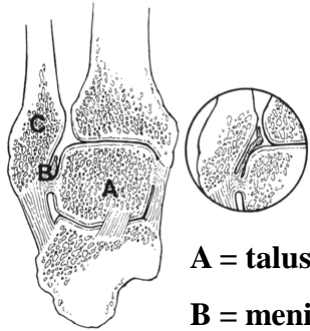
## Chronic Instability

- Treatment
  - Non-op
    - Brace, activity modification, PT
  - Operative
    - Anatomic reconstruction of of CFL & ATFL
      - Gould modification of the Brostrom, autograft reconstruction
    - Non anatomic tenodesis
      - Watson-Jones, Evans, Chrisman-Snook





## Lateral Impingement Syndrome



**A = talus**

**B = meniscoid  
lesion**

**C = fibula**

- Soft tissue impingement
- Anterior Tib Fib Ligament Hypertrophy
- Bony Impingement

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*DeLee & Drez, 1994*

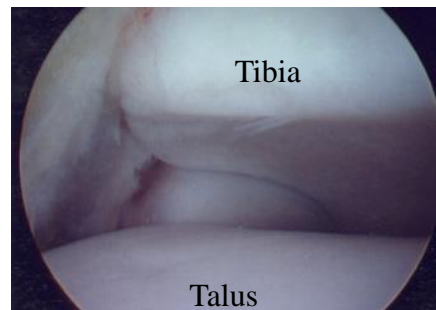
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## Surgical Findings

Soft-tissue impingement



Before Debridement



After Debridement

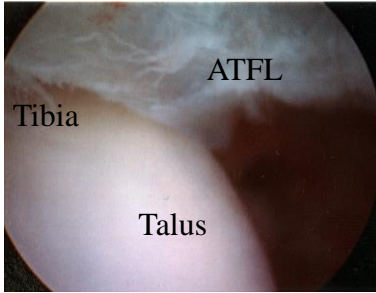
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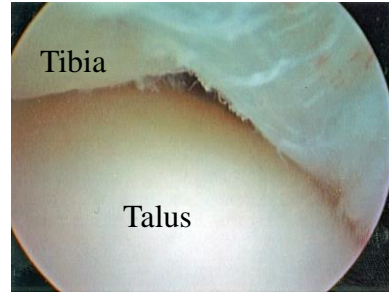


## Surgical Findings

Instability lesion with tear or hypertrophic ATibFibL



Before Debridement

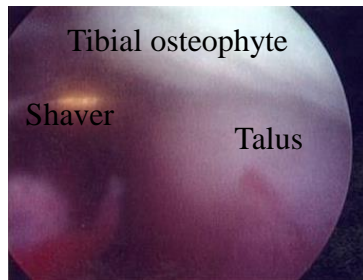


After Debridement

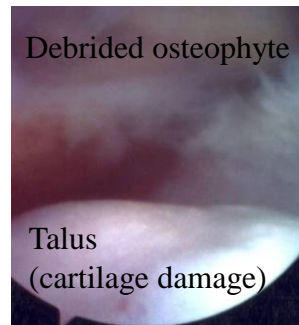


## Surgical Findings

Osteophyte



Before Debridement



After Debridement



## Question:

When should a child with an ankle sprain be placed in a cast

- A. Never
- B. If they can't get a cam walker
- C. If PT will be delayed
- D. If they have a Grade III or syndesmosis injury



## Question:

When should an MRI be ordered:

- A. Whenever the parent wants one
- B. If there is a lot of swelling
- C. For patients who don't respond to conservative treatment
- D. If there is significant instability



## Question:

What percentage of injuries to NCAA athletes do ankle ligament sprains represent?

- A. 10%
- B. 15%
- C. 20%
- D. 25%



## Thank You!

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