# Common Foot & Ankle Injuries

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- OSU PM&R  
- OSU Physical Therapy
Acknowledgement

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Disclosures

• None

Foot & Ankle Center of Excellence

• Comprehensive care for all adult foot and ankle problems:
  • Sports injuries / Sprains / Cartilage disorders
  • Arthritis / Degenerative conditions
  • Deformities
  • Trauma / Fractures
  • Bunion / Hammertoes
  • Whatever is causing your pain
### Common Problems of the Foot & Ankle

- Acute ankle sprains
  - Late pain after ankle sprains / associated injuries
- Stress fractures
- Achilles tendon ruptures
- Plantar fasciitis
- Bunions
- Ankle arthritis

### Acute Ankle Sprain

- Exceedingly common
  - 10-40% of civilian athletic injuries annually
    - Significant time lost to injury
  - 1 inversion event per 10,000 people per day
    - 23,000 to 30,000 ankle injuries per day in U.S.
    - 10% or ER visits in U.S.
  - 45% of all basketball injuries
  - 31% of collegiate football injuries
  - 20% of soccer injuries
  - Leading cause of time loss in NFL
  - Most common cause of acute injury in volleyball
The Ankle Sprain

- Mainstay of treatment is functional rehabilitation
  - 80% make a full recovery with conservative treatment

- 20-30% may be symptomatic 3 months after surgery

- Associated injuries may result in continued pain and dysfunction

- Repeat sprains or inadequate rehabilitation may result in chronic lateral instability in 20%

Anatomy and Biomechanics

Calcaneofibular (CFL)

Anterior Talofibular (ATFL)
Mechanism

• Position of instability: plantarflexion and inversion
  • Talus is more narrow posteriorly
• Failure occurs in predictable order
  • Anterolateral capsule
  • ATFL (involved in 85%)
    • Restraint to inversion in PF
  • CFL (also injured in 20-40%)
    • Restraint to inversion in neutral or dorsiflexion
  • PTFL rarely injured

Diagnosis

• History of injury
  • Mechanism of injury
    • Forces involved
    • Direction of foot deviation
  • Prior episodes and frequency
  • Immediate ability to weight bear
Examination of the Foot & Ankle

• Examination
  • Be systematic (knee to toe)
  • Inspection / gait
    – Ecchymosis and swelling
    – Localize tenderness
      » Soft tissue vs bony
    – Ambulatory capacity
    – Neurovascular exam
    – Range of motion

Examination of the Foot & Ankle

• Examination – special tests
  • Anterior drawer
  • Squeeze test
  • External rotation stress test
Anterior Drawer

- Allow the leg to hang freely with foot plantarflexed 25°
- Stabilize the tibia with 1 hand and grasp the heel with the other.
- Pull foot anteriorly, allowing it to rotate internally (around the deltoid) as it translates.
- Incompetent ATFL => Excessive anterior translation relative to other side

* Acute laxity does not correlate with development of late symptoms = does not always require surgery

Are RADIOGRAPHS indicated?

- Ottawa rules

- ANKLE X-rays
  - Posterior tenderness distal 6 cm of tibia or fibula
  - Malleolar tip tenderness
  - Both immediate inability to WB and not able to walk more than 4 steps in ED
Are RADIOGRAPHS indicated?

- Ottawa rules
- **FOOT X-rays**
  - Navicular tenderness
  - 5th metatarsal base tenderness
  - Both immediate inability to WB and not able to walk more than 4 steps in ED

MRI

- Not required in the ACUTE setting
- Considered for the patient with chronic pain (>6 weeks) after ankle sprain
  - Useful for assessing concomitant pathology
  - 90% accuracy for ATFL and CFL tears
- Does not give an absolute indication for surgery
Clinical Classification

• Mild Sprain
  • Able to walk without limp
  • Minimal swelling or point tenderness
  • Pain with reproduction of mechanism of injury

• Moderate Sprain
  • Walking with a limp
  • Localized swelling with point tenderness
  • Unable to rise on toes or hop on injured ankle

• Severe Sprain
  • Prefers crutches and has difficulty bearing weight
  • Diffuse tenderness and swelling

<table>
<thead>
<tr>
<th>Grade</th>
<th>Edema, ecchymosis</th>
<th>Weight bearing</th>
<th>Ligament pathology</th>
<th>Instability testing (anterior drawer)</th>
<th>Time to return to sport</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Localized, slight</td>
<td>Full or partial without significant pain</td>
<td>Ligament stretch</td>
<td>None</td>
<td>11 days</td>
</tr>
<tr>
<td>II</td>
<td>Localized, moderate</td>
<td>Difficult without crutches</td>
<td>Partial tear (ATFL)</td>
<td>None or slight</td>
<td>2-6 weeks</td>
</tr>
<tr>
<td>III</td>
<td>Diffuse, significant</td>
<td>Impossible</td>
<td>Complete tear (ATFL + CFL)</td>
<td>Definite</td>
<td>4-26 weeks</td>
</tr>
</tbody>
</table>
Mainstay of treatment is nonoperative management, even in the athletic population.

Treatment – Acute Ankle Sprain

- P.R.I.C.E
  - Protection
  - Rest
  - Ice
  - Compression
  - Elevation
- Progressive weightbearing as tolerated
- Early range of motion
- Physical Therapy – functional ankle rehabilitation
**Treatment – Acute Ankle Sprain**

**Bracing**
- Protection from inversion to prevent weaker type III collagen → elongation
- 3 weeks → collagen starts to mature, controlled stress on the ligament promotes proper collagen orientation

**Functional Rehabilitation**
- Ankle motion, stretching and strengthening will avoid harmful effects of immobilization on muscle, joint cartilage, and bone

- Full return to activities between 4-8 weeks

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**Treatment – Acute Ankle Sprain**

**Bracing**
- Semi-rigid ankle support: shorter time to return to work & sport, less symptomatic instability at short-term follow-up

<table>
<thead>
<tr>
<th>Grade 1 &amp; 2</th>
<th>Grade 3</th>
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</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Image 1" /></td>
<td><img src="image2.png" alt="Image 2" /></td>
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</table>
## The Ankle Sprain

- **Functional Rehabilitation**
  - Achieve full ROM
  - Peroneal tendon strengthening and proprioception
  - Gradual progression of weightbearing and return to play

  - Supervised PT has better outcome with regard to strength and proprioception in the short term
  - Re-injury rates and long term functional results similar to home therapy plans

## The Ankle Sprain

- Grade I and II → good to excellent

- Grade III → a little more controversial
Acute Sprain → Chronic Instability

- 10-20% risk after ankle sprain
- Two types
  - Mechanical
    - Abnormal clinical laxity
    - Pathologic hypermobility of the tibiotalar joint
  - Sign
  - Functional
    - Subjective instability
    - Unreliable ankle, no demonstrable radiographic signs of instability
    - Symptom

Operative Indications for Lateral Ankle Reconstruction

- Continued pain and instability despite extensive non-operative management
  - Must rule out and/or treat other pathology
Surgical Management of Lateral Ankle Instability

- Anatomic reconstruction
  - Modified Brostrom lateral ligament reconstruction
  - Allograft lateral ligament reconstruction

Return to Play after Lateral Ligament Reconstruction

- Outcomes of athletes after Brostrom
  - 58% returned to preinjury level
  - 16% competing at a lower level
  - 26% discontinued sport but still active
    • (Maffulli et al, AJSM 2013)
Rehab and Recovery after Reconstruction

- Phase I – ROM
- Phase II – Endurance
- Phase III – Strength
- Phase IV – Power
- Phase V – Return to Sport Testing and Physician Clearance
  - Achieve 90% of contralateral limb strength

Clinically significant late pain after ankle sprain

- Clinically significant pain >6 weeks after injury without recurrent injury or instability
  - Consider pathology that may be in conjunction with an ankle sprain or consider a different diagnosis
    - Soft tissue lesions
    - Bone / articular lesions
Soft Tissue Lesions

• Anterolateral soft tissue impingement

  • **Complaint:** focal anterolateral pain, worse with dorsiflexion and cutting maneuvers
  
  • **Exam:** focal anterolateral ankle tenderness
  
  • **Treatment:** steroid injection; arthroscopic debridement

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Soft Tissue Lesions

• Peroneal tendon tear

  • **Complaint:** focal lateral pain, worse with eversion
  
  • **Exam:** swelling, focal lateral tenderness, pain with eversion
Soft Tissue Lesions

- Peroneal tendon tear
  - **Treatment**: NSAID/immobilization, lateral heel wedge, surgical debridement or repair if no response

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Soft Tissue Lesions

- Peroneal tendon subluxation
  - **Complaint**: pain and snapping of tendons over fibula
  - **Exam**: swelling, focal ttp posterior to distal fibula, dislocation of tendons with resisted eversion
Soft Tissue Lesions

• Peroneal tendon subluxation
  • Treatment: fibular groove deepening and retinacular reconstruction

Soft Tissue Lesions

• Sinus tarsi syndrome
  • Complaint: pain and swelling lateral hindfoot, exacerbated on uneven surfaces
  • Exam: swelling, focal ttp anterior to distal fibula
  • Treatment: NSAID/immobilization, steroid injection, arthroscopic debridement
Syndesmotic Injury – High Ankle Sprain

- Collision sports, 10% of all ankle sprains
- Mechanism: external rotation
  - Direct force posterior calf of downed player with foot externally rotated
  - External rotation force on knee while foot firmly planted

Soft Tissue Lesions

- Syndesmotic injury
- Complaint: pain in distal leg and ankle with cutting/twisting
- Exam: external rotation stress test; squeeze test
- Xrays/MRI/US:
  - Stress xrays: disruption or widening of syndesmosis
Syndesmotic injury - Treatment

- Grade I and II:
  - RICE, PT, ankle brace or taping
- Grade III:
  - Acute- ORIF (screws/Tightrope)
  - Chronic- arthroscopic debridement + fixation
- Longer time to return to play and more residual symptoms than simple ankle sprain

Soft Tissue Lesions

- Superficial peroneal neuropraxia – intermediate branch

  - **Complaint:** anterolateral pain / burning / numbness
  - **Exam:** focal ttp, + tinels, decreased sensation dorsolateral foot
  - **Treatment:** neurontin / lidoderm patch / desensitization
    - Neurolysis vs. transection
## Bone / Articular Lesions

- **Juxta-articular fractures**
  - **Complaint:** pain swelling in the area of the fx
  - **Exam:** focal ttp, pain with provocative maneuvers
  - **Imaging:** often apparent on xray but must look closely
    - Bone scan: hot locally
    - CT scan: define fragment size and articular involvement to define surgical plan
  - **Treatment:** immobilization in cast or boot 4-6 weeks
    - Excision vs. ORIF if large articular fragments

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## Bone / Articular Lesions

- **Juxta-articular fracture**
  - **Anterior process of the calcaneus**
Bone / Articular Lesions

- Juxta-articular fracture
  - Posterior talar process (Stieda process)

Bone / Articular Lesions

- Juxta-articular fracture
  - Lateral talar process
Bone / Articular Lesions

- Juxta-articular fracture
  - Dorsal navicular rim avulsion
- Distal fibular avulsion
- Cuboid avulsion

Bone / Articular Lesions

- Osteochondral lesion of the talus (OLT)
  - **Complaint:** swelling, sharp pain/aching deep in joint, occasional mechanical locking/catching
  - **Exam:** focal ttp @medial / lateral shoulder of talus
  - **Imaging:** xray may show cyst in chronic OLTs, CT/MRI is diagnostic
  - Sometimes an incidental finding
    - If not symptomatic does not require treatment
<table>
<thead>
<tr>
<th>Bone / Articular Lesions</th>
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</thead>
<tbody>
<tr>
<td><strong>Osteochondral lesion of the talus (OLT)</strong></td>
</tr>
<tr>
<td><strong>Non-operative management</strong></td>
</tr>
<tr>
<td>• Non displaced acute lesions</td>
</tr>
<tr>
<td>• Immobilization x 6 weeks</td>
</tr>
<tr>
<td><strong>Operative Management:</strong></td>
</tr>
<tr>
<td>• Failed conservative care, large and/or displaced fragments</td>
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</tbody>
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<thead>
<tr>
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<tbody>
<tr>
<td><strong>Surgical Treatment:</strong></td>
</tr>
<tr>
<td>• Mesenchymal cell stimulation</td>
</tr>
<tr>
<td>• Microfracture, abrasion chondroplasty</td>
</tr>
<tr>
<td>• Autograft osteochondral transfer</td>
</tr>
<tr>
<td>• Allograft osteochondral transfer</td>
</tr>
<tr>
<td>• Allograft chondral transfer</td>
</tr>
<tr>
<td>• Autologous chondrocyte implantation (ACI)</td>
</tr>
<tr>
<td>• Juvenile particulated allograft cartilage</td>
</tr>
<tr>
<td>• Biocartilage</td>
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</tbody>
</table>
Bone / Articular Lesions

- 5th metatarsal fractures
  - Poor blood supply to zone 2
  - Clinically assess for:
    - Area(s) of tenderness
    - Cavovarus foot posture
    - Chronicity of fracture (sclerosis or periosteal reaction)

Zones:
1= tuberosity avulsion fractures (may enter 5th MT-cuboid articulation)
2= Jones fractures (metaphyseal-diaphyseal junction)
3= stress fractures (distal to 4/5 IM ligaments, extends distally into diaphysis for 1.5cm)
Zone 1 - 5th MT tuberosity avulsion fractures

- Treatment usually hard-soled shoe or boot
- 4 wks usually patients asymptomatic
- Time to healing approximately 8 wks
  - Symptomatic nonunion - excise fragment

Jones Fracture
5th Metatarsal Jones fracture

- Non-displaced fractures: Nonweightbearing cast or boot 6-8 wks
- Consider surgery if:
  - Displaced fracture
  - Athlete
    - Quill 1995: 25-50% of fractures treated closed found not to heal or to re-fracture
- Delayed union or nonunion:
  - Return to play @8-10wks post ORIF if radiographically healed fracture

Jones fracture
Bone / Articular Lesions

• Tarsal coalition

  • Complaint: recurrent ankle sprains in the adolescent, lateral hindfoot pain
  • Exam: rigid subtalar motion
  • Imaging:
    • Calcaneonavicular bar
    • Talocalcaneal coalition
  • Treatment: immobilization always first step
    • Resection/arthrodesis depending on size and location of refractory

Bone / Articular Lesions

• Anterior impingement

  • “Footballer’s ankle”
  • Runners and jumpers
  • Pain, localized anteriorly
  • Limited ROM
  • Xrays: exostosis distal tibia (usually lateral), cupping of talar neck +/- spur
  • Treatment
    • Conservative: ↓ activity
    • Surgery if persistent symptoms and xray evidence of impingement
### Metatarsal stress fractures

- "March" fractures
- Military recruits or dancers frequently affected
  - Increase in duration or intensity of exercise
  - 2nd MT involved more commonly than 3rd MT
- Fatigue-type fractures
- Point tenderness over affected metatarsal (not web)
  - Circumscribed swelling over dorsal foot that does not extend to medial or lateral border of foot
- Initial xrays usually negative
- Treatment: hard-soled post-op shoe, cessation of inciting activity
- Recovery variable: usually return to normal shoewear by 6-8wks
  - Shoe modification with orthosis

### Navicular Stress Fractures

- Exam:
  - Dorsomedial vague pain, prolonged symptoms
  - Positive percussion test over navicular
  - Limited motion of subtalar joint (50%)
  - Pain generated in navicular area when patient stands on toes
- Often xrays negative:
  - Bone scan sensitive, CT determines fx location and extent, MRI shows early edema
Navicular stress fracture

- Incomplete or nondisplaced fractures:
  - Cast and nonweightbearing for 6 wks
  - Protected WB for 6 wks
  - RTP avg 4 months; +/- orthotic with medial longitudinal arch support
- Operative treatment considered:
  - Complete fractures with sclerosis
  - Displaced fractures
  - High-demand athletes with nondisplaced fractures
    - Quicker RTP (83% healing, RTP 3.6mos vs 5.6mos)
  - Persistent symptoms or failed conservative treatment

Stress fractures

- MRI – most accurate test for suspected lower extremity stress fractures
  - Meta-analysis
    - Radiographs (sensitivity 12-56%)
    - Bone Scans (sensitivity 50-97%)
    - CT scans (sensitivity 32-38%)
    - Ultrasound (sensitivity 43-99%)
    - MRI (sensitivity 68-99%)

Achilles Tendon Rupture

• Dual blood supply
  • Muscles above
  • Bony attachment below
  • Watershed zone
    – 1-4 inches above tendon attachment to heel bone

Achilles Tendon Rupture

• Complete disruption of Achilles tendon
  • Location
    • Often 5-7 cm above insertion to heel bone
  • Commonly affected
    • Middle aged (average age in 40s)
    • Men (M:F ~3:1)
    • “weekend warriors”
### Achilles Tendon Rupture

**History**
- Mechanism of injury
  - Eccentric loading (pushing off)
- Pop
  - “someone hit the back of my ankle”
- Inability or difficulty walking
- Pain behind ankle
- Possible association with
  - Prodromal symptoms
  - Recent fluoroquinolone use
  - Recent steroid use

**Examination**
- 20-30% delayed diagnosis
- High clinical suspicion
- Thompson Test
- Gap sign
- Loss of resting equinus
Achilles Tendon Rupture

- Examination
  - Thompson Test

Achilles Tendon Rupture

- Examination
Achilles Tendon Rupture

- Imaging – not usually required
  - Xrays
    - May rule out fracture
  - MRI
    - Helpful for delayed presentation or equivocal clinical exam
  - U/S
    - Inexpensive, can confirm diagnosis and localize tear

Achilles Tendon Rupture

- Initial Treatment
  - Immobilize in plantarflexion
  - Keep nonweightbearing with crutches
  - RICE therapy
  - Counsel on signs and symptoms of DVT
Achilles Tendon Rupture

• Treatment
  • Controversial
    • With early diagnosis and immobilization, may achieve similar results
    • Management depends on surgeon and patient preference
    • May favor surgery for athletes, younger patients, and delayed diagnosis with diastasis of tendon ends

• Treatment
  • Nonoperative
    • NOT a passive treatment program
    • Immediate immobilization in plantarflexion
    • Progression to formal Physical Therapy for functional rehab after 2 weeks
      – Transition to boot with 2cm heel lift
      – Progressive return to weightbearing and controlled strengthening
Achilles Tendon Rupture

• Treatment
  ✓ Operative
    • Multiple options
    • Open
    • Limited incision
    • No significant differences confirmed between methods

Heel Pain – Plantar Fasciitis

• Most common cause of plantar heel pain
• Peak age of incidence between 40-60 years
• Risk factors include runners, prolonged standing, obesity, limited dorsiflexion of the ankle
Plantar Fasciitis

• **History**
  - Insidious onset without trauma
  - Typical pain with start up or initiation of weight bearing
  - First thing in the morning or after sitting for periods of time (watching TV, driving, eating)
  - Typically lessened or not symptomatic during activity
  - Often recent increase in activity or change in shoe wear

Plantar Fasciitis

• **Examination**
  - Pain at the medial tubercle of the calcaneus
Plantar Fasciitis

- **Differential**
  - Calcaneal stress fracture
    - Specific onset of symptoms
    - Constant pain
    - Tender on both sides of the heel
    - Worse with weight bearing
    - Present on plain radiographs

![Stress Fracture](image1.png)

- **Differential**
  - Neurogenic (tarsal tunnel, peripheral neuropathy, radiculopathy)
    - Pain may not be specific to the medical calcaneal tuberosity
    - Patients often report burning and tingling pain
    - Tinel's sign
    - Radiating symptoms
    - Lack of focal symptoms to exam
    - Not specific to weight bearing

![Tarsal Tunnel](image2.png)
# Plantar Fasciitis

## Treatment

- **Non-operative treatment**
  - Majority of patients >90% will improve with non-operative treatment
  - Tissue specific plantar fascia stretching
    - Achilles stretching
  - Heel cups
  - Over the counter orthotics
  - Night splints
  - NSAIDs

## Treatment - Nonoperative

- **Injections**
  - Cortisone
  - Platelet rich plasma
    - Limited studies documenting its efficacy
- **Extracorporeal shockwave treatment**
  - High and low energy options
    - Well tolerated
- **Immobilization**
  - Cam boot 2-4 weeks
## Plantar Fasciitis

- **Treatment – Surgical**
  - **Recalcitrant cases > 12 months**
    - **Plantar fasciotomy**
    - **Open or endoscopic techniques**
    - **Assess lateral plantar nerve**
  - **Achilles or Gastrocnemius lengthening**

## Hallux Valgus - Bunions

- **Common causes**
  - **Extrinsic**
    - Inappropriate shoegear
  - **Intrinsic**
    - Hereditary
      » Incompetent soft tissue restraints
      » Generalized joint hypermobility
      » Predisposing bony anatomy
Hallux Valgus - Bunions

- Conservative Therapy is always the first line
  - Operate on the shoe
  - Pads, Spacers

Bunions

- Surgical Treatment
  - Symptoms that persist despite nonsurgical treatment
  - Factors to consider
    - Existence of arthritis or arthrosis
    - Degree of deformity and passive correctability
  - Patient expectations
    - May potentially discourage surgery in
      - Athletes not willing to potentially give up sports
      - Women wanting to constantly wear high heels with narrow toe boxes
Bunions

- Surgical Treatment
  - Requires Osteotomy (cutting and resetting) or Fusion

<table>
<thead>
<tr>
<th>Minimally Invasive</th>
<th>Traditional</th>
</tr>
</thead>
</table>

[Images of surgical procedures]
## Ankle Arthritis

### Etiology

- Osteoarthritis is not the most common etiology
  - Trauma
  - Inflammation
  - Infection
  - Instability

### Symptoms

- Band of pain and swelling around ankle
- Limited motion (loss of dorsiflexion more common)
- Possible deformity
- Gait disturbance / Limp
Ankle Arthritis

• Xrays
  • Loss of joint space
  • Periarticular osteophytes
  • Subchondral sclerosis and cysts

Ankle Arthritis

• Nonoperative Treatment
  • Activity modification
  • NSAIDs
  • Bracing
  • Rocker bottom shoes
  • Injections
Ankle Arthritis

- Surgical Treatment
  - Arthroscopic/ open debridement
    - Bone and soft tissue impingement
  - Tibial/ calcaneal osteotomy
  - Distraction arthroplasty
  - Allograft replacement
  - Arthrodesis
  - Total ankle replacement

Ankle Arthritis

- Surgical Treatment
  - Tibial osteotomy
Ankle Arthrodesis

- Ideal patient
  - Reasonably mobile
  - Middle-to-old aged patient
  - Normal or low BMI
  - Good bone stock
  - Minimal deformities
  - Multiple joint arthritis
    - Rheumatoid arthritis
    - No neurovascular impairment

Total Ankle Replacement

- Ideal patient
  - Reasonably mobile
  - Middle-to-old aged patient
  - Normal or low BMI
  - Good bone stock
  - Minimal deformities
  - Multiple joint arthritis
    - Rheumatoid arthritis
    - No neurovascular impairment
## Summary

- Treatment of foot and ankle conditions can prove quite complicated
  - impact quality of life
  - minor foot and ankle problems can turn into big ones
- We provide comprehensive care responsive to current and long-term patient needs
  - Most problems can be treated effectively without surgery
- Forefront of orthopaedic technology, offering cutting-edge techniques and developing new procedures for difficult problems