Top 5 Sports Foot and Ankle Injuries

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Ankle injuries - Epidemiology

- Most common injury sustained during sporting activities
- Account for up to 40% of all athletic injuries
- Most commonly seen in basketball, soccer, running, and ballet/dance
- Account for up to 53% of basketball injuries & 29% of soccer injuries

Anderson, JAAOS, 2010.

- Multiple associated injuries
- 10% of ER visits in US
  - Incidence of 30,000 ankle sprains daily

Athletic Foot and Ankle Injuries

- Ankle Sprains
- Achilles Tendon Injuries
- Osteochondral Injuries
- Stress Fractures
- Turf toe

Ankle injuries

- 75% involve lateral ligament complex
  - Equal incidence b/w males & females
- 80% make a full recovery with conservative tx
- 20% develop mechanical or functional instability resulting in chronic ankle instability

Lateral Ankle complex

- Consists of 3 ligaments:
  - ATFL
  - PTFL
  - CFL

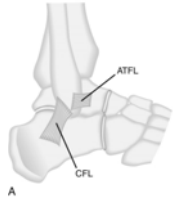
- ATFL is the weakest lateral ankle ligament
- Isolated testing of the ankle ligaments demonstrates that the ATFL is the 1st to fail (deep deltoid is last)

History

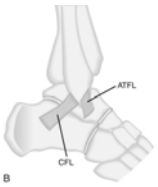
- Mechanism of injury
- Prior ankle injuries
- Ability to continue to play or bear weight
- Location of pain
- "Pop" (more severe injury)
- Level of activity
- Rehab: Period of immobilization?
  - Type? Duration?

The position of the talus relative to the long axis of the leg is important for determination of the function of the lateral ankle ligaments:

- In neutral DF: ATFL is perpendicular to the axis of the tibia & CFL is parallel
- CFL provides resistance to inversion or varus tilt



- When talus is PF: (most common position for lat ankle inversion injuries), ATFL is parallel & CFL is perpendicular
- ATFL is responsible for resisting inversion stress



Physical Exam

- Inspection
  - Swelling
  - Ecchymosis
  - Blisters
  - ? Gross deformity
- ROM: Active & passive
- Palpation
  - Ligaments: ATFL, CFL, PTFL, Syndesmosis, Deltoid
  - Bone: Fibula, Tibia, Talus, 5th MT, Calcaneus
  - Tendons: Peroneal, Post tibial

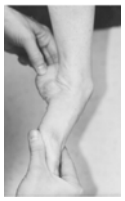
Special tests

- **Anterior drawer**
  - Pt is seated, flexed leg hangs off table
  - Examiner stabilizes distal tibia with 1 hand while other hand grasps heel & pulls foot forward
  - Performed in neutral DF (CFL) &
  - PF positions (ATFL) & compared w/contralateral ankle
    - False neg results may occur by involuntary guarding or pain
  - ↑ translation of 3 mm compared to uninjured side or absolute value ≥ 10mm correlates w/ATFL incompetence

(Karrlson AJSM 1989)

Special tests

- **Talar Tilt**
  - Pt is seated, leg secured with examiner's open hand, & the heel is grasped from behind w/the opposite hand
  - Varus (inversion) force is applied to produce talar tilt
  - Performed in neutral DF (CFL) & PF positions (ATFL) & compared with contralateral ankle

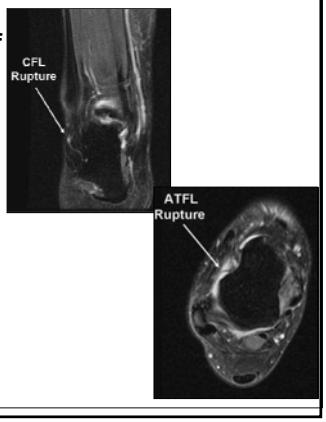


Imaging

- **Standard ankle series: AP, lat, mortise (wt bearing)**

MRI

- **Useful for evaluation of acute, subacute & chronic lateral ankle ligament injuries.**
- **Associated injuries to talar dome, peroneal tendons, IO ligaments, tarsal coalition.**
- ***Swenson et al. AJSM 2009.***



Initial Treatment (1st 24-48 hours)

- **Rest/ Crutches**
  -Gradual return to full weight bearing as tolerated.
- **Immobilizaton**
  -Fracture boot or splint
- **Ice**
  -20 minutes per hour while swelling present
- **Elevation**
  -Above heart level while reclining to decrease swelling.
- **Anti-inflammatory Medications**
  -Ibuprofen, Naproxen

Grading System

Acute Grade	Anatomic Injury	Historical Findings	ExamFindings
I	Stretching of the ATFL	Inversion injury, subacute pain and swelling, continuous athletic activity	Mild swelling, mild ATFL tenderness, stable ankle
II	Partial tearing of the ATFL	Inversion injury, acute pain and swelling, inability to continue athletic activity, painful gait	Moderate swelling, moderate ATFL tenderness, stable ankle
III	Complete rupture of the ATFL ± CFL	Inversion injury with associated "pop," acute severe pain and swelling, inability to walk	Severe swelling, severe ATFL tenderness, unstable ankle

Less important to differentiate a grade I from grade II, but a distinction should be made between a grade I & grade III, or an isolated ATFL from an associated syndesmotic injury

Non-Op Treatment

- **Early mobilization**
- **Ankle support**
  - **Taping**
  - **Semirigid (air-stirrup) brace**
  - **Lace-up brace**

Non-Op Treatment

- Rehab:
  - Motor strengthening
    - Peroneals in particular
  - Proprioception training
    - ↑ balance & neuromuscular control
      - Tilt board
      - Trampoline
  - Coordination

Surgical Indications

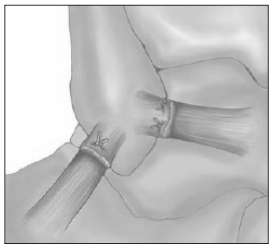
- Indicated for patient with chronic injuries that remain symptomatic after a focused rehab program.
  - Instability ± pain
- Contraindications:
  - Pain without instability
  - Instability due to neuropathy

Chronic Lateral Ankle Instability

- Assoc w/ apprehension, discomfort, swelling, weakness, tenderness, & loss of coordination
- Worse on uneven surfaces
- Develops in 20% of patients after acute injury
- Brand et al: reported 10% prevalence of "functional" lat ankle instability among 1300 Naval academy freshmen
  - May be related to prior ankle sprain, chronic instability or peroneal weakness
- Impaired proprioception, neuromuscular control

Anatomic Repair

- Brostrom: 1st to describe a midsubstance repair of the ATFL & CFL in 1966 after reporting on a series of 60 patients
- Gould Modification:
  - Reinforce the repair using the inferior extensor retinaculum to help ↓ inversion & correct ST instability



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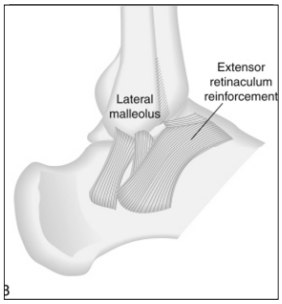
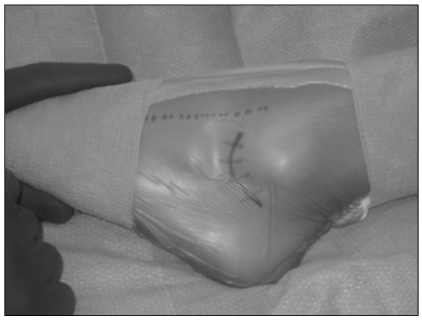
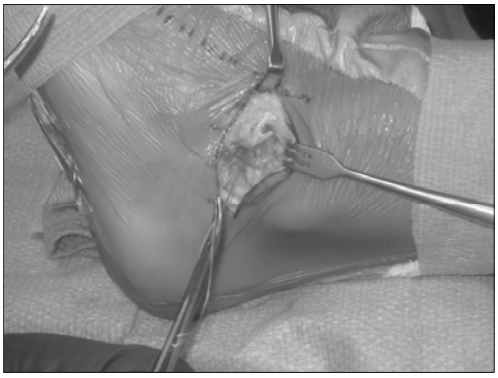


Approach





Post-op Course

- Splint with ankle in neutral DF & eversion
- Changed to cast at 7 days (x3 weeks)
- Begin ROM at 4 weeks
  - Avoid inversion stretching
- Strengthening at 6 weeks
  - Proprioception, balance
- Return to Play: 3-6 months post-op
  - Ankle bracing for 1 year +

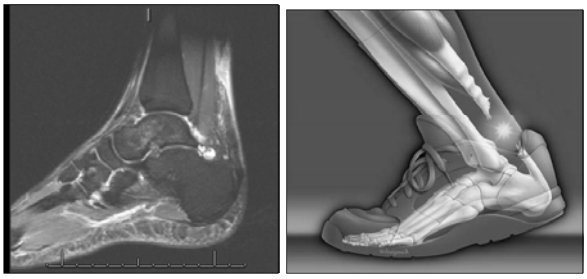
Conclusions

- Ankle sprains and lateral ankle instability are extremely common injuries in athletics.
- Initial treatment should focus on R.I.C.E. with progressive weightbearing and proprioception training physical therapy.
- Chronic instability may require bracing, longterm therapy, or even surgery.
- Prophylactic strengthening is the key to injury prevention.
- Return to play should be a team decision between the player, coaches, and medical staff.

Return to Play Guidelines

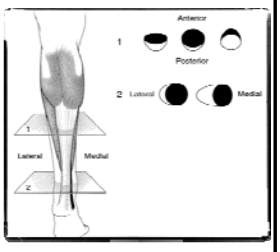
- Initial injury is resolved.
- Pain and swelling are resolved.
- The injured joint has a full range of motion.
- There is full or close to full (90-percent) strength.
- Patients feel they can “trust” the injured leg.
- Sense of instability has resolved.
- The athlete and family understand the risk of reinjury
  associated with returning to sports.

Achilles Tendon Ruptures



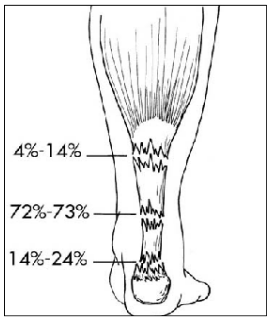
Achilles Anatomy

- Achilles tendon is the strongest + largest tendon in the body
- Begins at junction of gastrocnemius and soleus tendons in middle of calf
- Typically 3 to 11 cm in length
- AT is subjected to the highest loads in the body - up to 10x body weight



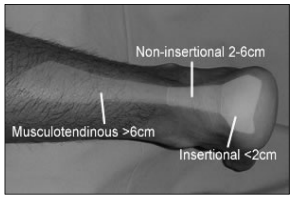
Common Sites of Rupture

- Myotendinous Junction
- Midsubstance 2-6 cm proximal to insertion
- Avulsion



Achilles Tendon Rupture:

- Antecedent tendinitis/tendinosis in 15%
- 75% of sports-related ruptures happen in patients between 30-50 years of age.
- Most ruptures occur in watershed area 2-6cm proximal to the calcaneal insertion.



Achilles Tendon Rupture

- History
  - Feels like being kicked in the leg
  - Mechanism

    Eccentric loading (running backwards in tennis)

    Sudden unexpected dorsiflexion of ankle

    (Direct blow or laceration)

Diagnosis

- Physical Exam
  - Palpable defect
  - Thompson Test
  - Bruising/Swelling
  - Weakness with plantar flexion

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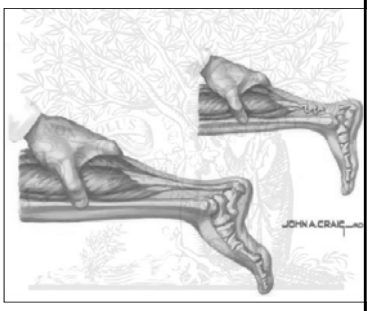

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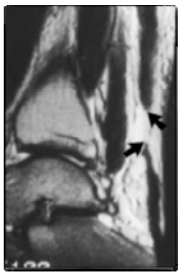
  - Bruising/Swelling
  - Weakness with plantar flexion

Diagnosis

- Imaging
  - Xrays
  - Avulsion suspected
- Preoperative MRI/US used to assess:
  - Condition of tendon ends
  - Orientation of the torn fibers
  - Width of diastasis

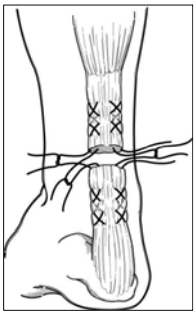
Management Achilles Tendon Ruptures

- Management depends on surgeon and patient preference
- Surgery treatment of choice for athletes, young patients and delayed rupture
- Acute rupture in non-athletes can be treated nonoperatively



Surgical Management

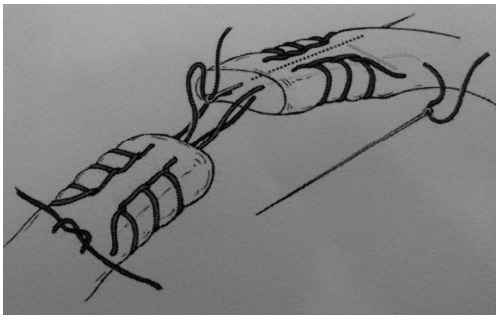
- Bunnell Suture
- Modified Kessler
- Many techniques available



Nonsurgical: Cast or Bracing

- Start early
- Prevent Dorsiflexion
- Plantarflexion Casts
  - 4 weeks
- Bring to neutral
  - 4 to 6 weeks
- Heel lift
- Physical therapy

Surgical Management



Open Technique

- Medial Incision
- +/- Debride mop ends
- Direct suture repair
  - Krackow
  - Nonabsorbable
- Repair paratenon
- Augmentation
  - Turn down flap
  - FHL transfer
  - Plantaris

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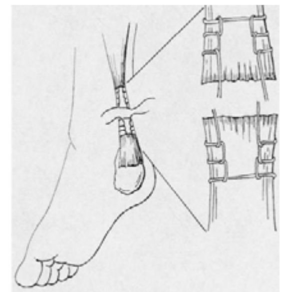

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Surgical Management : Post– op Care

- Assess strength of repair, tension and ROM intra-op.
- Apply splint with ankle in the least amount of plantarflexion that can be safely attained.
- Nonweightbearing for 3 weeks
- Patient returns to clinic 7-10 days post-op and is placed into a plantarflexed cast for 2 weeks.
- At 3 weeks, removable boot with heel wedges to be removed weekly. Progressive weightbearing.
- PT for ROM and progressive strengthening to begin at 6 weeks post op.
- Return to full activity at 6-9 months.

Osteochondral Injuries

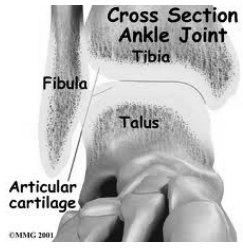
- <u>Definition</u>:
- Injury or disease process affecting the articular surface and/ or subchondral bone of the tibiotalar joint. *Stone, 1996*
- …Most commonly due to trauma and/ or ischemic injury, … comprise a spectrum of injuries related to location, architecture, and size. *Mitchell et al., 2009.*

Achilles Tendon Rupture Recommendations

- Individualize patients
- Determine patient goals
- Increased strength and lower risk of rerupture with surgical repair.
- Conservative Treatment
  - Functional bracing and early rehab

Ankle Cartilage Biology

- Talar articular cartilage is thinner than cartilage in the knee and hip.
- Mean thickness of talar articular cartilage = 0.89 mm.
- Femur, patella, and tibial plateau = 2.0, 3.33, and 2.92 mm, respectively.
- Mechanical properties better maintained with age than knee and hip.
- *Al-Ali et al., 2002; Ateshian et al., 1991.*



Classification

- I Subchondral bone compression
- II Osteochondral fragment partially detached
- III Osteochondral fragment completely detached but not displaced
- IV Osteochondral fragment completely

Surgical Indications

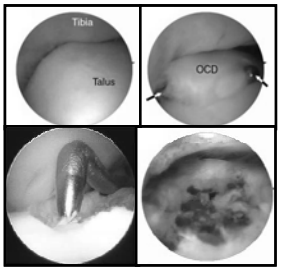
- Symptomatic focal lesions that fail to respond to nonsurgical measures.
- Lesions with loose or unstable fragments.
- Contraindications to surgical management of CIA's include infection and medical comorbidities.
- Lesions associated with diffuse ankle arthrosis.
- Lesions that are identified incidentally or not confirmed to be the source of the symptoms.

Diagnostic Imaging

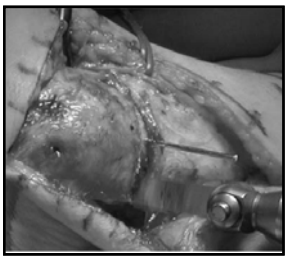
Microfracture Drilling

- Unstable cartilage is removed using a curet, shaver, and grasper.
- Create a stable, contained defect.
- Calcified cartilage layer is removed with a curet.
- Subchondral plate of the defect is

penetrated in multiple locations.



OATS/ Mosaicplasty



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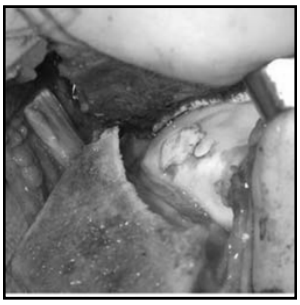

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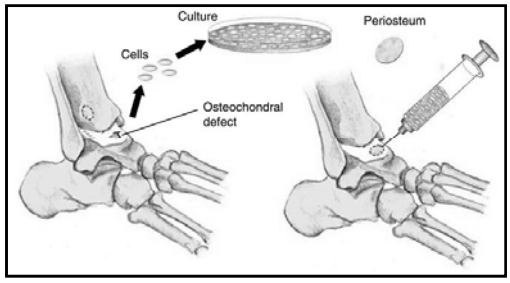

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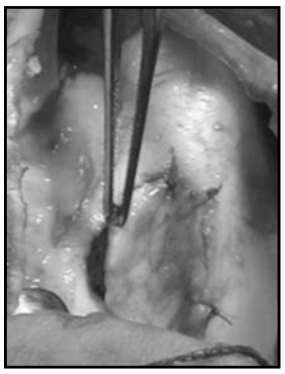

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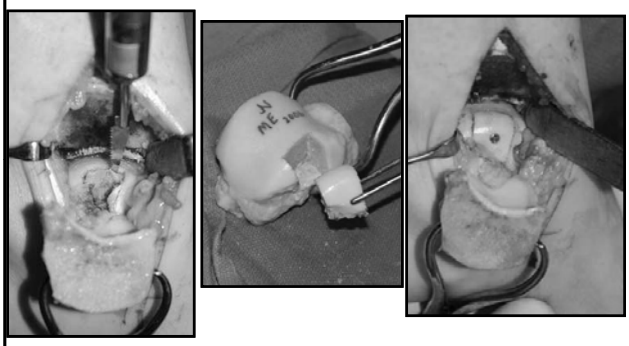
Structural Allograft Reconstruction



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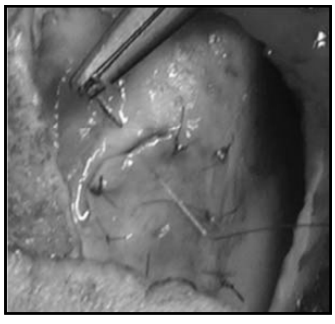

Conclusions

- When nonsurgical measures fail, osteochondral lesions of the ankle can be managed effectively in most cases with arthroscopic débridement and drilling/microfracture.
- Larger-diameter lesions, those associated with subchondral cysts, and those that have failed arthroscopic treatment are candidates for OAT or ACI.
- These techniques have the potential to restore hyaline cartilage in the lesion.

Stress Fractures

Stress Fractures

High-risk stress fractures:

- Anterior Tibial Cortex
- Medial Malleolus
- Navicular
- 5th Metatarsal Base
- Sesamoids

Stress Fractures

- Common overuse injuries in running athletes.
- After ankle sprains, 2nd most common injury among track and field athletes.
- The Female Triad

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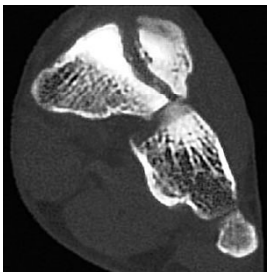

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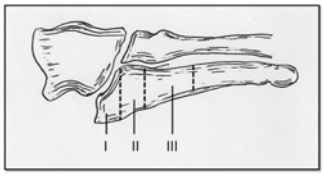
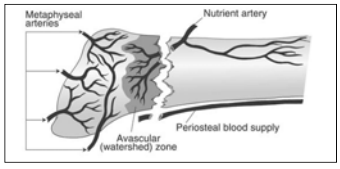
5th Metatarsal Base Stress Fractures

- Jones Fracture





Presentation

- Prodromal activity-related pain associated with varying amounts of swelling.
- Untreated, progresses to affect ADL's.
- Associated with an abrupt change in the training regimen.
- Increased frequency or intensity of training.
- Point tenderness often develops at the site of the stress fracture.
- Positive hop test, percussion test, tuning fork test.

Imaging

- Plain radiographs often negative.
- Bone scan is sensitive but not specific.
- MRI is preferred test because of high sensitivity and specificity.

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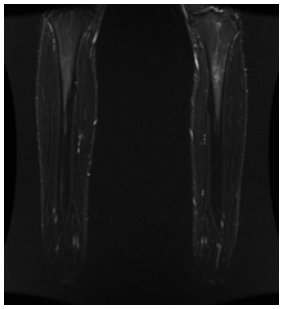


Stress Fracture Classification

- **Clinical and Radiographic Classification System**
- **Based on grade, anatomic site, and imaging modality.**
- **15 Sports Medicine clinicians reproduced the classification system from memory with 97.3% accuracy.**
- **Substantial to "almost perfect" interobserver reliability. (K> 0.6 and 0.8)**
- ***Kaeding, Miller, 2012.***

Grade	Pain	Radiographic Findings (CT,MRI,Bone Scan or X-ray)
I	-	Imaging evidence of Stress FX No fracture line
II	+	Imaging evidence of Stress FX No fracture line
III	+	Non-displaced fracture line
IV	+	Displaced Fracture (> 2 mm)
V	+	Nonunion

38 year old male runner with lateral foot pain x 5 weeks, worse with running.

High Risk Stress Fractures- Treatment

Anterior tibial cortex- Prolonged immobilization and protected weight bearing until symptoms resolve. Intramedullary nailing when no healing is evident within 4-6 months

Medial malleolus- Open reduction and internal fixation with a one-thirdtubular plate and 3.5-mm screws. Bone graft for nonunion.

Navicular- Two 4.0-mm partially threaded, cannulated, or solid compression screws

Fifth metatarsal- (ie, Jones) Solid 4.5+ mm intramedullary screw

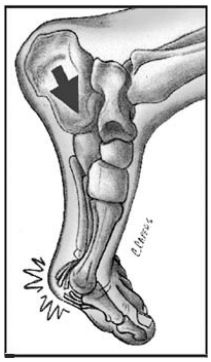
Sesamoids- Excision

Optimize nutrition, hormonal status, and shoe wear!

Turf Toe

Turf Toe

- **Result of a 1st MTP hyperextension injury with axial loading.**
- **Incompetent plantar plate/ sesamoid complex.**
- **Tear of the plantar plate from the distal insertion at the 1st proximal phalanx.**



Turf Toe- Taping

- **Prevent MTP joint hyperextension.**
- **Allow moderate MTP flexion and minimal extension**
- **Create an 'X' of tape with the cross passing over the great toe MTP joint.**
- ***Coker, et al., AJSM, 1978.***

Turf Toe- Grading and Treatment

Grade	Description	Treatment	RTP
I	Attenuation of plantar Structures. Localized swelling	Individualized based on the symptoms	As tolerated
II	Partial tear of plantar structures Moderate swelling Restricted motion because of pain	Walking boot, crutches as needed. Carbon fiber orthotics.	Taping may be required for ≥2 wk
III	Complete disruption of plantar structures Hallux flexion weakness Frank instability of the Hallux MTP joint	Long-term immobilization in a boot or a cast or surgical Reconstruction/ repair.	10-16 wk, depending on sport and position Taping or bracing likely needed

Turf Toe- Surgery

•Plantar Capsuloligamentous Complex Repair.
•Indications: Grade III injuries with refractory symptoms in a high- level athlete.
RTP: 6-12 months without orthosis or taping.
•Late sequelae: Hallux Rigidus

***Anderson R: Turf toe injuries of the hallux metatarsophalangeal joint. Techniques in Foot & Ankle Surgery 2002;1:102-111*.**

Common Foot and Ankle Conditions

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Heel Pain

- Plantar fasciitis
- Heel spur syndrome
  - Misnomer
- Post static dyskinesia
- Plantar heel pain
  - Medial calcaneal tubercle

Objectives

- Top 5 conditions
  - Heel pain
  - Bunions
  - Neuroma
  - Digit deformities
  - Verruca
- Basic evaluation and overview
- Basic treatment

Etiology

- Flat foot
- Overpronation
- Weight gain
- Exercise regimen
- Poor shoe gear
- Barefoot walking

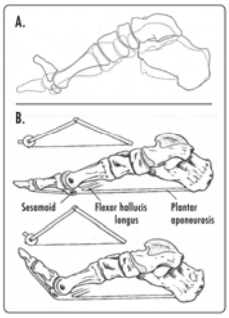
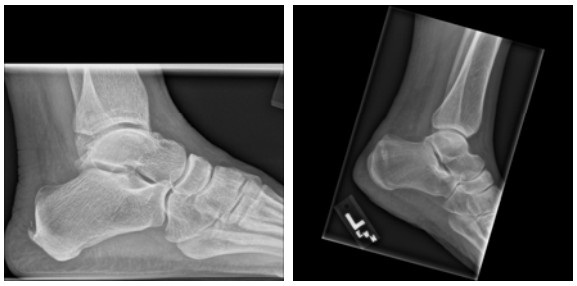


Image from Wikipedia

Spur Comparison

Not Plantar Fasciitis



Physical Exam

- Pronated foot
- Obese
- Edema to plantar/medial heel
- Pain with palpation
  - ✓ Lateral compression

Treatment

- Stretching
- Home cryotherapy
- Avoid barefoot walking
- NSAIDs
- Activity modifications
- Support

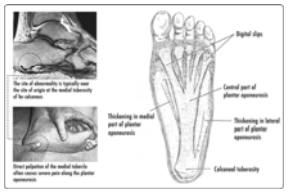


Image from Wikipedia

Secondary Treatment

- Injections
  - ✓ Steroid
- Night splint
  - ✓ Windlass
- Immobilization
- Custom orthotics
- Formal physical therapy

Bunion/Hallux Valgus

- Bump pain
- Etiology
  - Family history
  - Shoe wear
  - Hyperpronation

Surgical Treatment

- Surgery
  - Failed conservative treatment >6 mos
    - Plantar fasciotomy
    - ESWT (extracorpeal shockwave therapy)
    - Coblation

Symptoms

- Medial prominence
- Lateral deviation
- Range of motion
- Bursitis
- Callus
- Central metatarsalgia
- Hammertoe

Radiographic Evaluation

- IM angle
- HA angle
- Joint evaluation
- Congruency
- Bone stock
- Metatarsal length

Surgical Options

- Osteotomy
- Fusion

Treatment

CONSERVATIVE

- Shoe modifications
- NSAIDs
- Orthotics
  - No EBM
- Brace/Padding

Distal Osteotomy

Lapidus Fusion

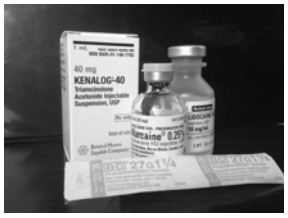
Proximal Procedure

Lapidus Fusion

Phalangeal Osteotomy

Neuroma/Morton's Neuroma

- Burning pain
- Numbness/Tingling
- Sharp radiating pain
- "Wrinkled-sock sensation"



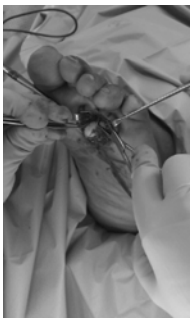
Treatment

- Shoe modifications
- Orthotics
- Padding
- Injections
  - Steroid
  - EtOH
- Surgery
  - Excision
  - Decompression

Exam

- Pain with palpation
- Mulder's click
- Radiating sensation
- Radiographs
  - ✓ R/O differentials
- Ultrasound
- MRI

Neuroma Excision



Digital Deformities

- Hammertoe
- Claw toe
- Mallet toe
- Crossover toe
- Adductovarus
- Contracture

Polydactyly

Exam

- Radiographs
- Pain with palpation
- Callus
- ROM
- Stability/push up/WB

Conservative Treatment

- Shoe modifications
- Padding
- Debridement
- Taping
- Injections

Surgery

- Arthroplasty
- Arthrodesis
  - Fixation
- Osteotomy
- Tendon transfer
  - Soft tissue balance

Physical Exam

- Hyperkeratotic tissue
- Pinpoint bleeding
- Divergent skin lines
- Pain with lateral compression
  - Differentiates

Verruca

- Human papilloma virus
  - 1,2,4,63
- Verruca plantaris
- Benign epithelial tumor
- 7-10% of population
- Moist surfaces
- Difficult to treat

Not a Wart

Treatment

- Keratolytics
  - Salicylic Acid (60%)
  - Canthiridin
- Cryotherapy
- Laser treatment
  - Leaves a wound
- Excision

Conclusion

- Exhaust conservative treatment
  - Shoe modifications
- Realistic goals
  - Patient expectations
- Surgical treatment options