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Foot and ankle sports injuries

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Foot and ankle reconstruction

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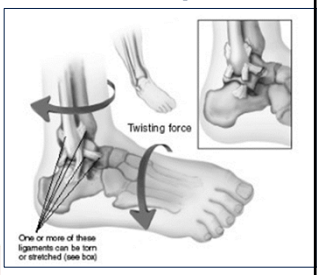
Anatomy of an Low Ankle Sprain

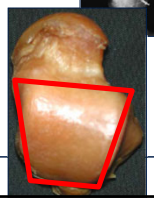
- Common, up to 1/3 of all athletic injuries
- Vast majority respond well to conservative treatment
- Up to 15-20% can develop chronic ankle instability
- Most common mechanism is plantar flexion of the ankle and inversion of the foot



Disclosures: none

The "Equinus Athlete"

- Puts ATFL on stretch
- Less contact area in ankle, biomechanically less stable position → makes these athletes prone to ankle injuries



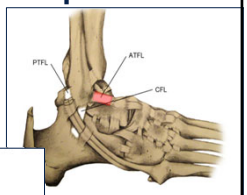
- Ankle instability
  - Chronic lateral ankle instability
- Peroneal tendon pathology
- Turf toe

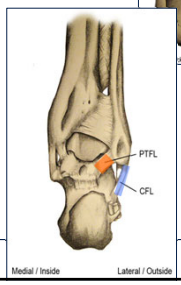
Anatomy: Joint Architecture

- Its really THREE joints!
  - Ankle joint (tibiotalar)
  - Subtalar
  - Syndesmosis

Anatomy of an Ankle Sprain

- Anterior Talofibular Ligament
  - Limits anterior lateral displacement of the talus
  - Limits inversion during plantar flexion of the ankle
- In a more severe plantar flexion inversion ankle sprain the Calcaneofibular ligament may be injured
- Posterior Talofibular ligament generally not injured unless there is a frank dislocation





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Physical Exam

- Swelling and tenderness over the affected ligaments
- Fingertip palpation (most important)
  - Ask patient to point with one finger were they hurt the most
- ROM of ankle: limited DF, PF, Inversion
- Anterior Drawer – ATFL
- Talar Tilt - CFL
- Squeeze test - syndesmosis
- External rotation stress

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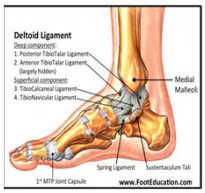
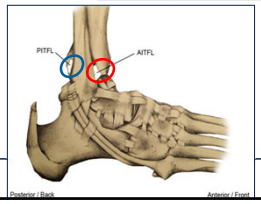
Anatomy of an Ankle Sprain

- Medial ligamentous complex (ie deltoid ligament)
- Rarely injured during an ankle sprain
- If injured it is a sign of a more serious injury



- Syndesmosis "High Ankle Sprain"
- Stabilizes the ankle by resisting rotational, translational, and axial forces



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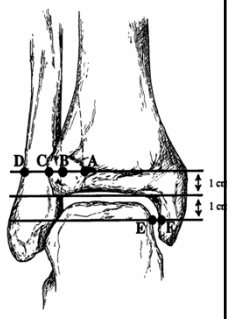
Standard Imaging

- A/P, Mortise, and Lateral x-rays with patient weight bearing if they can tolerate it



- NO ROLE FOR ACUTE MRI

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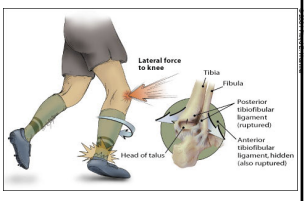
Anatomy of an High Ankle Sprain

- Syndesmosis "High Ankle Sprain"
  - Rare – 1%
  - Mechanism of injury is external rotation of the talus causing separation of the syndesmosis
  - Expect a longer recovery, slower back to play



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Anterior Drawer Test

- Tests integrity of ATFL
- Performed with foot in slightly plantarflexed positions
- A few millimeters of translation is normal (Ringleb et al. 2011 JOR)
- Compare to contralateral side
- "Suction Sign" is positive if dimple in the anterolateral ankle with mane

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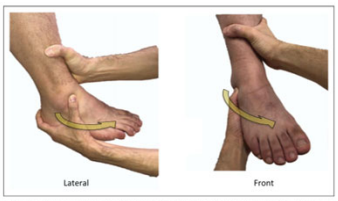
Anterolateral drawer

- ATFL:
  - restraint to anterior talar translation
  - Axial talar rotation
- Therefore testing only anterior translation does not capture true instability
- Anterolateral drawer better then direct anterior drawer (Mann 1999, Phistikul 2012 FAI)



Chang et al. JAAOS 2021

The anterolateral drawer test is performed with the hindfoot held with the thumb overlying the lateral joint line and the ankle plantarflexed 10° to 15° while the other hand stabilizes the tibia. While pulling the foot forward, the foot is allowed to internally rotate and the palpating thumb assesses any progressive step-off between the anterior fibula and the lateral talus.

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Squeeze Test

- Tests integrity of syndesmosis & distal tibia-fibula joint
- Pain at anterior-inferior aspect of ankle suggests anterior inferior tibiofibular ligament injury (AITFL)

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Talar Tilt

- Tests integrity of CFL and ATFL
- Neutral position tests CFL
- Plantarflexed position tests ATFL
- Compare to other side

Jorge de Castillo

Fig. 85.5 Talar tilt test.

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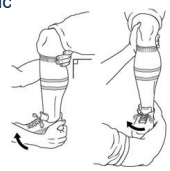
External Rotation Test

- Tests integrity of syndesmosis & distal tib-fib joint
- Pain over anterior or medial ankle suggests syndesmotic injury
- Can be done standing



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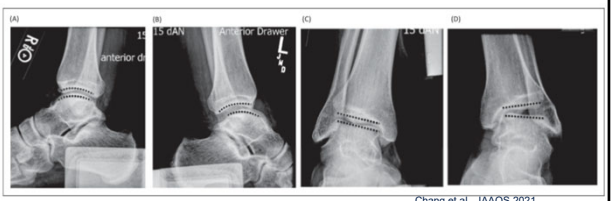
Stress xrays

- AP translation 10mm or 5mm difference compared to contralateral side
- 10deg valgus tilt or at least 5deg difference compared to other side (Hoffman et al FAI 2011)



Chang et al. JAAOS 2021

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Non-Operative Treatment

- Mainstay of management, even in the athletic population
- RICE
- 2wks in boot to rest, then start formal PT for functional rehab
- 10-20% have CLAI

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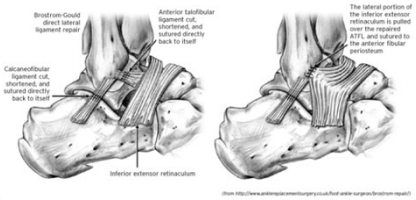
Ankle stabilization procedures:

- Non-anatomic : historical due to subtalar stiffness
- Does not restore physiologic motion of ankle
- Brostrom procedure with Gould modification
- But where should we be repairing the ligaments?



19 Presentation Title

Brostrom vs Brostrom / Gould

Is there a difference?

- Aydogan et al : inferior extensor retinacular augmentation provides protective effect compared to 1 ligament repair
- Behrens et al : no stability difference btw Brostrom and Brostrom Gould

Biomechanical data shows Brostrom alone effectively treats CLAI and that Gould modification may offer slight improvement

20 Presentation Title

Open repair vs suture anchor vs suture tape

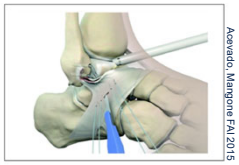
- Biomechanical data show no difference in strength of open repair vs suture anchor fixation
- However **suture anchor** repair is fast and lower complication rate (less soft tissue dissection)
- **Suture tape** augmentation shows superior strength compared to brostrom alone – however unclear how much to tighten
- Potential for over tightening

21 Presentation Title

Open vs all arthroscopic technique

- Easier recovery, faster RTN to sport
- Several biomechanical data: all agree no difference in strength/stiffness in standard open vs all arthroscopic
- Yeo et al. FAI : RTC of 2 techniques: no diff in clinical outcome / stress XR 1yr
- Arthroscopic stabilization is reasonable however SPN risk

Figure 4. Arthroscopic view through anteromedial portal showing relative location of both sets of suture anchors on distal fibula.



Acevedo, Mangone FAI 2015

Figure 5. Animated diagram shows accurate placement of anchors 1 cm apart, ideal exit points of suture limbs also 1 cm apart, and skin incision along Langer's lines for subcutaneous retrieval of sutures. (Courtesy of Arthrex, Inc.)

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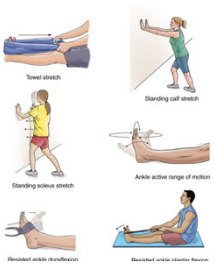
Rehab protocol

- Rehab: biomechanical data supports use of early wb : axial load increases, contact pressure increases rotational stability with ankle in neutral
- Non wb 2wks, then wb in boot/cast, regular shoes 6wks
- RTN to sports ~ 4months
- Ankle brace/taping during play – 70% reduction in recurrent sprains (Dizon et al J Sci & Med in sport 2010)



23 Presentation Title

Peroneal tendon injuries

24 Presentation Title

Peroneal tendon

- Primary hindfoot evertors
- 2ndary plantarflexors

- Important dynamic ankle stabilizer
- Fibula Sulcus
  - Brevis deep to Longus
    - Lower muscle belly
- Superior retinaculum
- Avascular zones
  - Lateral mal
  - cuboid

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Clinical presentation

- Repetitive or acute trauma
- Pain posterior and distal to fibula, on passive hindfoot inversion or active resisted eversion/ankle dorsiflexion
- Palpation/visualization w circumduction
- Hindfoot alignment, coleman block
- Peroneal tunnel compression test

Dreshner MD, Operative Tech in Ortho Surgery, Vol IV

Epidemiology

- Frequently missed. 60% (24/40) peroneal disorders were accurately diagnosed at first clinical evaluation. (Dombek et al)
- Common cause of chronic lateral ankle pain in runners and ballet dancers.
- Reported in up to 77% of patients with chronic lateral ankle instability. (DiGiovanni et al, 2000)
- In cadavers, incidental peroneus brevis splits found 11-37%. Peroneus longus splits are less frequent. (Thompson et al, 1989)

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Dx: Imaging Studies

- X rays
  - Osseous injuries
  - Os peroneum (predispose to PL tears)
  - Lateral impingement
  - Exotoses
  - "*Fleck Sign*" an avulsion of superior peroneal retinaculum
  - Hindfoot alignment views

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Predisposing/associated factors

- Among patients treated for peroneal tendon tears
  - 33% required lateral ligament reconstruction
  - 33% had low-lying PB muscle belly / p. quartus
    - (Dombek et al, 2003)
  - insufficient retromalleolar groove w subluxation
  - 32-82% had cavovarus hindfoot (Redfern et al, 2004. Brandes et al, 2000)

  - Posterior fibula plating

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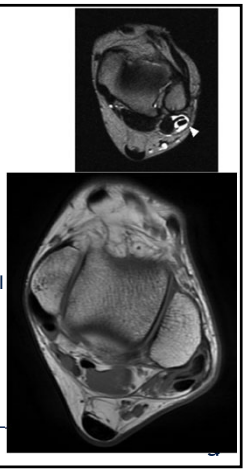
Imaging studies

- *Clinical dx*
- MRI
  - Axial cuts best, but. . . .
  - "Magic angle" (55° to coil)
    - Patient position (prone preferred)
- Ultrasound – operator dependent – dynamic ultrasound best for dislocation/subluxation. Better than MRI
- Concomitant injuries
  - OCD
  - Lateral ligamentous injury



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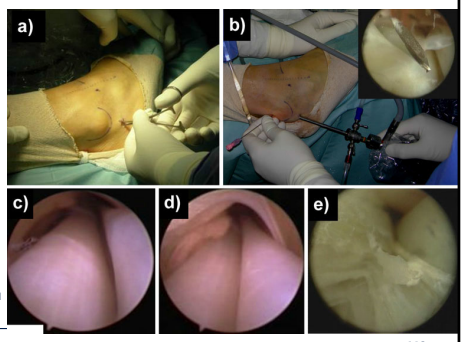
Peroneal Tendinopathy

- Conservative – RICE
- Tendoscopy



(Marmotti et al. Curr Rev Musculoskeletal Med 2012)

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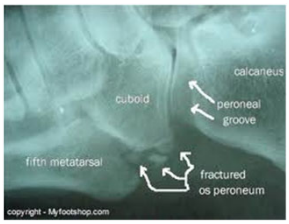
Peroneus Longus Tears

- Retromaleolar sulcus
- Peroneal tubercle
- Rupture distal to os peroneum
  - Fragment retraction from C-C jt
    - 10 mm on lateral
    - 20 mm on oblique
    - Diastasis > 6mm
      - Bridido et al Rad 2005



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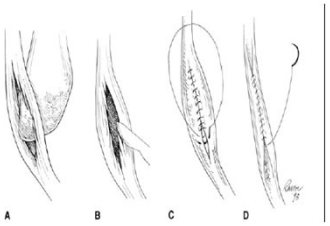
Treatment – peroneal tears

- Krause & Brodsky Classification
  - I <50% involvement
    - Debride/tubularization
  - II >50% involvement
    - *Excision & tenodesis ?*
- Good outcomes for simple tendon repairs



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Irreparable tears: both PB and PL

- Hamstring allograft/autograft if there is sufficient muscle excursion
- Muscle atrophy/fatty infiltration:
- FDL or FHL tendon transfer → PB or 5th metatarsal base
- Staged reconstruction for chronic rupture, with Hunter rod. 3 months later, FHL to PB stump.

- Repair/tubularization
  - ROM/strengthening 2-4wks postop
- Tenodesis/tendon transfer
  - ROM 2-4wks, strengthening 6-8wks

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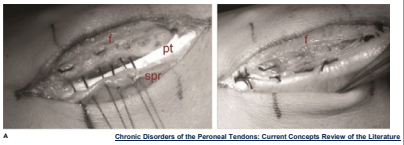
Open peroneal tendon (brevis) repair

- Open tendon debridement, tenosynovectomy, repair vs tendoscopy
- Excision of prominent peroneal tubercle/p quartus muscle
- Correction of cavus deformity
- Fibular groove deepening
- SPR repair



Chronic Disorders of the Peroneal Tendons: Current Concepts Review of the Literature
van Dijk, Pim A. D.; Kerkhoffs, Gino M. M. J.; Chiodo, Christopher; DiGiovanni, Christopher W.
JAAOS - Journal of the American Academy of Orthopaedic Surgeons27(16):590-598, August 15, 2019.
doi: 10.5435/JAAOS-D-18-00623

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Outcome: Return to activities and sports
(Steginsky et al FAI 2016)

- Peroneal Tendon tears: return to activity after operative treatment
- 201pts (PB repair), age 44yo, FU 4.6years
- 1yr postop: 76% RTN preinjury activities
- At final fu 83% RTN to sports
- 58% scar tenderness, 54% residual swelling, 27% lateral ankle numbness (sural n), 31% pain at rest
- 91% would undergo the same procedure

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Outcome: The mangement of concomitant tears of peroneus longus and brevis tendons
(Redfern and Myerson, FAI 2004)

- 28 pts underwent tendon repair, tendonesis, or tendon transfer for concomitant tears of PL and PB.
- 31% (9) normal, 59% (17) moderate peroneal muscle strength
- Post op complications in 9/28 (31%)
  - 3 wound infections
  - 1 wound dehiscence
  - 2 sural neuritis
  - 1 CRPS, 1 required lysis of adhesions, 1 repair failed
- 50% (14) had persistent pain with exercise
- 21 pts were satisfied (managing patient expectations)

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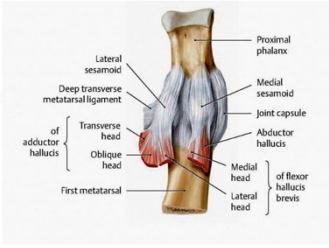
Anatomy

- 1st MTP joint is unstable.
  - Shallow socket of base of PP
- Capsuloligamentous structure is a primary stabilizer of joint.
- Plantar plate contains sesamoid bones, containec in FHB
- Medial sesamoid more commonly bipartate.



The attachment and ligaments on the sesamoid bones: plantar view (Picture illustrated from Thieme Atlas of Anatomy: General Anatomy and Musculoskeletal System (pp.416) by K. Wesker, 2007, New York, Thieme, Stuttgart. Copyright 2005 by Georg Thieme Verlag).

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Turf Toe

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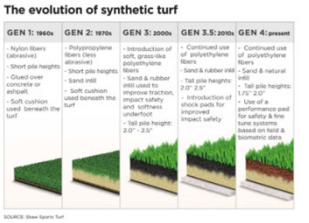
Risk factors:

- Playing on older artificial surfaces that are harder and less forgiving than natural grass
- Flexible shoes



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Turf Toe

- More common w/ artificial playing surfaces, flexible athletic shoes
- Hyperextension of 1st MTP joint.
- Capsular avulsion or sesamoid injury.
- May result in traumatic hallux valgus.
- Axial compression: OCD 1st met head

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Evaluation / Diagnosis :

- Palpation: plantar plate, medial lateral collateral ligaments sesamoid complex
- Varus and valgus stress
- Dorsoplantar stress test “Lachman”

Fig. 3
The dorsoplantar drawer, or Lachman, test examines the stability of the plantar structures. The joint is stressed vertically (arrow) to evaluate for laxity.
Poppe et al. JBJS 2019

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Diagnostic Imaging:

- AP, lateral, medial oblique, lateral oblique, sesamoid view.
- Lateral dorsiflexion stress view
- Compare to contralateral foot
- MRI will show extent of bone, cartilage, ligament damage.

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Surgery ?

- Rarely indicated for turf toe.
- Considered for
  - large capsular avulsion w/ unstable joint
  - Diastasis of bipartate sesamoid
  - Displaced sesamoid fracture
  - Retracted sesamoid
  - Traumatic or progressive hallux valgus
  - Presence of loose body or chondral injury

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Classification Capsiloligamentous Injuries

- Grade 1
  - Stretch/ minor tearing
- Grade 2
  - Partial tear
  - Mild to moderate decrease in ROM
  - Moderate pain w/ weight bearing
  - Inability to play sports
- Grade 3
  - Complete tear
  - Associated injuries
    - OCD injury
    - sesamoid fx
    - bipartate sesamoid diastasis
    - Sesamoid prox migration
  - Severe limitation ROM
  - Inability to bear wt on medial forefoot

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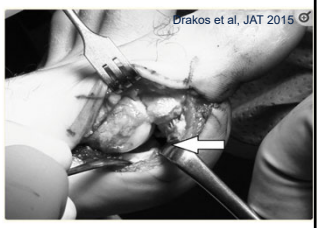
Goals of Surgery

- Repair capsule, flexor hallucis brevis, and plantar plate defect.
- If primary repair vs suture anchors / drill tunnels
- Dorsal block 10deg of plantar flexion
- Non wb for 6wks
- Boot to stiff shoe 8wks



Schafer, McCormick OTSM 2021

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Treatment

- Nonsurgical
  - RICE
  - Immobilization in walker boot
  - Early ROM to prevent loss of motion.
  - Carbon fiber or spring plate insert to get athletes back to work sooner.

- Grade 1
  - Return to sport w/ toe taped + stiff sole.
- Grade 2
  - Avoid play for 2wk.
- Grade 3
  - Avoid play for 2-6 weeks.
- Nondisplaced Sesamoid Fx
  - Hard-sole shoe, boot or cast for 4-6 weeks.
  - Heel weight bearing, avoid 1st MTP extension.

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Return to Sport After Turf Toe Injuries

A Systematic Review and Meta-analysis

Matthew L. Vopat,* MD, Maaz Hassan,† BS, Tanner Poppe,† BS, Armin Tarakemeh,† BA, Rosey Zackula,* MA, Mary K. Mulcahey,‡ MD, Scott Mullen,† MD, Rick Burkholder,§ MS, ATC, John Paul Schroeppel,† MD, and Bryan G. Vopat,†|| MD

Investigation performed at the University of Kansas Medical Center, Kansas City, Kansas, USA

- 112patients
- Nonop – RTN play 5.8wks
- Surgery – RTN 14.7wks
- Professional atheletes returned sooner than high school/collegiate
- Majority at pre injury level 1yr but many will still have some stiffness/discomfort

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Thank you!

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