Ankle sprain

Presented by

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Anatomy Review

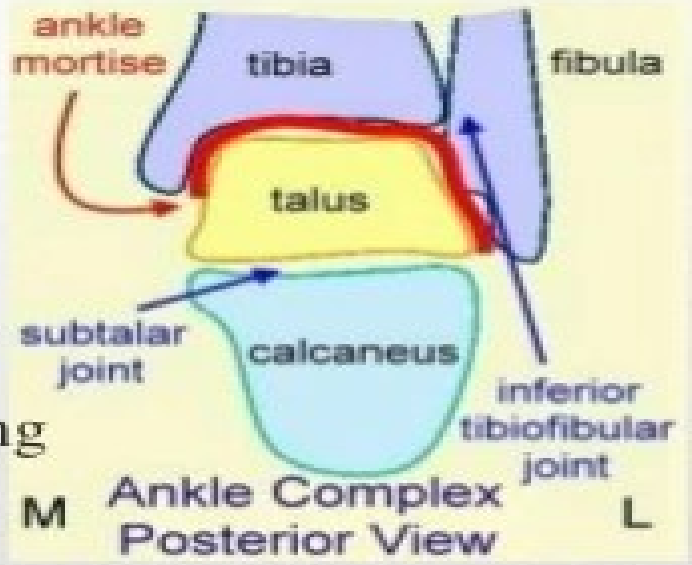
- The ankle complex includes three joints:

1. Talocrural (ankle) joint
   - Synovial hinge joint between tibia, fibula, and talus
   - Inferior tibiofibular joint unites tibia and fibula into mortise

   - Talus is tenon within mortise of tibia + fibula
   - Motion: Hinge joint: Extension (dorsiflexion) and flexion (plantar flexion)

Anatomy Review

2. Subtalar joint:
   - Synovial joint between talus and calcaneus
   - divided into an anterior and posterior articulation separated by the sinus tarsi
   - Motion: Inversion, eversion, and anteroposterior gliding

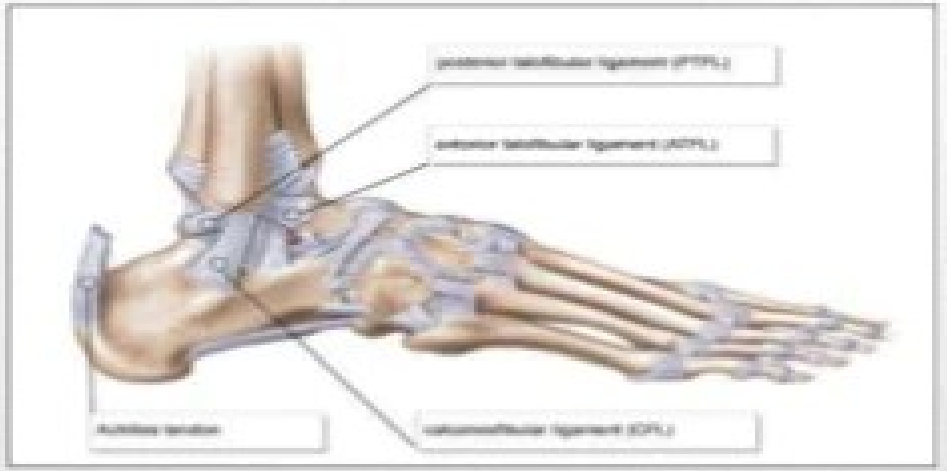


3. Inferior tibiofibular joint:
   - distal parts of the fibula and tibia articulate to form fibrous Inferior tibiofibular joint (tibiofibular syndesmosis).

Anatomy Review

❖ Ligaments:

- 3 sets of ligaments stabilize ankle complex:
  1. lateral collateral ligaments
  2. Medial collateral ligaments (deltoid ligaments)
  3. Distal tibiofibular syndesmotic complex



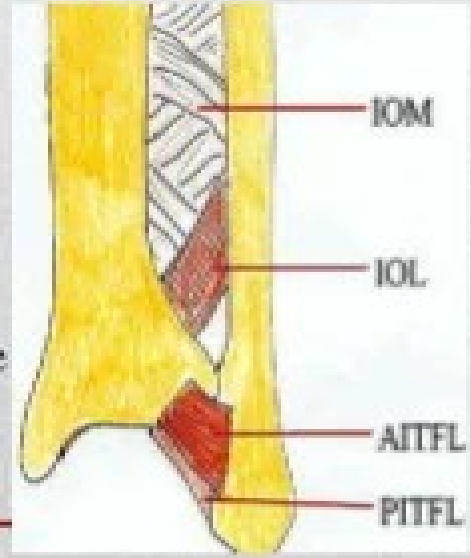
➢ lateral collateral ligaments: Stabilize ankle against inversion and anterior, posterior subluxation

- Anterior talofibular ligament (ATFL): it is the main talar stabiliser. Stabilizes talus against anterior displacement, internal rotation, and inversion
- Calcaneofibular ligament (CFL): secondary lateral restraint of subtalar joint
- Posterior talofibular ligament (PTFL)
- Lateral talocalcaneal ligament (LTCL)

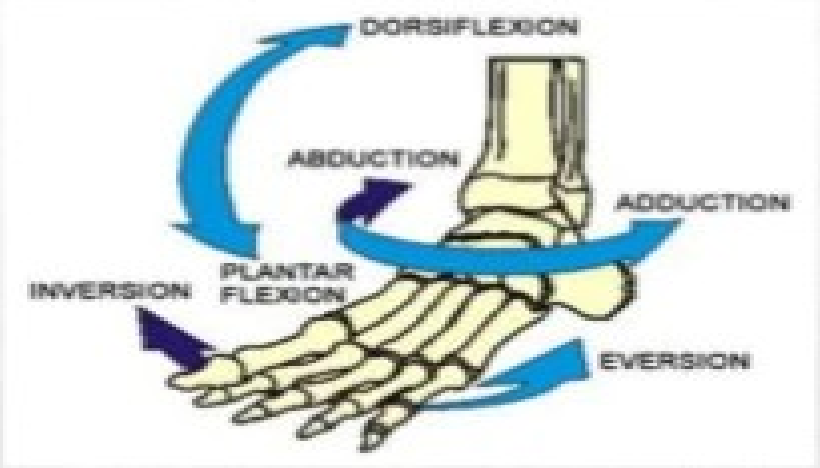
Anatomy Review

- Medial collateral ligaments (deltoid ligament):
  - Divided into superficial and deep components
  - Superficial: From superficial margin of medial malleolus. provide rotational stability
  - Deep: Posterior and anterior tibiotalar ligaments. prevent joint eversion

- Tibiofibular syndesmotic ligaments:
  - Maintain width of ankle mortise, stabilize against eversion
  - Anterior and posterior inferior tibiofibular ligaments
  - Inferior transverse ligament: Distal to main posterior tibiofibular ligament
  - Interosseous ligament: Distal thickening of syndesmotic membrane



Anatomy Review



- RANGE OF MOTION:

- Primary plane motions include:
  - Sagittal plane motion: dorsiflexion (15°- 25°) and plantarfiexion (50°-55°)
  - Frontal plane motion is inversion (35°) and eversion (20°)
  - Transverse plane motion is abduction (10°) and adduction (20°)

- Triplanar motions occurring about oblique axes defined:
  - Pronation (20°) is a combination of dorsiflexion, eversion, and abduction.
  - Supination (35°) is a combination of plantarfiexion, inversion, and adduction.

Introduction

Fong DT et al. A systematic review on ankle injury and ankle sprain in sports. *Sports Med. 2007;37(1):73-94.*

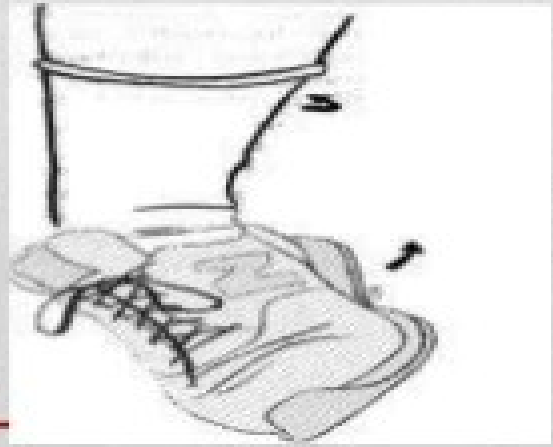
Sport	Most commonly injured body site	2nd most commonly injured	3rd most commonly injured
American football	Knee (21%)	Ankle (17%)	Shoulder (8%)
Football (soccer)	Ankle (21%)	Knee (16%)	Thigh (12%)
Running	Knee (29%)	Ankle (20%)	Foot (11%)
Triathlon	Knee (23%)	Trunk (12%)	Foot (9%)
Ice Hockey	Head (21%)	Knee (15%)	Thigh (11%)
Gymnastics	Ankle (32%)	Arm (26%)	Knee (9%)
Fell walking	Head (29%)	Ankle (24%)	Leg (14%)
Luging	Head (13%)	Hand (11%)	Trunk (9%)
Parachuting	Ankle (33%)	Leg (27%)	Trunk (11%)
Trampoline	Arm (48%)	Head (6%)	Ankle (6%)
Tug of War	Trunk (42%)	Knee (17%)	Arm (12%)

Introduction

- 28,000 ankle sprains occur daily in the US (Kaminski 2013)
- Ankle is the 2nd most commonly injured body site. (Ferran 2006)
- Ankle sprains are the most common type of ankle injury. (Ferran 2006)
- A sprained ankle can happen to athletes and non-athletes, children and adults.
- Inversion injury most common mechanism (Ferran 2006)
- Only risk factor is previous ankle sprain (Ferran 2006)
- Sex , generalized joint laxity or anatomical foot types are not risk factors. (Beynnon et al. 2002)

Introduction

- It is estimated that 80% to 85% of ankle sprains occur to the lateral ligaments (Ryan et al., 1986)
- It is generally accepted that an eversion ankle sprain is more severe, with greater instability. however, an inversion ankle sprain is more common, with the lateral ligaments being involved in 80% to 85% of all ankle sprains. (Ryan et al., 1986)
- ATFL is most common injured ligament
- High rate of recurrence (20%-40%)(Verhagen 2010)
- Chronic ankle instability (20-50%) (Verhagen 2000)



Classification

- Ankle sprain classified in to:

1. Low ankle sprain:
   I. Lateral ankle sprain "classic sprain" 80% to 85%
   II. Medial ankle sprain 5% to 10%

2. High ankle sprain (Syndesmotic sprain) 5% to 10%

Low ankle sprain

- Lateral ankle sprain:
  - The most common mechanism of ankle injury is inversion of the plantar-flexed foot.
  - The anterior talofibular ligament is the first or only ligament to be injured in the majority of ankle sprains. Stronger forces lead to combined ruptures of the anterior talofibular ligament and the calcaneofibular ligament

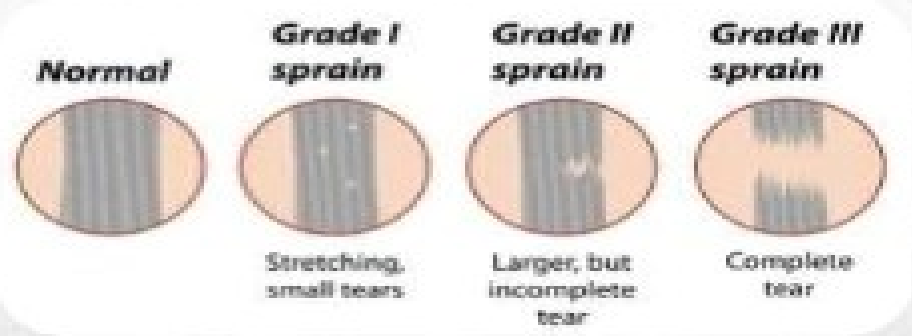
Low ankle sprain

- Medial ankle sprain
  - The medial deltoid ligament complex is the strongest of the ankle ligaments and is infrequently injured.
  - Forced eversion of the ankle can cause damage to this structure but more commonly results in an avulsion fracture of the medial malleolus because of the strength of the deltoid ligament.

High ankle sprain

- High ankle sprain (Syndesmotic sprain):
  - Dorsiflexion and/or eversion of the ankle may cause sprain of the syndesmotic structures.
  - There generally tends to be less swelling with a high ankle sprain, however there tends to be pain that is more severe and longer lasting.
  - Syndesmotic ligament injuries contribute to chronic ankle instability and are more likely to result in recurrent ankle sprain and the formation of heterotopic ossification.

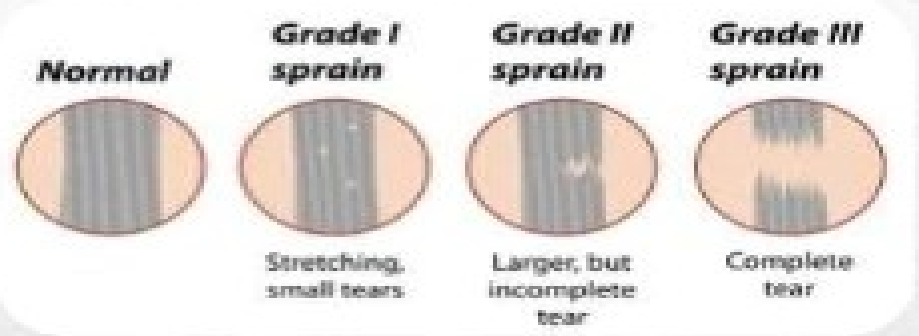
Grading & symptoms



I. Grade I sprain:

- It results from mild stretching of a ligament with microscopic tears.
- Patients have mild swelling and tenderness.
- There is no joint instability on examination, and the patient is able to bear weight and ambulate with minimal pain

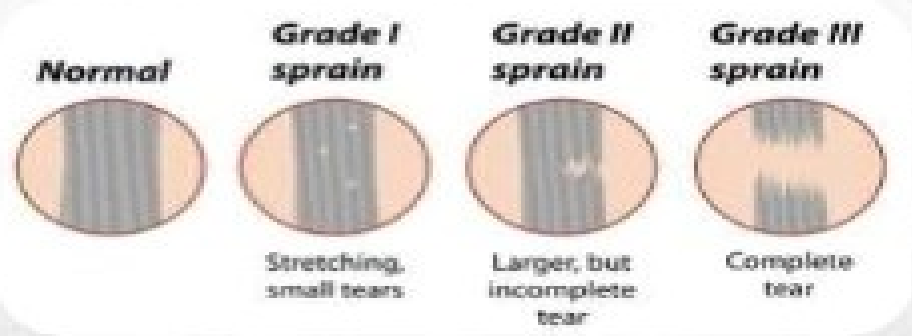
Grading & symptoms



II. Grade II sprain

- Is more severe injury involving an incomplete tear of a ligament.
- Patients have moderate pain, swelling, tenderness, and ecchymosis.
- There is mild to moderate joint instability on exam with some restriction of the range of motion and loss of function.
- Weight bearing and ambulation are painful

Grading & symptoms



III. Grade III sprain

- involves a complete tear of a ligament.
- Patients have severe pain, swelling, tenderness, and ecchymosis.
- There is significant mechanical instability on exam and significant loss of function and motion. Patients are unable to bear weight or ambulate

Grading & symptoms

Sign/symptom	Grade I	Grade II	Grade III
Ligament tear	None	Partial	Complete
Loss of functional ability	Minimal	Some	Great
Pain	Minimal	Moderate	Severe
Swelling	Minimal	Moderate	Severe
Ecchymosis	Usually not	Common	Yes
Difficulty bearing weight	None	Usual	Almost always

physical examination

- There is swelling, ecchymosis, and tenderness over affected site.
- The degree of swelling or ecchymosis is proportional to the likelihood of fracture.
- Palpation should include bony landmarks such as the lateral malleolus, the medial malleolus, the fibula, the fifth metatarsal, and, the physis in skeletally immature patients.
- Achilles tendon, peroneal tendons, and posterior tibial tendon should also be palpated.
- Tenderness over the anterior joint line or syndesmosis may indicate a sprain of the interosseous membrane.

physical examination

- Recurrent sprains often have very little swelling.
- An individual with an ankle sprain can almost always walk on the foot carefully with pain.
- Grade III ankle sprains often include an audible snap followed by pain and swelling
- A careful neurologic examination is essential to rule out loss of sensation or motor weakness, as peroneal nerve and tibial nerve injuries are sometimes seen with severe lateral ankle sprains.

Special Tests

Anterior Draw Test

Purpose:

To test for ligamentous laxity or instability in the ankle. This test primarily assesses the strength of the Anterior Talofibular Ligament.

Diagnostic Accuracy:

Sensitivity: 71%

Specificity: 33 %

Special Tests

Talar Tilt test

Purpose:

The talar tilt test detects excessive ankle inversion. If the ligamentous tear extends posteriorly into the calcaneofibular portion of the lateral ligament, the lateral ankle is unstable and talar tilt occurs.

Diagnostic Accuracy:

Sensitivity: 67%

Specificity: 75%

Special Tests

External Rotation Stress Test

Purpose:

To help identify a tibiofibular Syndesmotic injury (high ankle sprain).

Diagnostic Accuracy:

Sensitivity: 20%

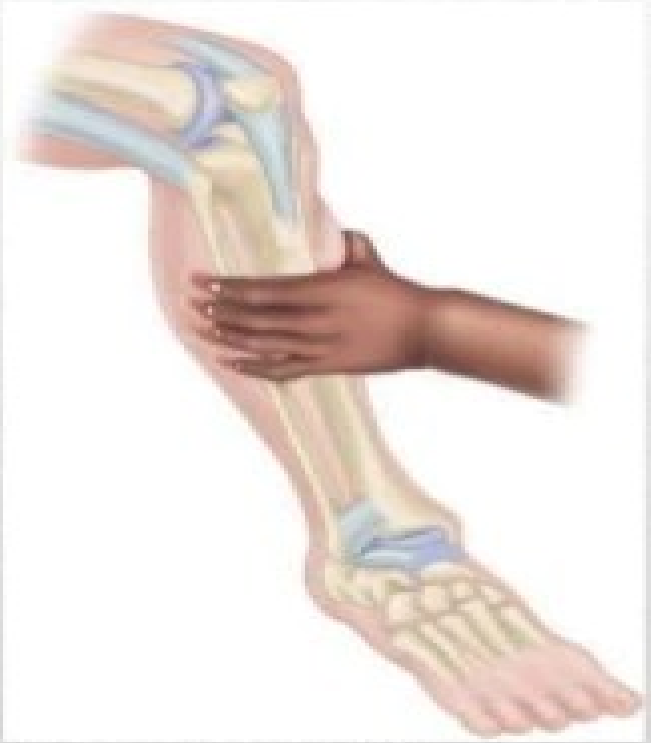
Specificity: 84.5%

Special Tests

Squeeze (Hopkin's) Test

Purpose:

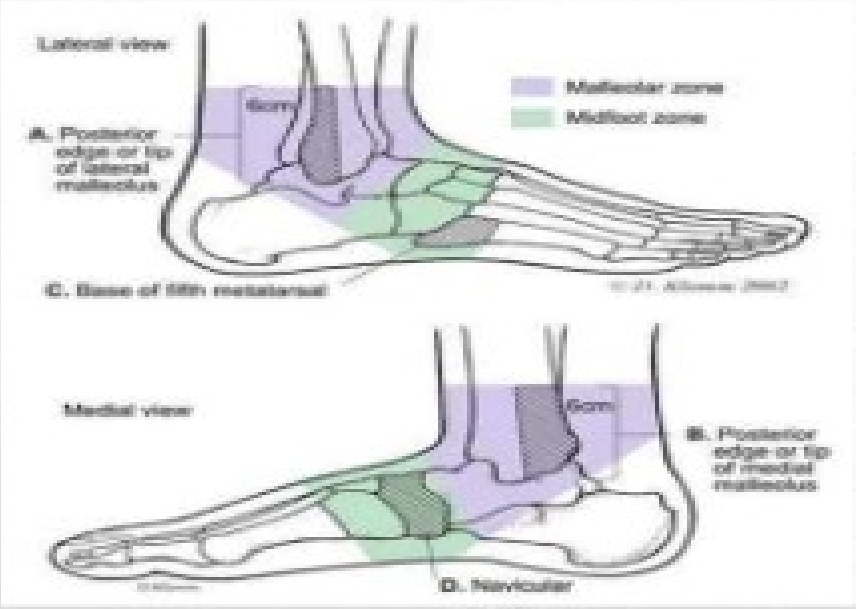
To help identify inferior tibiofibular Syndesmotic injury. consisting of compression of the fibula against the tibia at the mid-calf level producing pain in the syndesmosis.



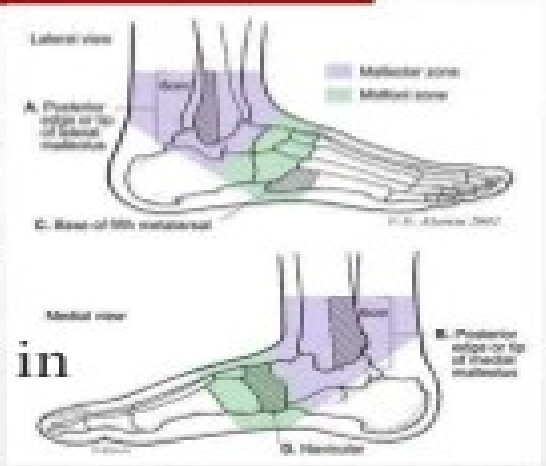
Imaging

- The **Ottawa ankle rules** are a set of guidelines for clinicians to help decide if a patient with foot or ankle pain should be offered X-rays to diagnose a possible bone fracture.
- Sensitivity: 98.5%

- MRIs, CT scans, Bone scans, and arthrograms all have diagnostic utility for specific injuries (fractures; avulsions; talar dome fracture) but have little role in the initial evaluation of ankle sprains.



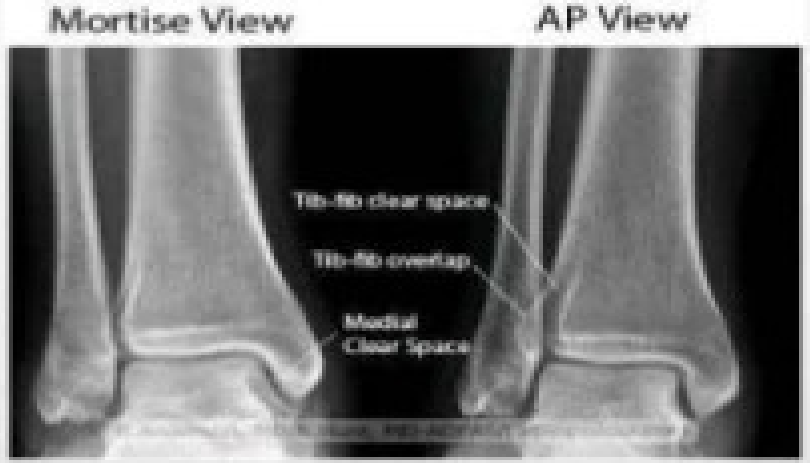
Imaging



- The rules are as follows :
  - An ankle series is only indicated for patients who have pain in the malleolar zone AND
    - Have bone tenderness at the posterior edge or tip of the lateral or medial malleolus OR
    - Are unable to bear weight both immediately after the injury and for four steps in the emergency department or doctor's office.
  - A foot series is only indicated for patients who have pain in the midfoot zone AND
    - Have bone tenderness at the base of the fifth metatarsal or at the navicular OR
    - Are unable to bear weight both immediately after the injury and for four steps in the emergency department or doctor's office.

Imaging

- weight-bearing AP, lateral, and mortise radiographs of the injured ankle to rule out fracture
- If a high ankle sprain is suspected, the radiograph should include the upper leg to assess for bony injury or gross syndesmotic disruption.
- stress views are performed by applying external rotation and lateral displacement stresses If a high ankle sprain is suspected.
- These should be compared to the contralateral uninjured ankle since there is variability in soft tissue laxity between patients.



stress view

Imaging

- Abnormal findings includes:

1. decreased tibiofibular overlap
   - normal >6 mm on AP view
   - normal >1 mm on mortise view
2. increased medial clear space
   - normal less than or equal to 4 mm
3. increased tibiofibular clear space
   - normal <6 mm on both AP and mortise views

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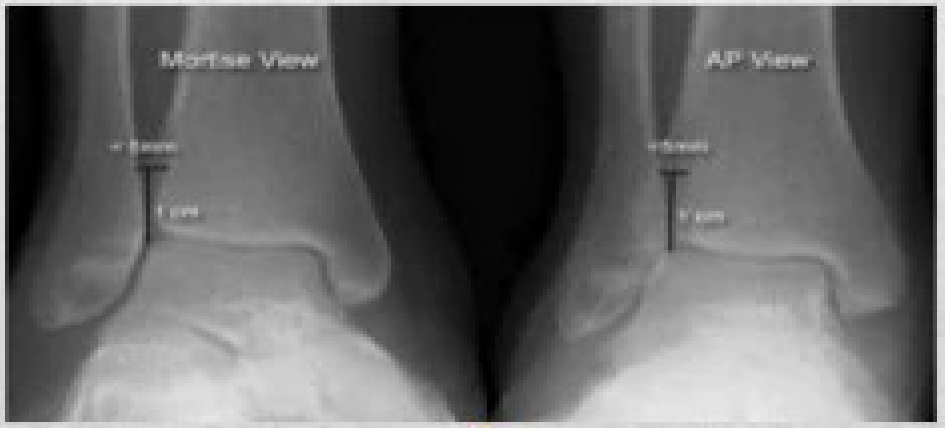

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Management

❖Conservative Management

Initial Management:

- The initial management of ankle sprain requires the PRICER regimen;

P= Protection …. crutches, splint or brace

R= Rest ….

I= Ice …. 20 minutes every 2 hours

C= Compression ….

E= Elevation ….

R= Rehabilitation ….

- This is probably (the single-most important factor in treatment, particularly with grade I and grade II injuries).
- Pain and swelling can be reduced with the use of electrotherapeutic modalities
- Analgesics (NSAID) may be required.

Management

❖ Conservative Management

Restoring of Full Range of Motion:

- The patient may be non-weight-bearing on crutches for the first 24 hours but should then commence partial weight-bearing in normal heel-toe gait.
- It will be necessary from this stage to protect the damaged joint with strapping or bracing.
- As soon as pain allows, active range of motion exercises can be commenced.

Management

❖ Conservative Management

- **Muscle Conditioning:**
  - Strengthening exercises should be commenced as soon as pain allows.
  - Active exercises should be performed initially with gradually increasing resistance
  - Exercises should include plantarflexion and dorsiflexion, inversion and eversion.

Functional Exercise:

- Functional exercises (e.g. jumping, hopping, twisting, figure-of-eight running) should be commenced when the athlete is pain-free, has full range of motion and adequate muscle strength and proprioception.

Management

❖ Conservative Management

Treatment of grade III injuries:

- Treatment of grade III ankle injuries requires initial conservative management over a six-week period.
- If the patient continues to make good progress and is able to perform sporting activities with the aid of taping or bracing and without persistent problems during or following activity, surgery may not be required.
- If, however, despite appropriate rehabilitation and protection, the patient complains of recurrent episodes of instability or persistent pain, then surgical reconstruction is indicated.

Management

Max. protection phase	Mod. Protection phase	Min. protection phase	Return to activity
1-3 Days	4-10 Days	11-21 Days	3-8 weeks
• PRICE formula • Protection with a splint • Icing every 2hours during 1st 48hours • Elevation to reduce swelling • Gentle mobilization to inhibit pain • Partial WB with crutches • Muscle-setting Techniques	• Non weight bearing AROM • Cross-fiber massage • Grade 2 joint mobilization • Toa curls • Seated calf stretches • Endurance training • strengthening exercises of intrinsic foot muscles	• Weight bearing as tolerated • Initiate Eccentric ex. • Toe walks • Subtalar mobilization • Tape or Brace for sports or other strenuous activities • Proprioception/ balance board ex	• ↑ Weight bearing as tolerated • Agility drills. • Adv. Exercises Static→dynamic • Isokinetic resistance training • Specific sport training • Protective bracing for participation into a sports

Caroline, Kysner, and Colby Lyn Allen. "Therapeutic Exercise Foundation and Techniques." *FA. Davis, Philadelphia* (1988).

Management

- **Conservative Management**
  - Medial ankle sprain and high ankle sprain can be treated conservatively as lateral ankle sprain by PRICER protocol but time of full recovery and return to function may extend to twice that of classic ankle sprain.

Management

❖ Operative Management

Indication of operation in low ankle sprain:

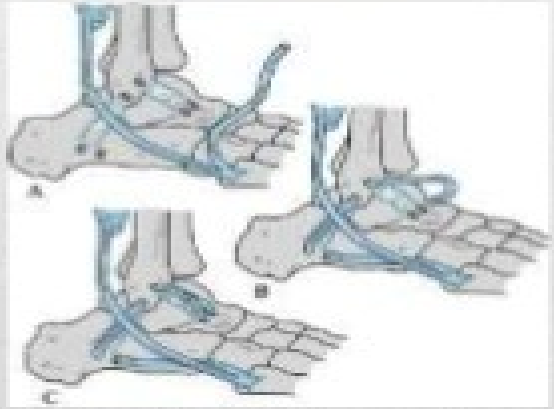
1. pain and instability despite extensive nonoperative management
2. large bony avulsions
3. severe ligamentous damage on the medial and the lateral sides of the ankle
4. severe recurrent injuries

Management

❖ Operative Management

Techniques of operation in low ankle sprain:

- ❑ Arthroscopic reconstruction
- ❑ Gould modification of Brostrom anatomic reconstruction
  - an anatomic shortening and reinsertion of the ATFL and CFL
- ❑ Tendon transfer and tenodesis



Management

❖ Operative Management

Indication of operation in high ankle sprain:

1. syndesmotic sprain (without fracture) with instability on stress radiographs
2. syndesmotic sprain refractory to conservative treatment
3. syndesmotic injury with associated fracture that remains unstable after fixation of fracture

Management

❖ Operative Management

Techniques of operation in high ankle sprain:

- ❑ syndesmosis screw fixation
- ❑ syndesmosis fixation with suture button
  - o fiberwire suture with two buttons tensioned around the syndesmosis +/- syndesmosis screw.