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BAHÇEŞEHİR ÜNİVERSİTESİ TIP FAKÜLTESİ  
*"scientia et amore vitae"*

# Foot and Ankle Disorders

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## Anatomy

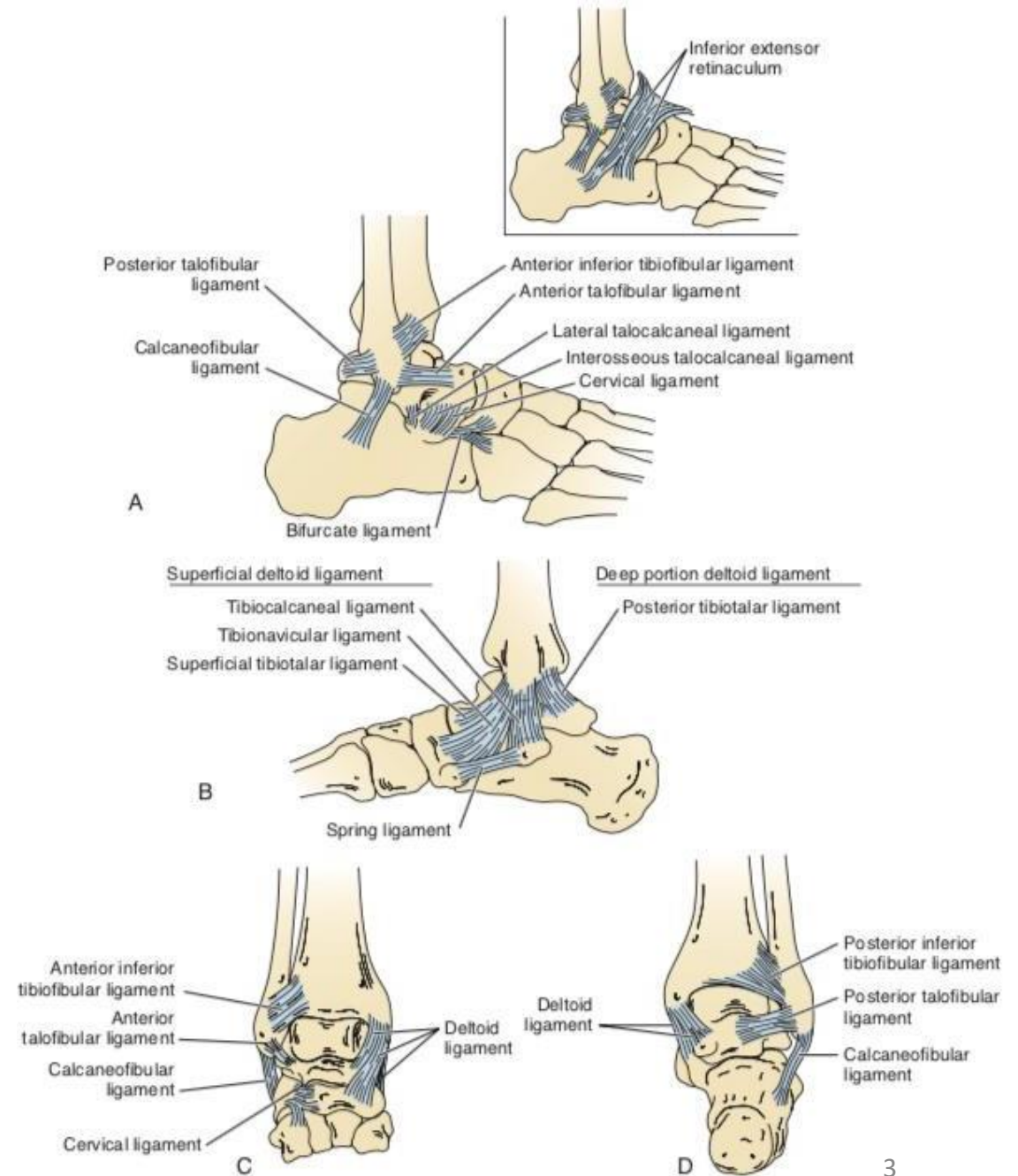
- Ankle mortis
  - Forms lateral malleolus, medial malleolus, and tibial plafond
  - Mortis articulates with the talus dome



- Lateral ligaments resist varus effect

- Anterior talofibular ligament (ATFL) (weakest)
- The ATFL is the most commonly injured ligament in the ankle.
- Calcaneofibular ligament (CFL)
- Posterior talofibular ligament (PTFL)
- Medial ligaments resist the valgus effect

- Deltoid ligament complex
  - superficial fibers
  - deep fibers

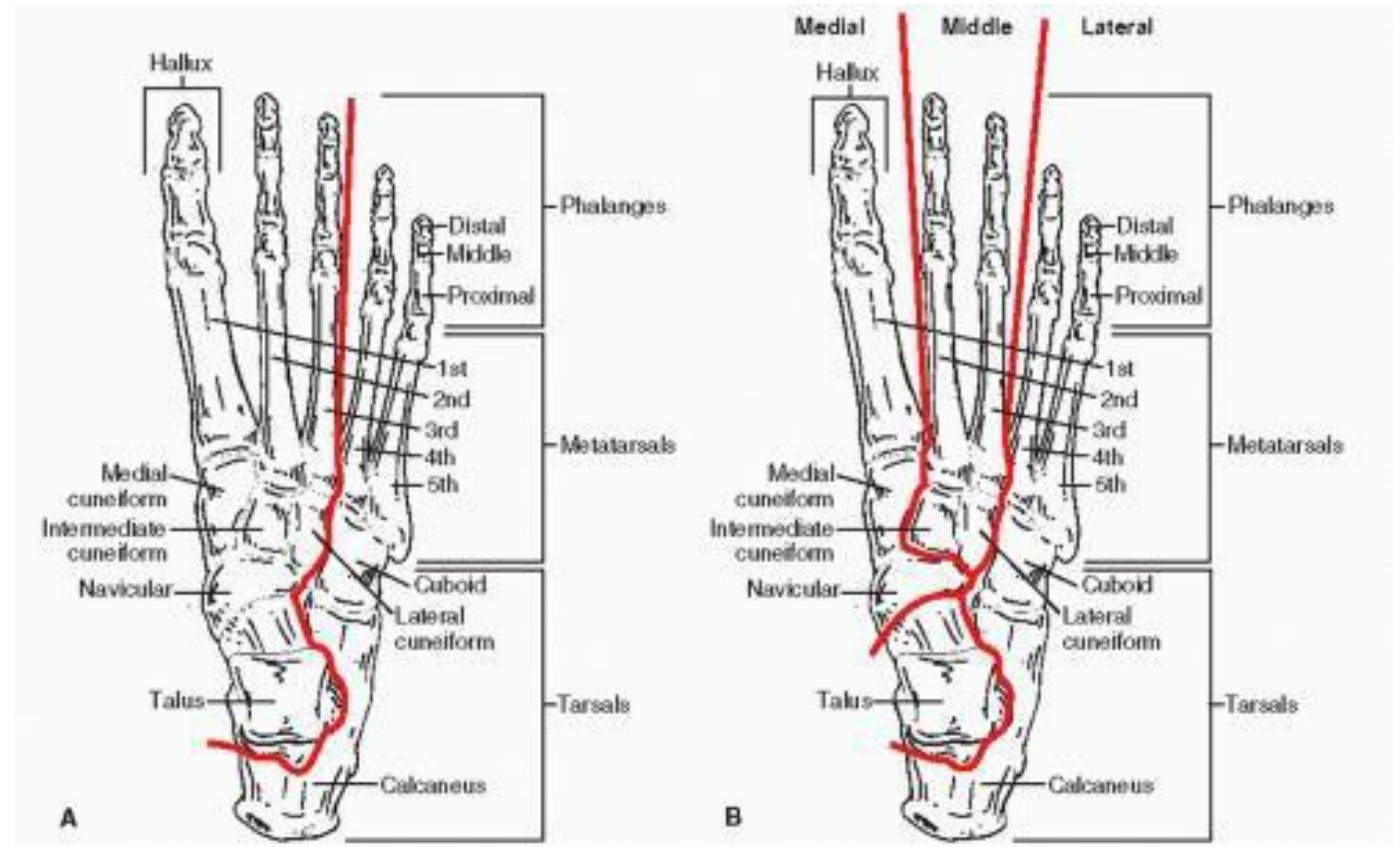


- The foot is divided into 3 zones
  - Hind foot
  - Midfoot
  - Forefoot



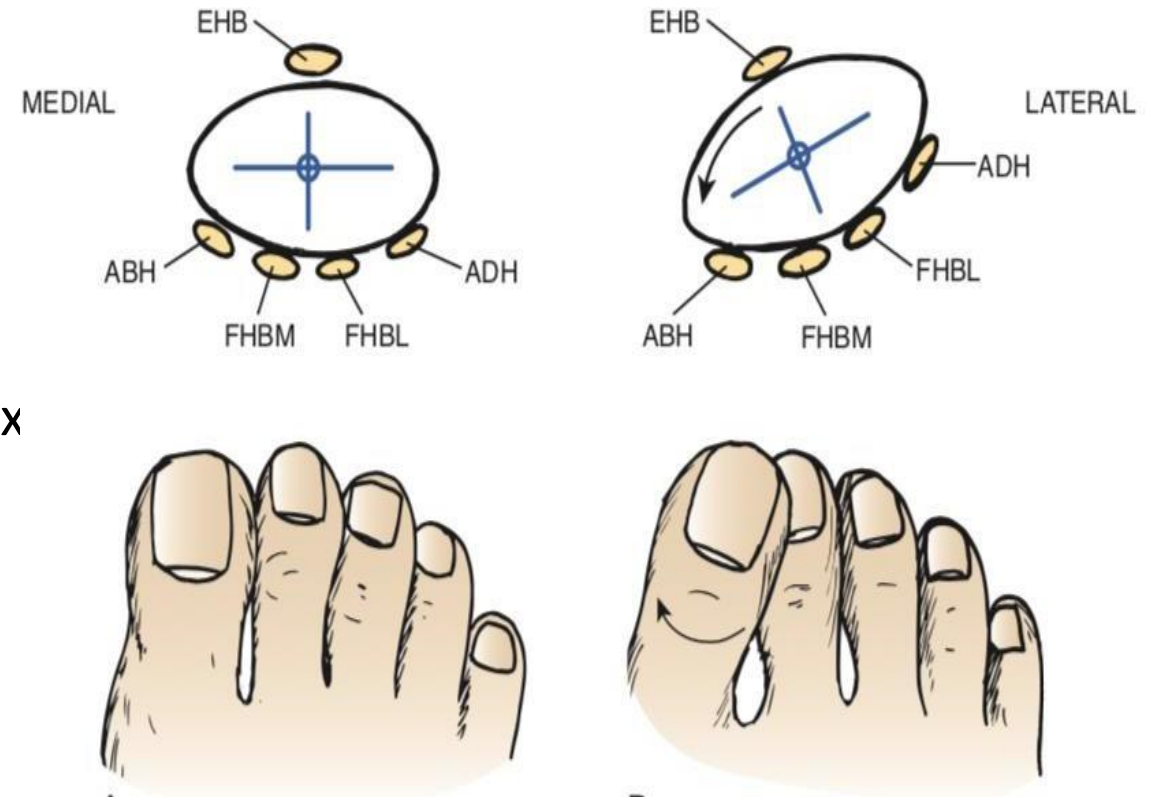
# Anatomy

- There are 3 columns in the foot
  - Medial column
  - Middle column
  - Lateral column

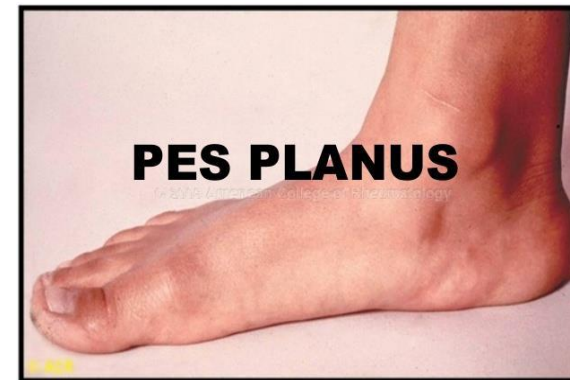


# Hallux Valgus (Bunion)

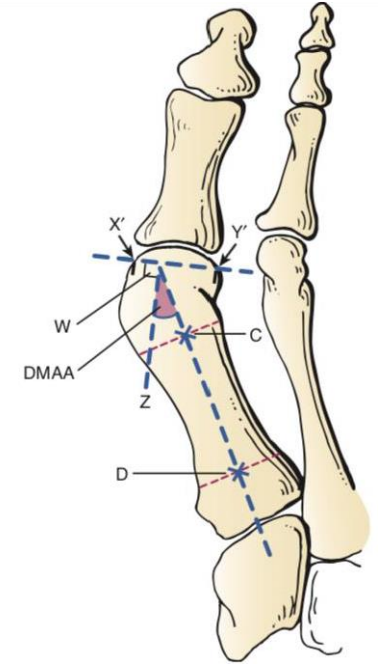
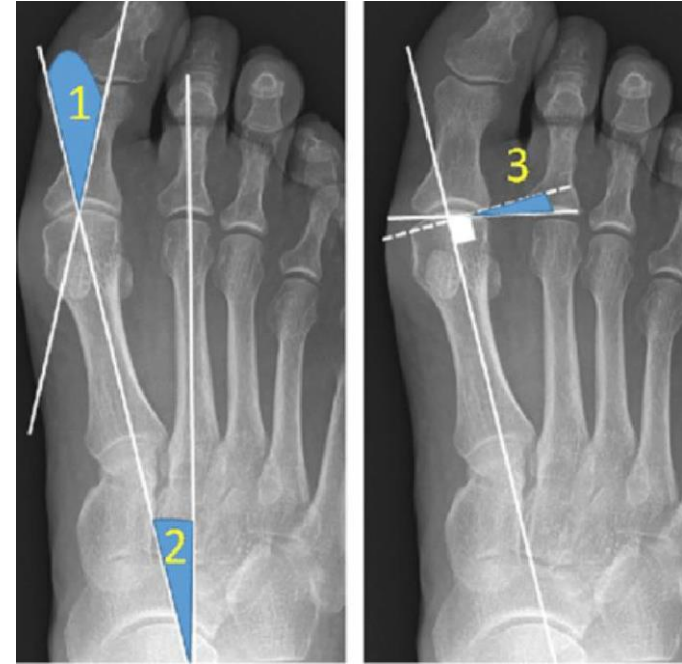
- It is a common orthopedic pathology in which the thumb bends outward with inward deviation of the 1st metatarsal.
- Mechanism
  - Medial capsular attenuation
  - Muscle imbalance with lateral migration of tendons and lateralization of the proximal phalanx
  - Valgus and pronation in the thumb
  - The head of the first metatarsa goes to medial side and the intermetatarsal angle increases
  - Contracture of the lateral capsule, adductor hallucis, and intermetatarsal ligament



- There are multifactorial factors;
  - Genetic predispositions such as pes planus, ligament hypermobility.
  - Causes such as narrow shoes, high heels.
- It can start at early in life
  - Juvenile and adolescent hallux valgus
- Radiological evaluation
  - AP-lateral radiographs on weight bearing
  - Deformity of the bone and joint - 1. MT length and shape
  - Congruent / incongruent joint
  - Osteoarthritis
  - Forefoot alignment – Metatarsus Adductus
  - Pes Planus / Pes Cavus.



- Some angles are evaluated in the weight bearing radiography
  - **1. Hallux valgus angle (HVA)**
  - **2. Intermetatarsal angle (IMA)**
  - **3. Distal Metatarsal Articular Angle (DMAA)**



**Radiographic Measurements in Hallux Valgus**

Radiographic Measurements in Hallux Valgus			
Hallux valgus (HVA)	Long axis of 1st MT and prox. phalanx	Identifies MTP deformity	Normal < 15°
Intermetatarsal angle (IMA)	Between long axis of 1st and 2nd MT		Normal < 9 °
Distal metatarsal articular (DMAA)	Between 1st MT axis and line through base of distal articular cap	Identifies MTP joint incongruity	Normal < 10°



## • Treatment

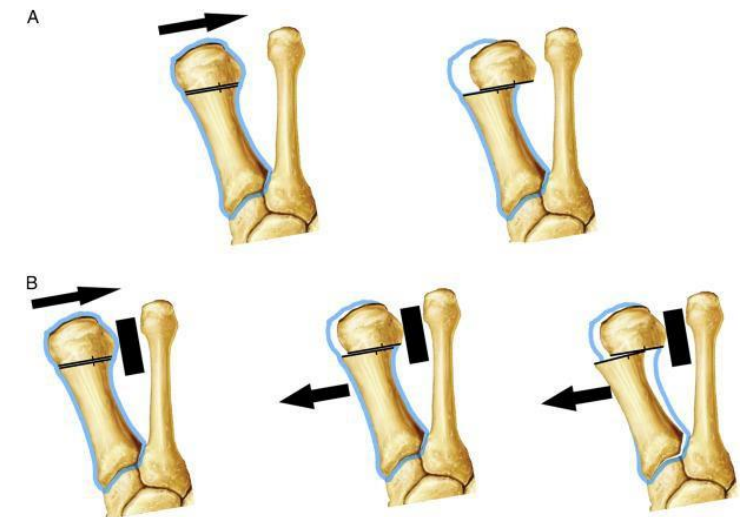
### • Conservative treatment

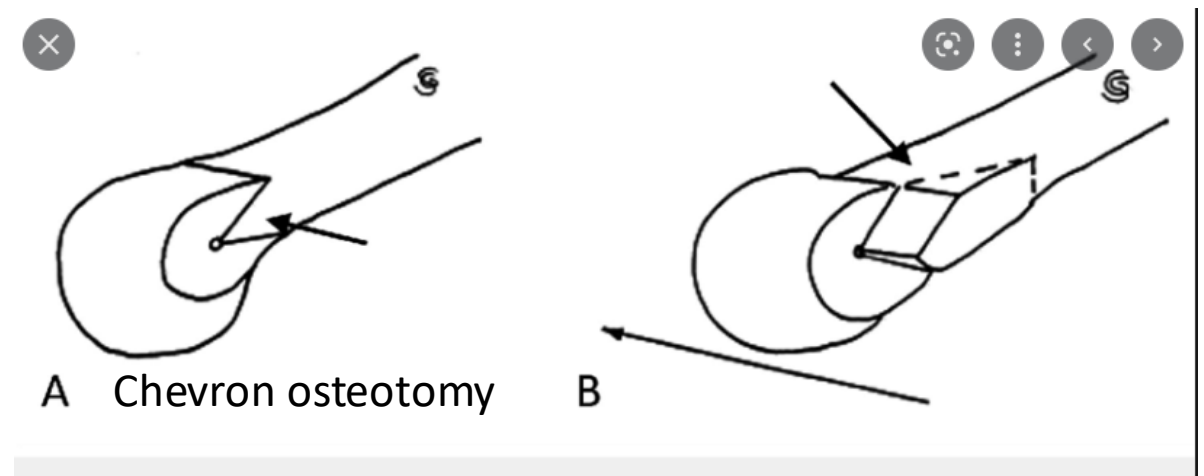
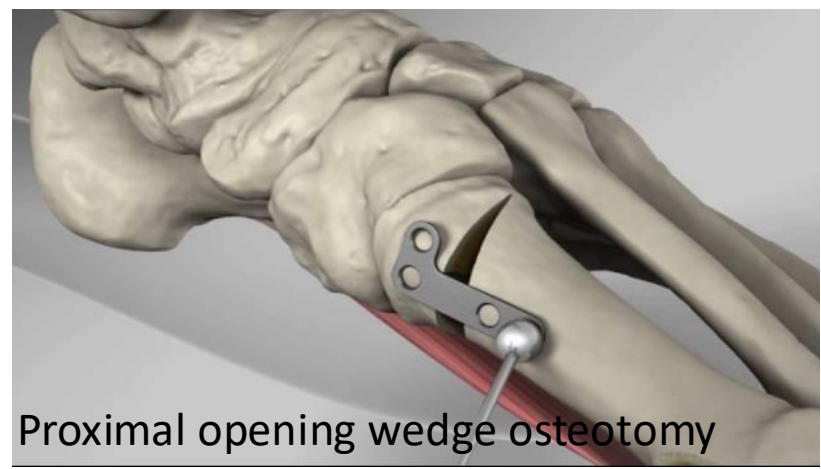
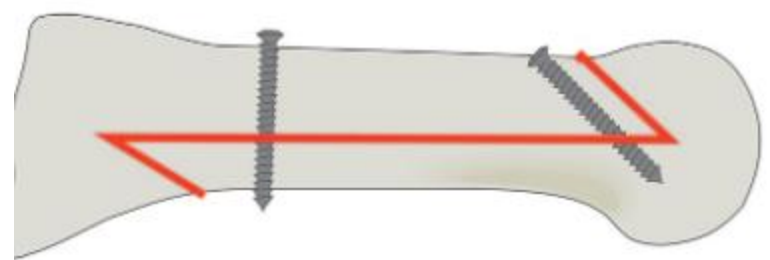
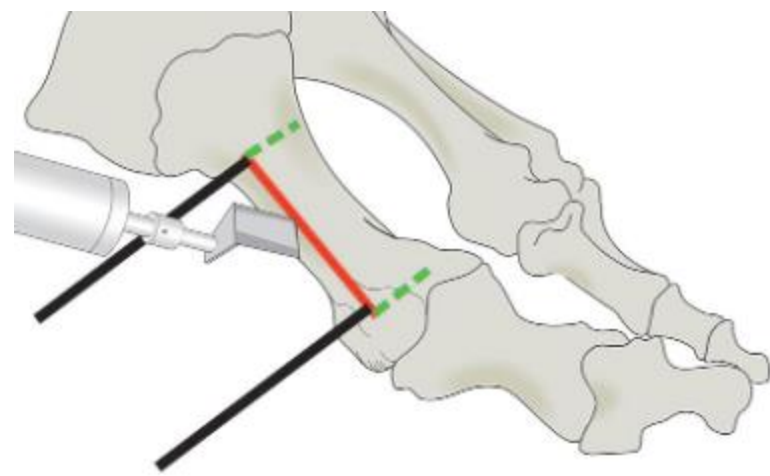
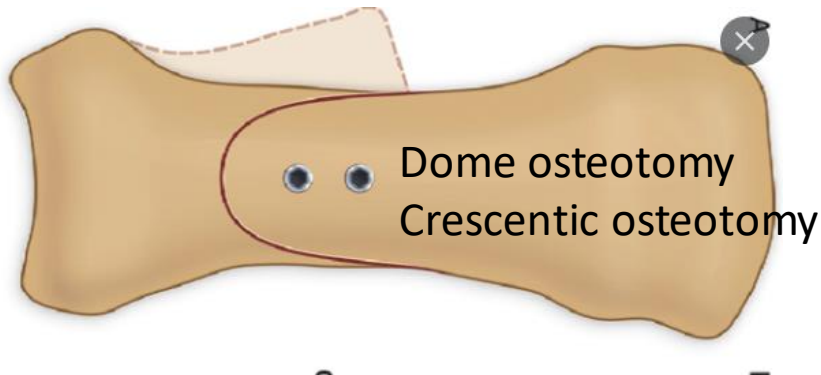
- Shoe modification, hallux valgus night splint, fingertip silicone reel
- They don't prevent the progression, orthoses more helpful in patients with pes planus or metatarsalgia



### • Surgical treatment

- 100+ options available
- Angles are preferred according to their degree
  - **Distal osteotomies if  $HVA < 40$  and  $IMA < 13$ ;**
  - **Metatarsal body or proximal metatarsal osteotomies if  $HVA > 40$  and  $IMA > 13$ ;**
  - **Lapidus surgery (TMT arthrodesis) if there is instability in the TMT joint**
  - **1. MP joint arthrodesis if arthrosis is present in the MP joint**





Lapidus procedure  
Tarsometatarsal arthrodesis

This surgery indicated  
Tarsometatarsal joint  
hypermobility



- **Complications**

- Avascular necrosis



- Recurrence



- Dorsal malunion



- Nonunion

- Hallux varus



# Hallux Rigidus

- Hallux rigidus is a common foot condition characterized by pain and loss of motion of the 1st MTP joint in adults due to degenerative arthritis.
- Diagnosis is made with orthogonal radiographs of the foot that may show joint space narrowing and dorsal osteophytes of the 1st MTP joint.
- Most common location of osteoarthritis in the foot
- Difficulty wearing shoes and limited movement



## Pathophysiology

Primary etiology unknown

Acute trauma and repetitive microtrauma predispose to arthritic changes

Osteophyte formation and degeneration of the cartilage occur dorsally in early stages and progress to involve the entire joint

Anatomic variations of first metatarsal may play a role in arthritic predisposition



- Narrowing in joint space
- Osteophytes
- Subchondral cyst
- Sclerosis



# Physical examination

## Inspection

- swelling of the 1st MTP joint
- dorsal prominence over the 1st MTP joint (due to dorsal osteophytes)
- severe disease may present with hyperextension deformity

## Motion

- limited dorsiflexion
- pain with terminal dorsiflexion

## Provocative tests

- pain with grind test

## Neurovascular

- medial branch of the medial dorsal cutaneous nerve overlies 1st MTP joint
- can become irritated by dorsal osteophytes

- dorsal medial foot paresthesia



## Treatment

Nonoperative  
NSAIDS, activity modification, intra-articular injections

- Operative
- Joint debridement and synovectomy

- Dorsal cheilectomy

- 25-30% of the MT head is taken, it is especially preferred in those with stage 1-2, dorsal osteophyte and dorsal pain.

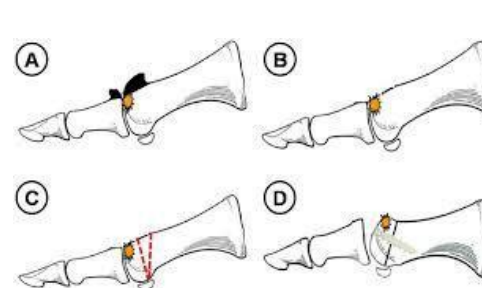
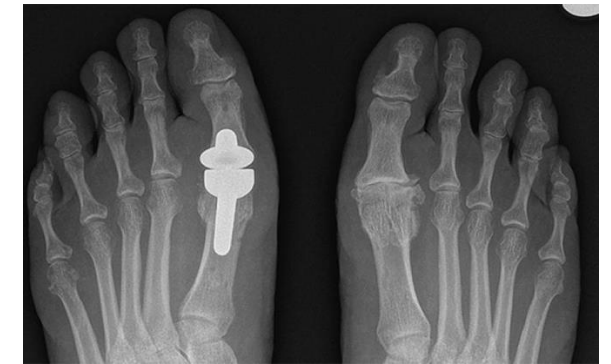
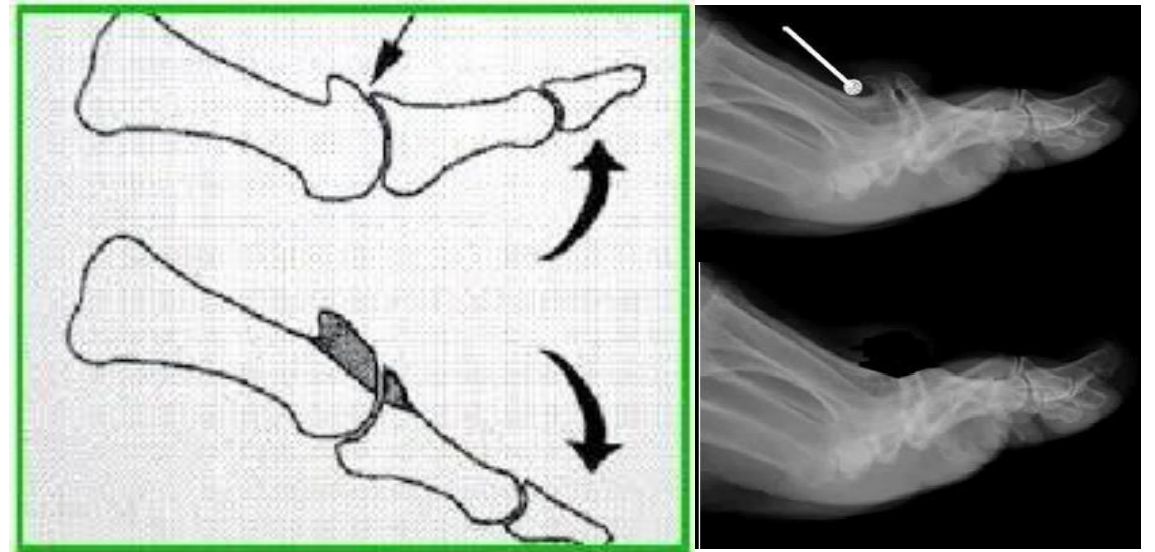
- Dorsal closed wedge osteotomy

- Increases range of motion and dorsiflexion.

- Arthroplasty

- Arthrodesis

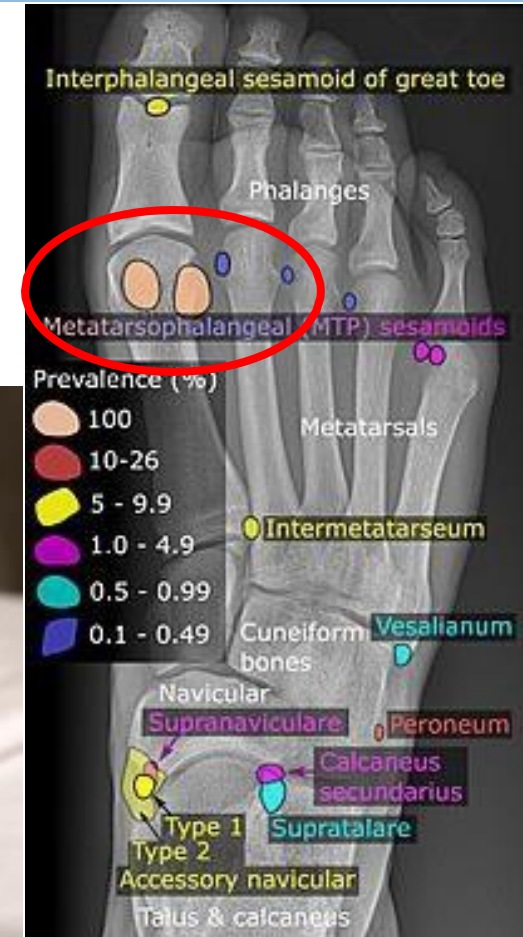
- Preferred in advanced stage





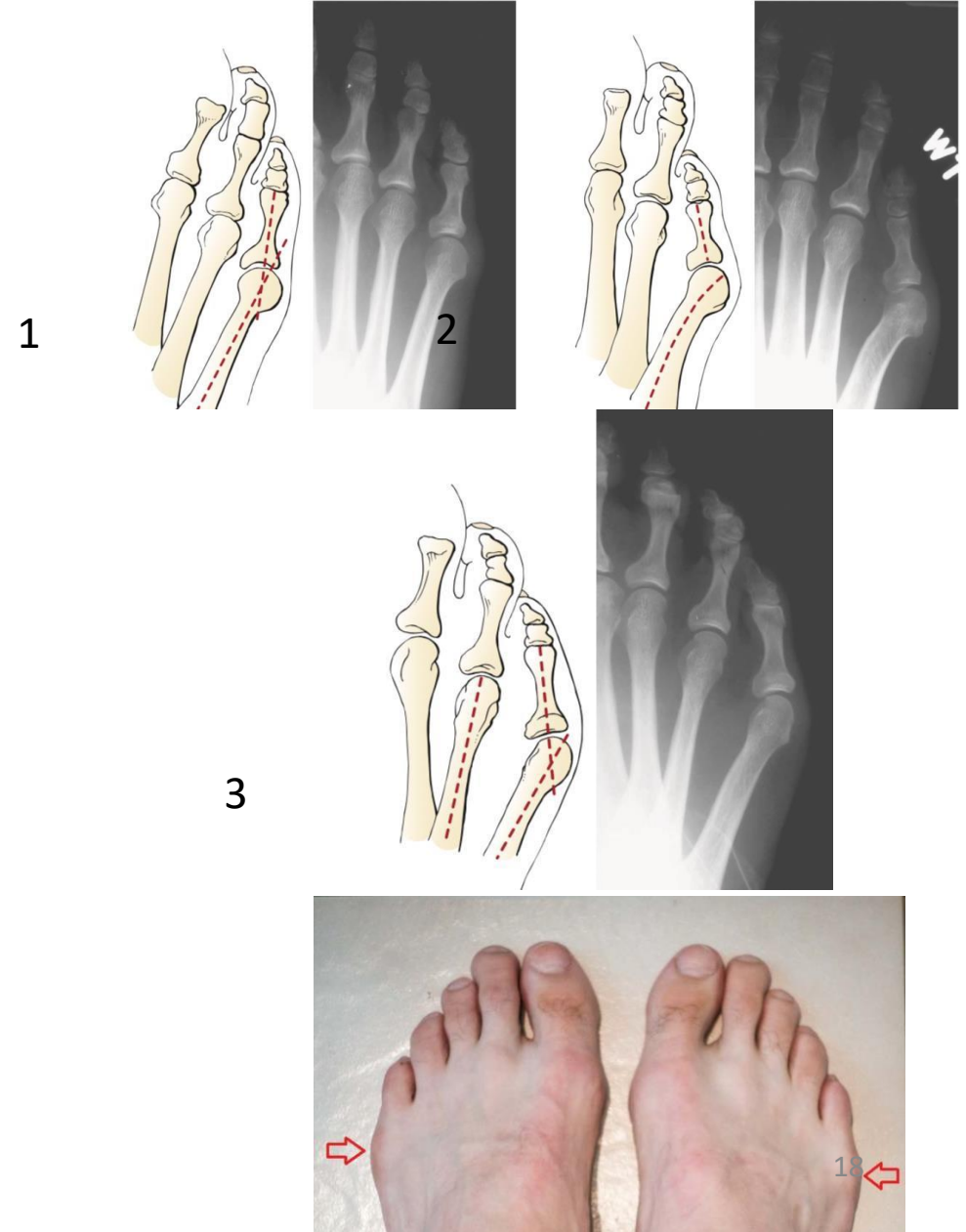
# Sesamoid diseases

- There are two in the plantar plate.
    - Tibial and fibular
  - They absorb the load on the metatarsal head.
    - They protect the FHL
  - **Hypertrophied sesamoid**
  - **Bipartite sesamoid**
  - **Sesamoid fractures**
  - **Sesamoiditis**
- 
- **Conservative treatment is generally effective for all sesamoid diseases.**

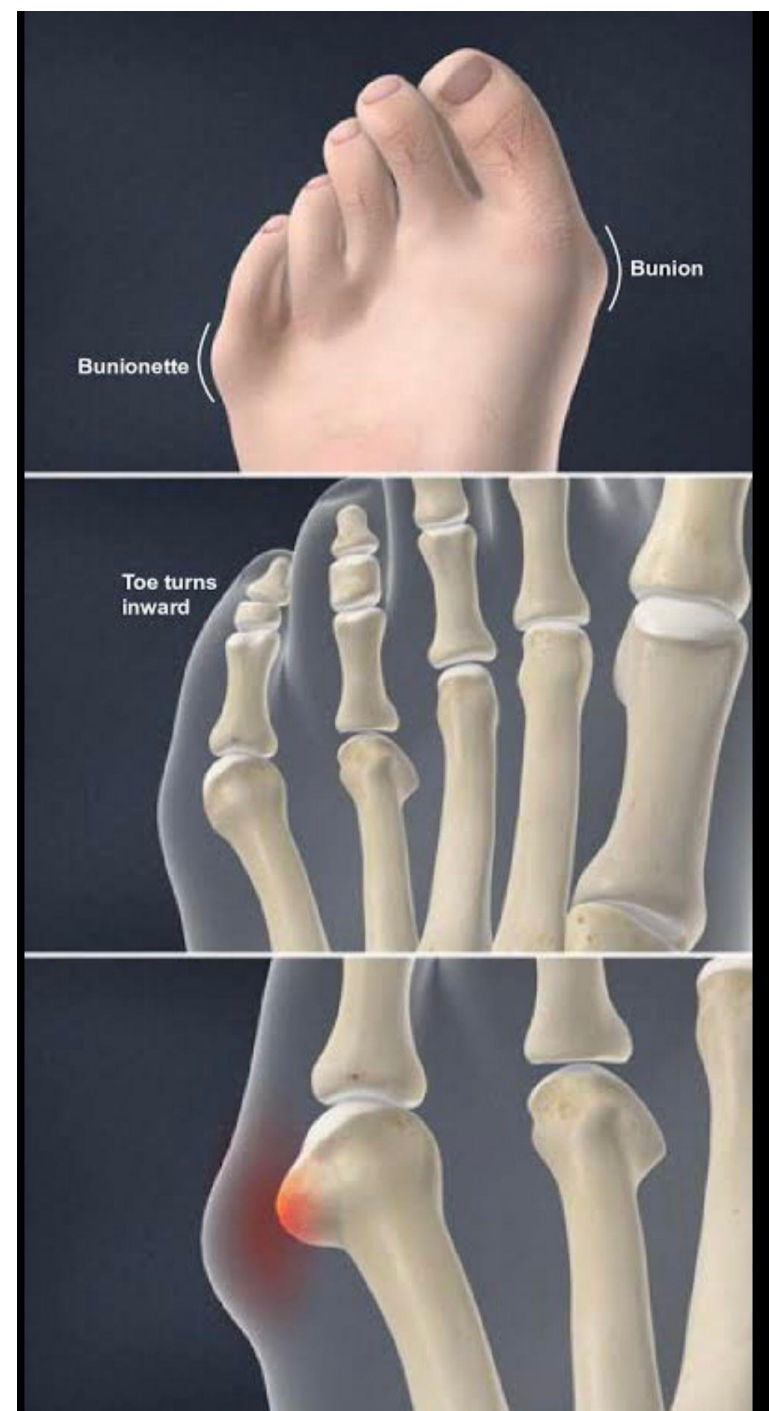
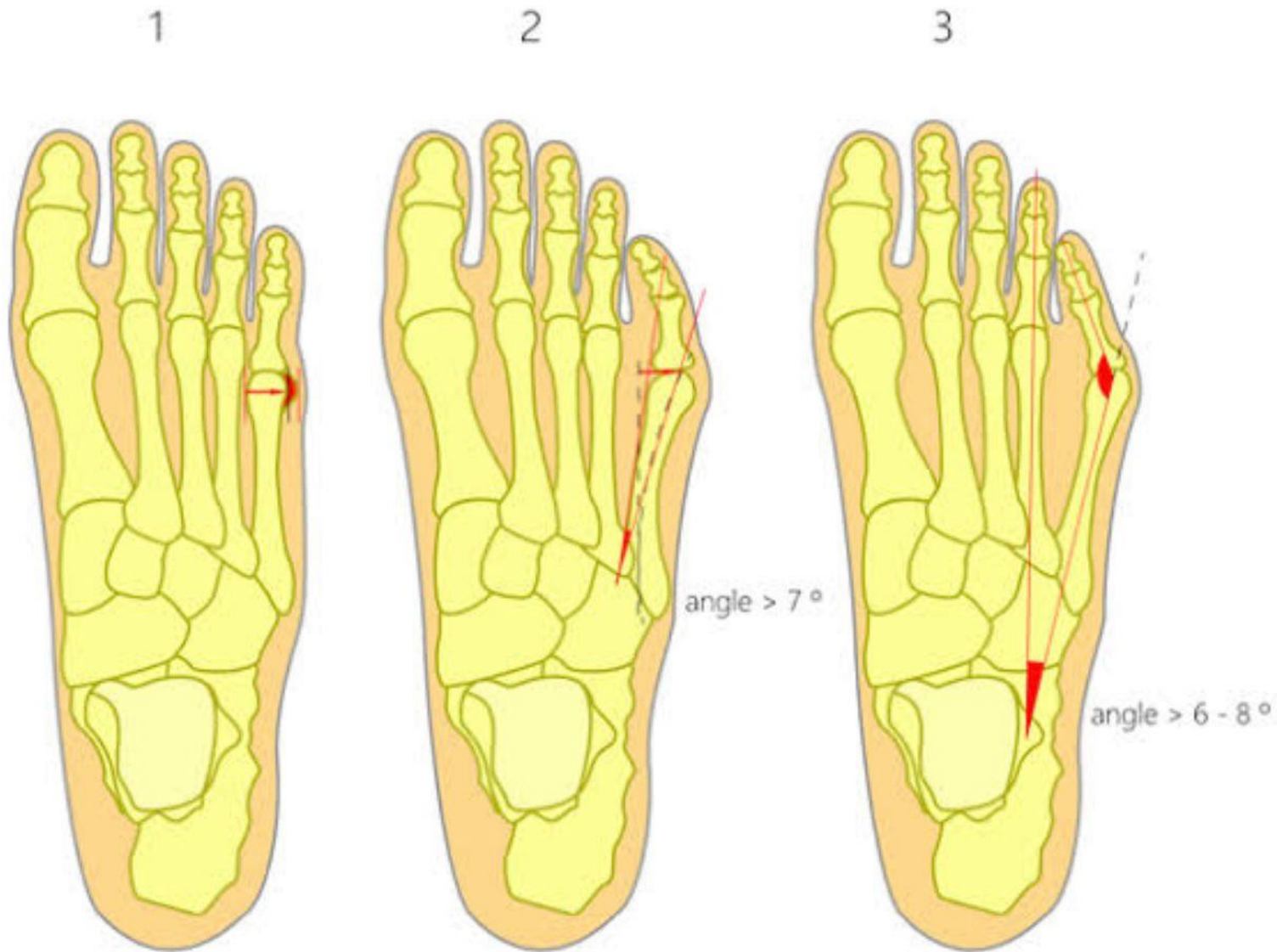


# Bunionet (tailor's bunion)

- Prominence of the 5th metatarsal head
- It hurts especially when wearing shoes.
- If with HV »splayfoot»
- There are 3 types according to the size of the deformity.
- Depending on the type, surgery is performed from bone spur removal to corrective osteotomy.



# Bunionet (tailor's bunion)

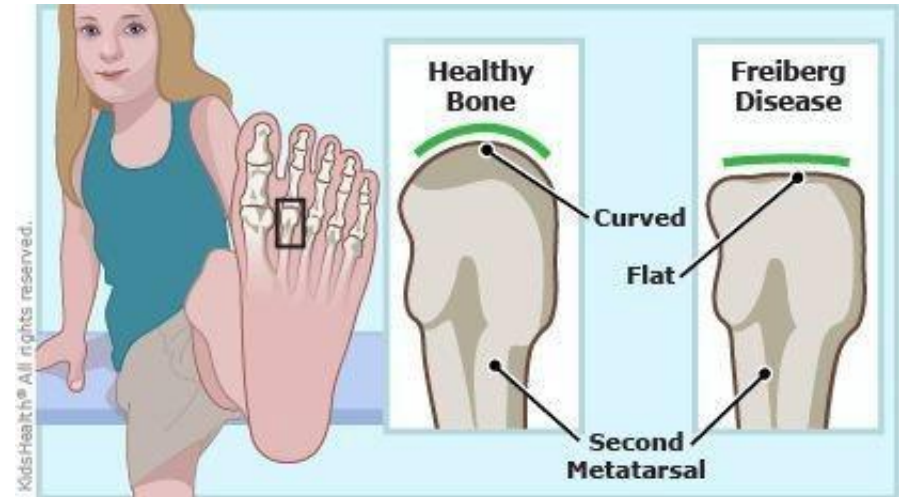


# Freiberg disease

- Osteochondrosis of the 2nd metatarsal head
  - Rarely, it can be found in other metatarsals.
- Diagnosis is made radiographically with plain radiographs showing subchondral sclerosis, flattening of the involved MT head and eventual joint destruction in advance disease.
- MRI studies may be needed to detect early disease.



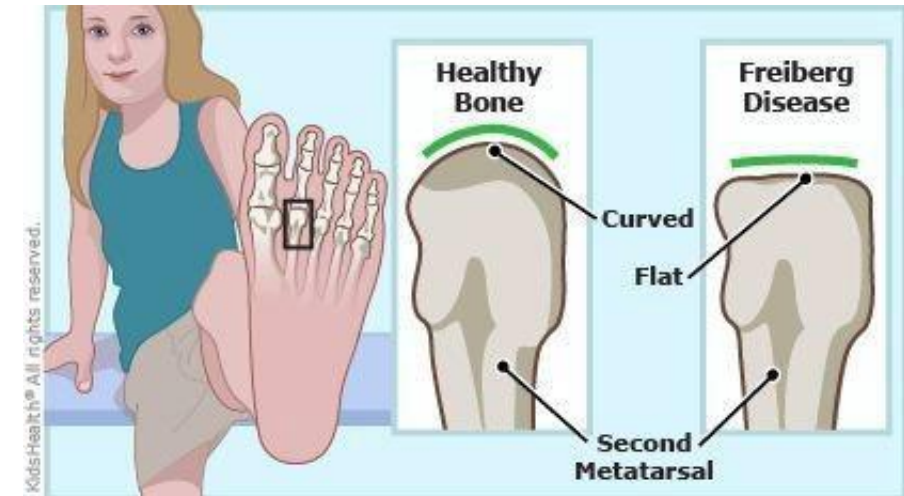
female to male = 4:1  
most commonly seen in patients 13-18 years  
more common in female adolescent athletes  
more common in patients with long 2nd metatarsals



# Freiberg disease

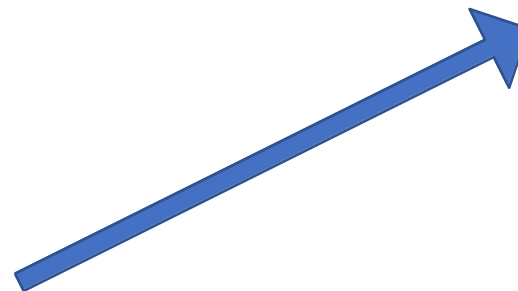
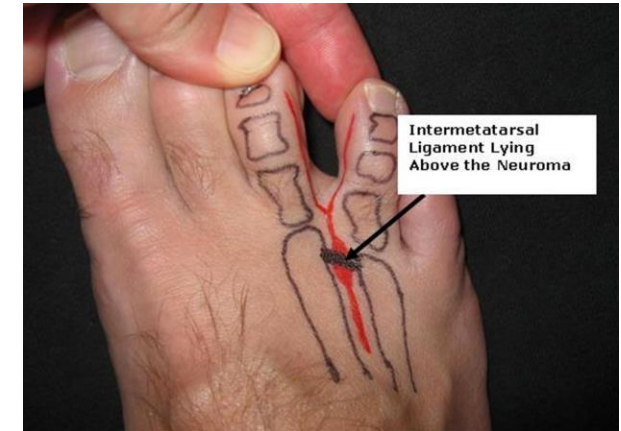
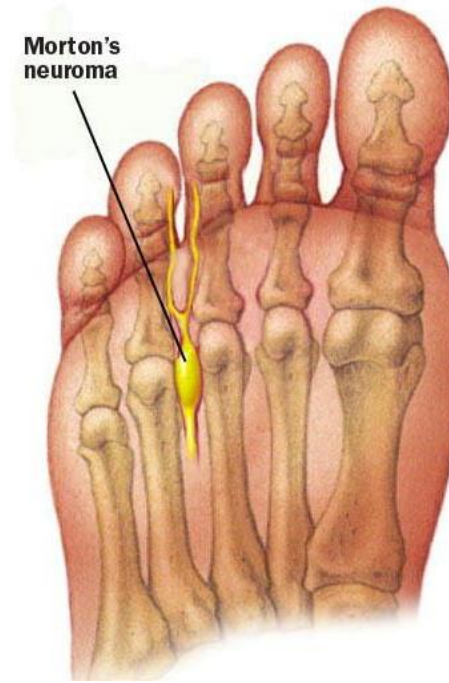
## Pathophysiology

- Thought to be related to a disruption in the blood supply due to microtrauma or osteonecrosis and stress overloading leads to eventual collapse of 2nd MT head
- Pain increases with walking and activity
- It is characterized by flattening of the metatarsal head, osteophyte formation, and osteochondral free body.
- Treatment
  - Metatarsal pad in the early stages-**activity limitations, NSAIDs, immobilization**
  - In advanced stages, joint debridement or dorsal closed wedge osteotomy is performed.



# Morton neuroma

- Compressive neuropathy of the interdigital nerve
  - It is 9 times more common in female.
  - Most often between the 3rd and 4th metatarsals, less often between the 2nd and 3rd metatarsals.
- Leads to plantar forefoot pain.
- Diagnosis is made clinically with tenderness over the plantar aspect of the involved webspace with a palpable neuroma
- Positive web-space compression test



# Morton neuroma

- Pathophysiology
  - Compression/stretching around the transverse intermetatarsal region
  - Endoneural edema
  - Perineural fibrosis and entrapment of the interdigital nerve
- Pain and paresthesia
- Although MRI and US are used for diagnosis, they are not necessary !
- Treatment
  - Ice, metatarsal pad, steroid injection
  - **Neurectomy**
- Compression test and foot squeeze test



# Tarsal tunnel syndrome

- Compressive neuropathy of the tibial nerve within the flexor retinaculum (laciniate ligament)
- Reasons
  - Tenosynovitis, ganglion, varicose veins, nerve sheath tm, lipoma, post-fracture fragments, accessory muscles
  - Inflammatory diseases such as DM, RA





- **Burning pain and paresthesia**, especially in the medial ankle and radiating to the sole

- **Diagnosis**

- EMG (nerve conduction test)
- MRI
- Presence of space-occupying lesion?

- **Treatment**

- Conservative
  - NSAID, vit B, FTR
- Surgical
  - If there is a space-occupying lesion, the lesion is removed.
  - If there is no response to conservative treatment, decompressive surgery

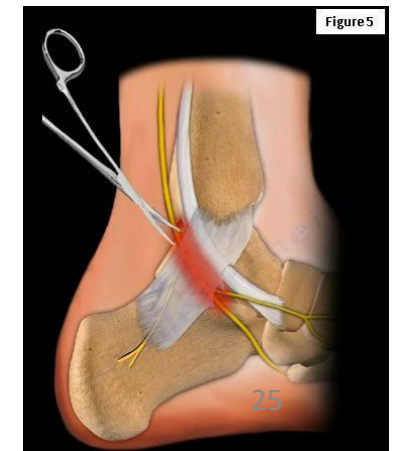
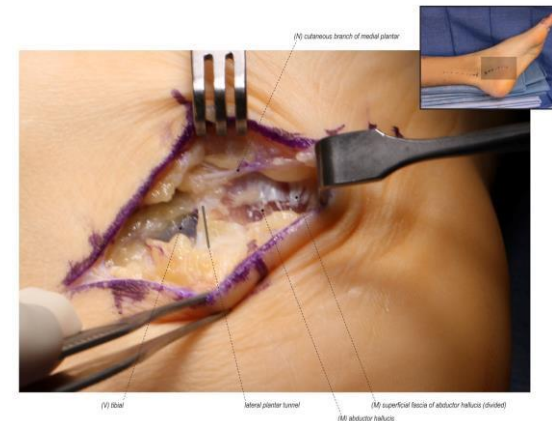
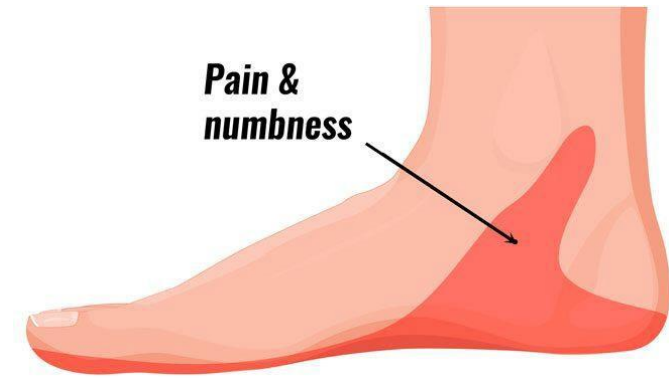
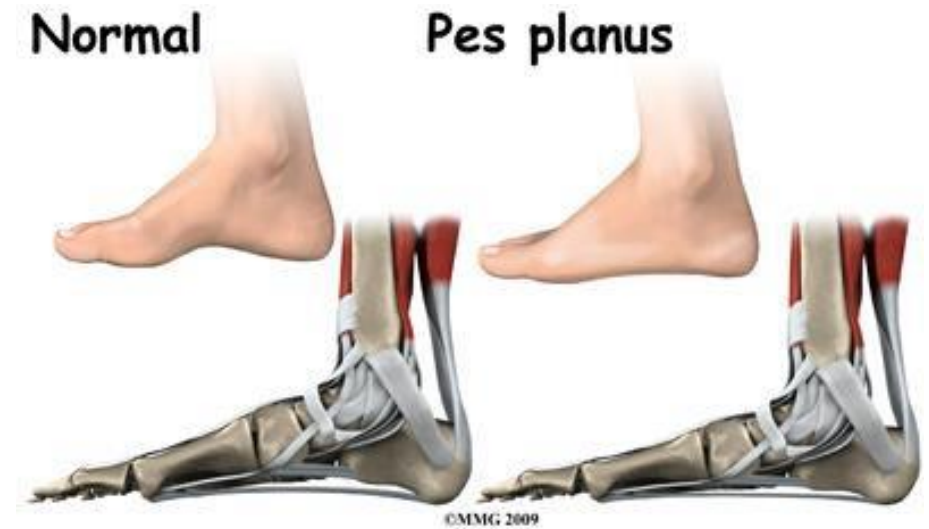


Figure 5

# Pes planus (Flatfoot)

- It is mostly congenital but can also be acquired.
- **Posterior Tibial Tendon Insufficiency (PTTI)** is the most common cause in adult patients.
- In childhood
- It is important to determine whether it is **flexible or rigid !!**
  - 95% flexible
  - The most common cause of rigid ones is the presence of a bar between the tarsal bones it is called tarsal coalition or syndromic feet.

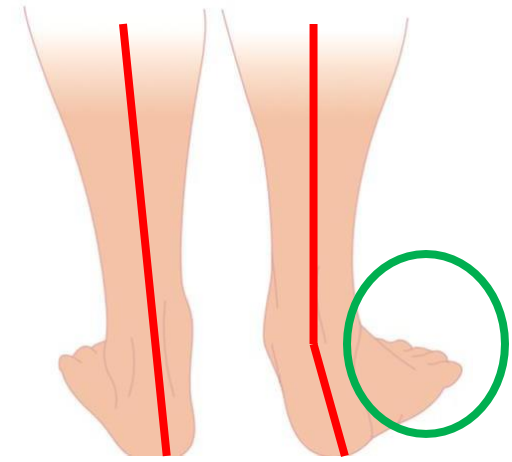


- Especially parents of children aged 2-6 apply to the outpatient clinic.

- Generally no complaints
  - usually asymptomatic in children
  - may have arch pain or pretibial pain

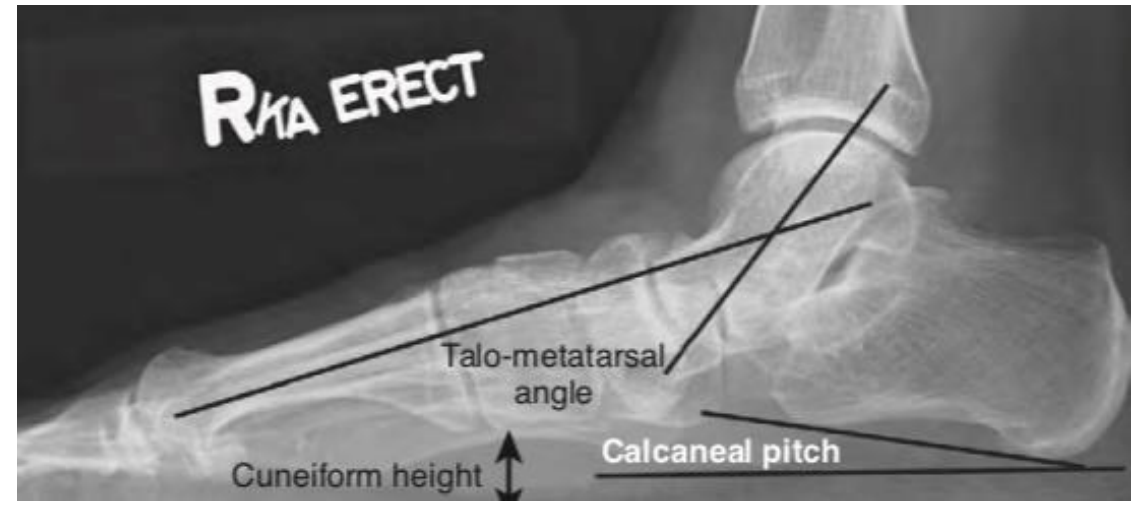
- Physical examination
  - Collapsed medial arch
  - Valgus hindfoot
  - Forefoot abduction
  - «Multi-finger sign»

- Foot is only flat with standing and **reconstitutes with toe walking, hallux dorsiflexion, or foot hanging**



- Imaging

- weightbearing AP foot
  - evaluate for talar head coverage and talocalcaneal angle
- weightbearing lateral foot
  - evaluate Meary's angle



- Treatment is planned according to the degree of deformity

- **Athletic heels with soft arch support or stiff soles**
- Calcaneus osteotomies
- Triple arthrodesis
- + achilles lengthening



# Pes cavus

- Most commonly caused by **neuromuscular disease**
  - CMT, tethering cord, spinal cord tumor
- It can also be of traumatic origin and idiopathic.
- The most common complaint is painful calluses on the forefoot and heel.



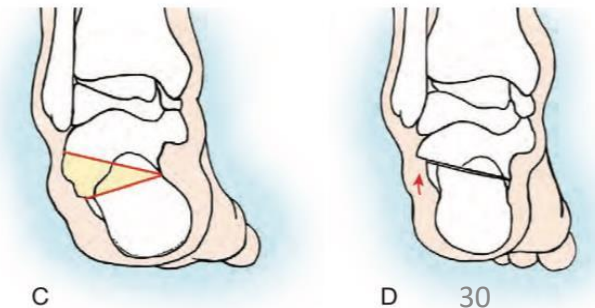
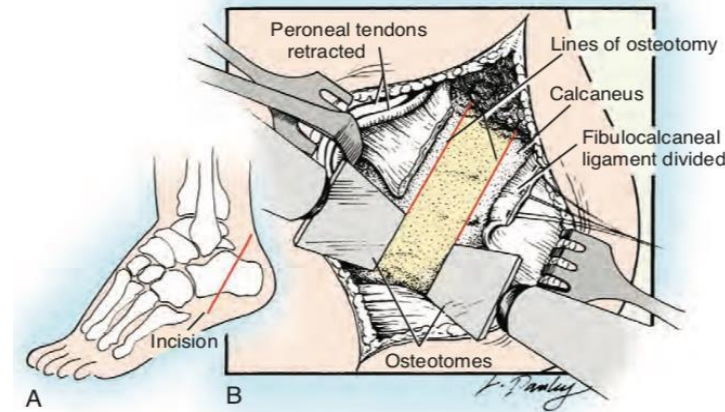
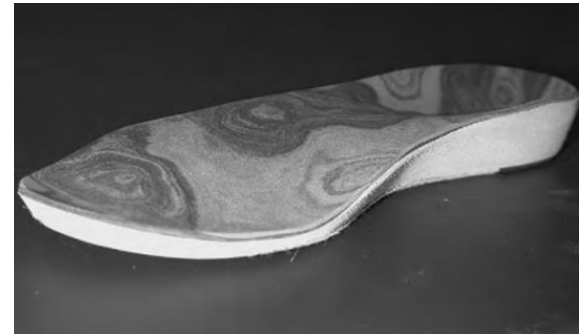
- It is important in the treatment whether the hindfoot is flexible or rigid in the clinic.

- **Coleman block test**



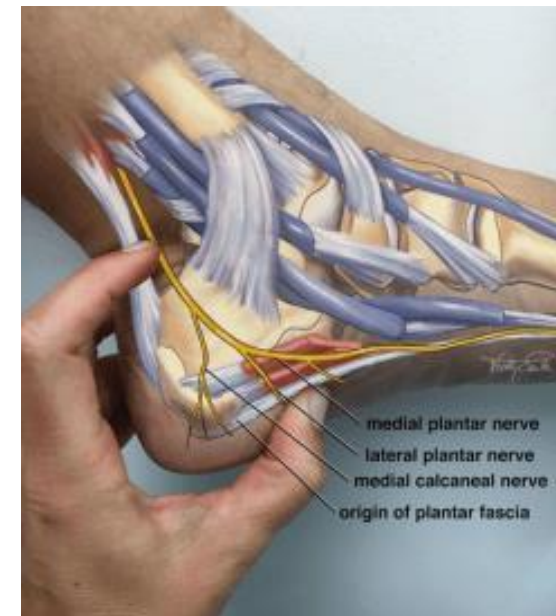
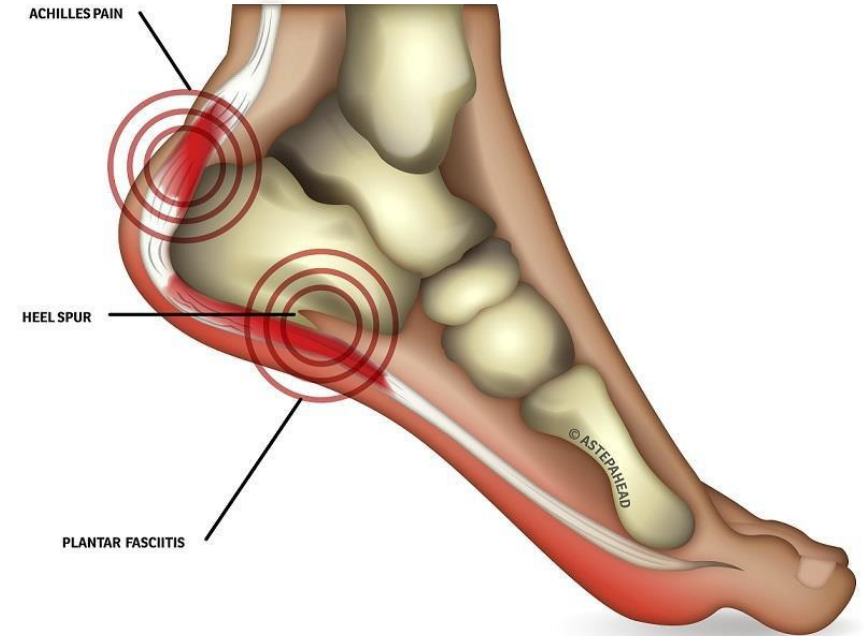
- **Treatment**

- Insoles
- Tendon transfers if there is improvement in the block test
  - If there is no improvement, osteotomies of the calcaneus and 1st metatarsal



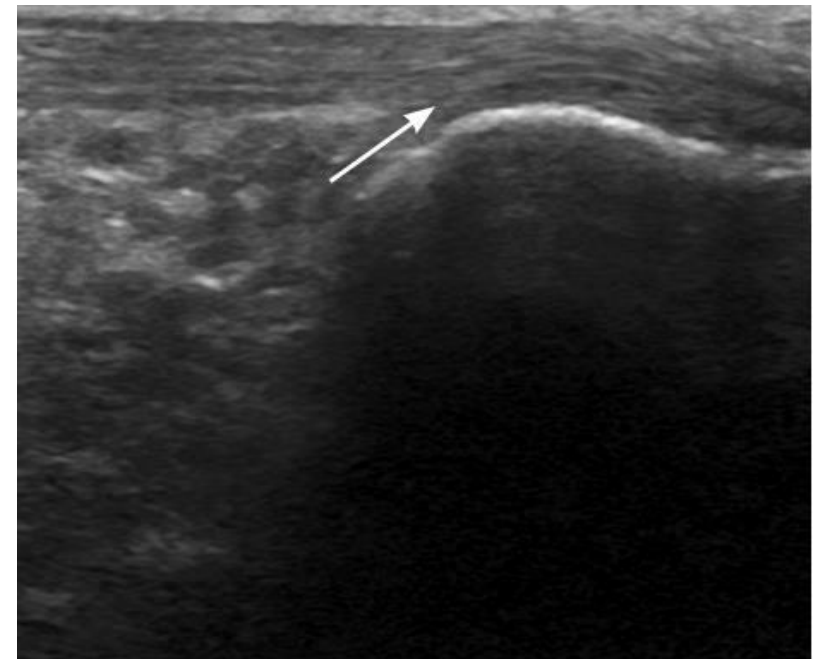
# Heel pain

- Plantar heel pain
  - **Plantar fasciitis (most common)**
  - Calcaneal stress fracture
- Posterior heel pain
  - **Achilles tendinitis (most common)**
  - Haglund's deformity (retrocalcaneal bursitis)



# Plantar fasciopathy

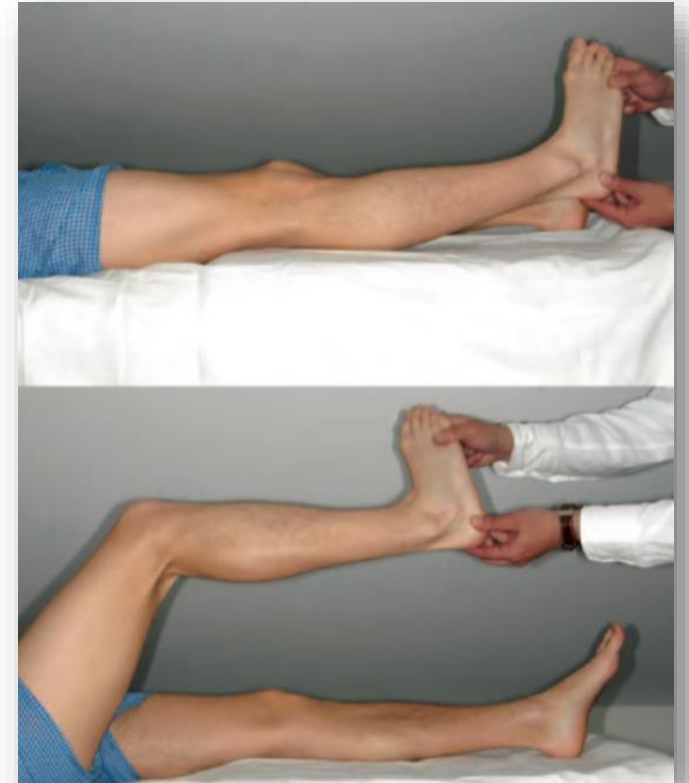
- Plantar fasciitis
- **Thickening and degeneration, not inflammation!!**
- Most common cause of heel pain
- About 15% of all foot complaints
- Most common between the ages of 45-65
- 5-10% in athletes
- A self-limiting disease
  - 6-12 months





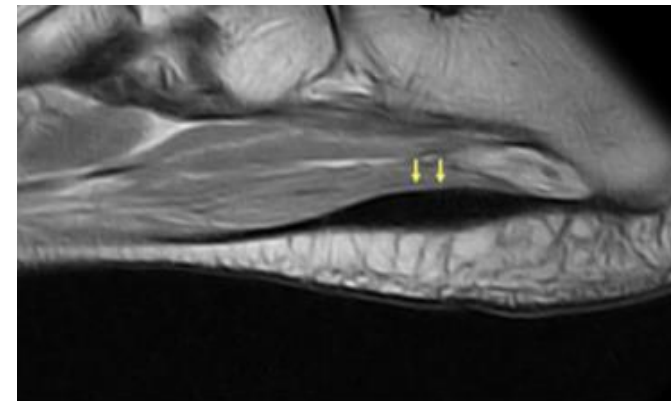
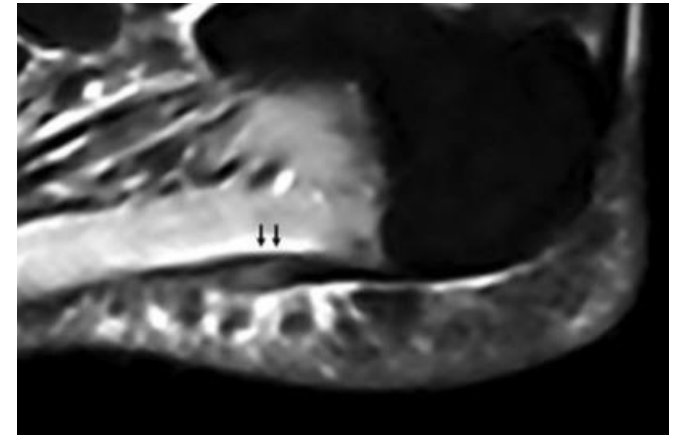
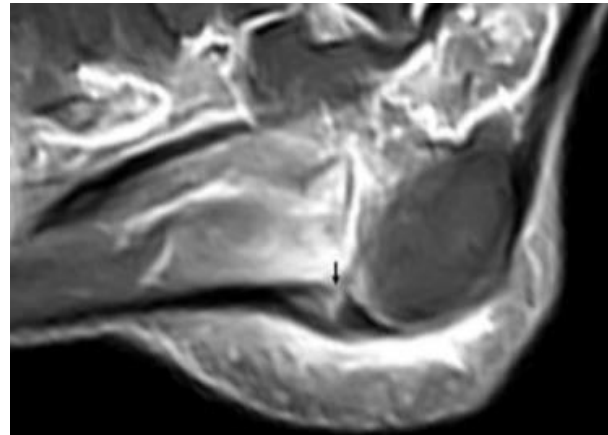
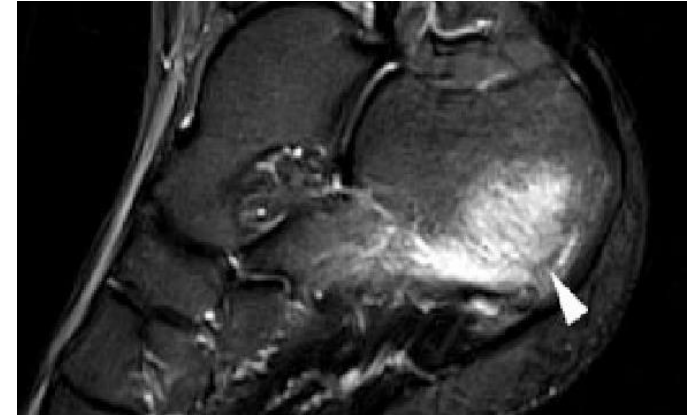
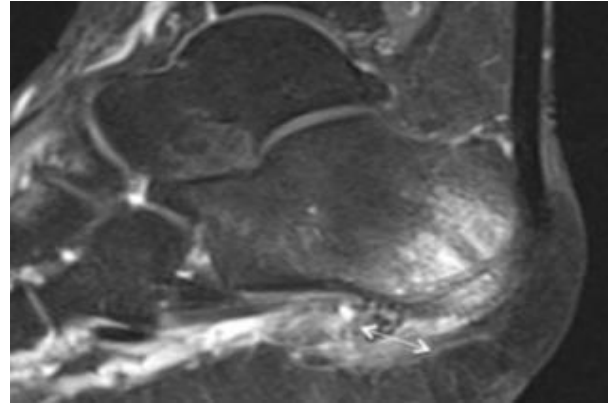
# Presantation

- Insidious onset of heel pain, often when **first getting out of bed**
  - *Post-static dyskinesia or Start-up pain*
  - relieved by ambulation
- Generally symptoms bilateral
- **Tender to palpation at medial tuberosity of calcaneus**
  - Dorsiflexion of the toes and foot increases tenderness with palpation
  - limited ankle dorsiflexion due to a tight Achilles tendon
  - tenderness at origin of abductor hallucis



# Differential diagnosis

- Plantar
- Stress fracture
- PF tear
- Plantar infection
- Presence of foreign body
- Nerve entrapment
  - Baxter
  - tarsal tunnel syndrome
  - medial calcaneal nerve

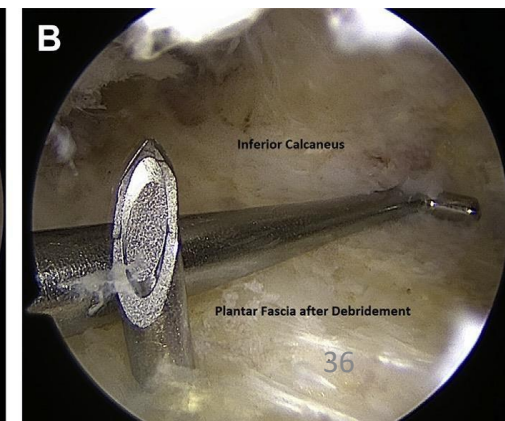
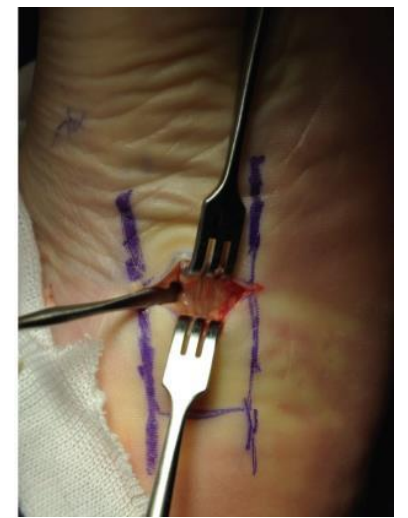


# Treatment options

<b>Medicine</b>	<b>NSAID, Acetaminophen, Steroid</b>
<b>Physically</b>	Orthotic use <b>Stretching exercises *</b> Soft tissue massage Taping and kinesiotherapy
<b>Instrumental</b>	<b>ESWT</b> US Low dose RT Cryoultrasound Iontophoresis
<b>Injections</b>	<b>Corticosteroid</b> <b>PRP</b>
<b>Surgery</b>	<b>Fasciotomy (partial, complete, endoscopic)</b> <b>RF microtenotomy</b> <b>Gastrocnemius release</b> <b>Nerve decompression</b>

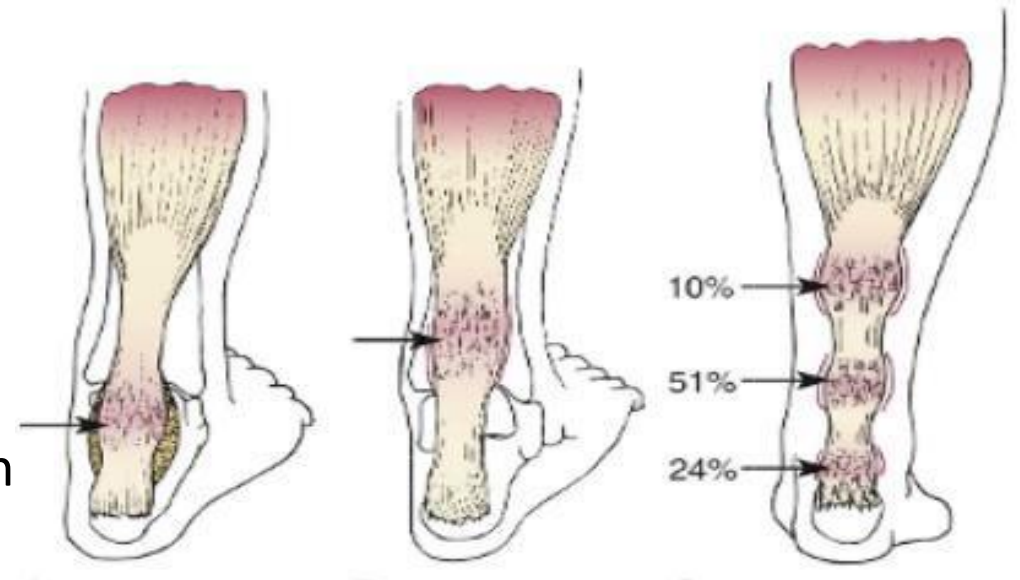
# Plantar fasciotomy

- **1/3 release with medial open approach**
  - Most preferred method
  - Results are also successful with direct plantar incision.
- Endoscopic method
- Spur excision
  - **No additional contribution...**
  - Risk of calcaneal stress fracture with excessive debridement



# Achilles tendinopathy

- Most common foot and ankle **overuse injury**
- Various names are used
  - Tendinitis, tenosynovitis, tendinosis, paratenonitis, tendinopathy, paratendinopathy
- **Insertional and noninsertional**
  - Insertionally in generally active people
  - Non-insertional, on the other hand, is observed in elderly, less active and overweight patients.



# Etiology

## • Intrinsic factors

- Leg length inequality
- hyperpronation
- Varus deformity
- Pes cavus
- Limited mobility of the subtalar joint
- Advanced age
- inflammatory arthropathy
- Steroid use
- DM, HT, Gout
- Obesity
- Lipidemia
- Aromatase inhibitors
- Quinolone use

## • Intrinsic factors

- Biomechanical and systemic problems

## • Extrinsic factors

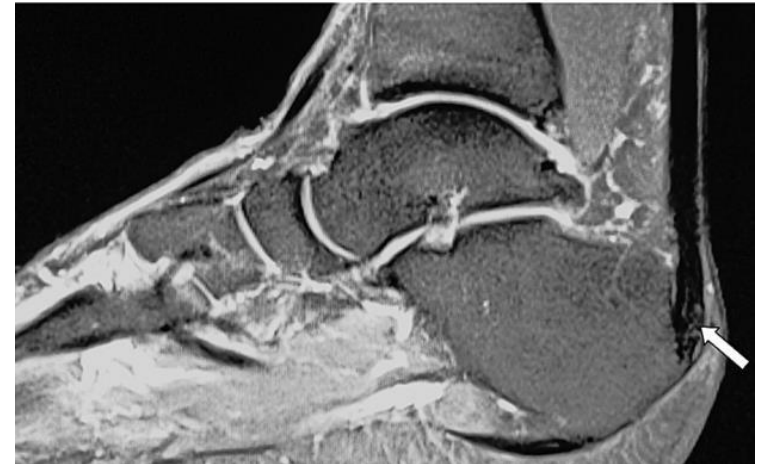
- External causes such as shoes, floors, tempo

## • Extrinsic factors

- Mechanical overload
- Training mistakes
  - Interval training
  - Unexpected changes in the program
  - Extreme hill workouts
  - Hard or sloping ground workouts
  - Extremely long distance
  - Increased repeater loading
  - Poor shock absorption
  - Wrong choice of shoes

# Insertional AT

- About 2% of the general population
- Bone prominence 65-80% (+)
- Increased pain after physical activity and stiffness after rest
- Difficulty wearing shoes and restriction in daily activities



# Achilles tendinopathy

- **Mechanism**

Overuse

Imbalance of dorsiflexors and plantar flexors

Poor tendon blood supply

Genetic predisposition

Fluoroquinolone antibiotics

Inflammatory arthropathy

- **Pathophysiology**

Theorized to be due to abnormal vascularity 2 to 6 cm proximal to Achilles insertion in response to repetitive microscopic tearing of the tendon

- **Classification**

- **Achilles tendinosis**

Tendon thickening

Thought to be caused by anaerobic degeneration in portion of tendon with poor blood supply

- **Achilles peritendonitis**

Involves inflammation of tendon sheath

Inflammation of paratenon



- It is observed 2-6 cm proximal to the Achilles attachment site.
- It is around 4% in the population
  - Around 9% of runners
- Secondary to mechanical loading
  - Especially in runners
- It is important to distinguish between tendinitis and tendinosis.
  - Tendinitis
    - In an acute setting, inflammatory response within the tendon after mechanical overload
  - Tendinosis
    - A degenerative process secondary to a chronic overuse phenomenon that causes tearing and degeneration due to repetitive stresses

## Non-insertional AT



# Treatment

- **Early life**

- Rest
  - It should be kept short
- Ice
- Walking boot
- Use of braces or splints
  - Not very active
- Training modification

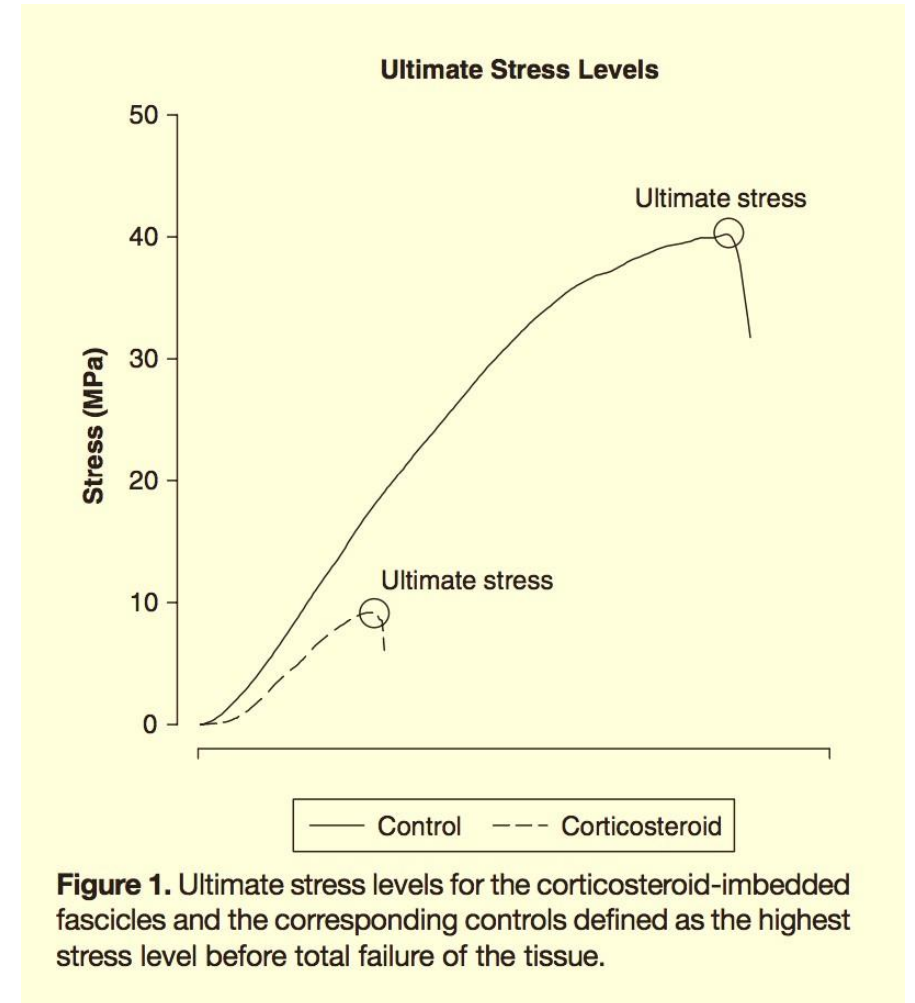


## • Steroid injection

- The effect is not clear
- Although it is effective in the short term, it has many side effects.
  - Rates up to 82%
  - Decreased tensile strength, atrophy and rupture
- Insufficient evidence for use

## • PRP

- Stimulates soft tissue healing with growth factors and cytokines
- Said to increase the production of collagen type 1-3
- Insufficient evidence, studies needed



# Insertional AT-Surgical treatment

- **Open resection**

- Retrocalcaneal bursitis excision,
- Posterior calcaneal process resection
- Re-suturing the calcaneus with or without a tendon graft

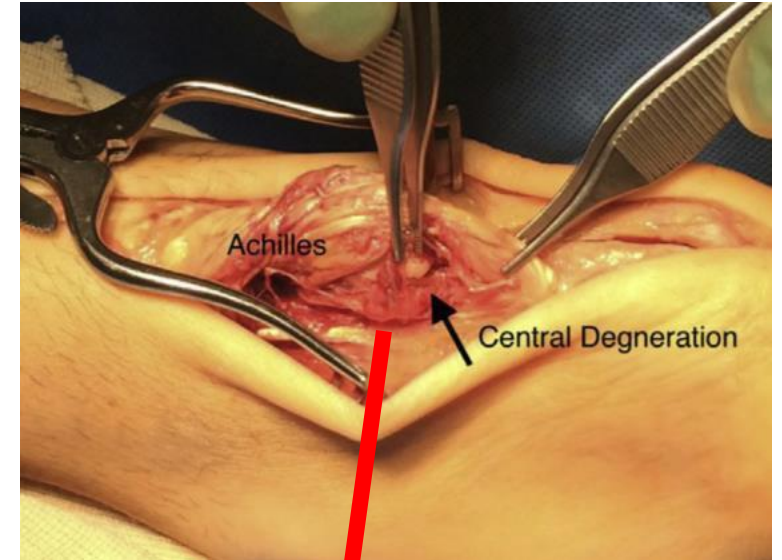
- **Endoscopic**

- Retrocalcaneal bursectomy and calcaneoplasty



# Non-insertional AT- Surgical treatment

- Patients who did not respond to conservative treatment for at least 4-6 months
- Contraindications
  - Arterial insufficiency
  - Active skin infection
  - Medical comorbidity
- It is important to protect the continuity of the tendon at 50% <
- Various incisions available
  - Longitudinal tendon stripping, medial, lateral,



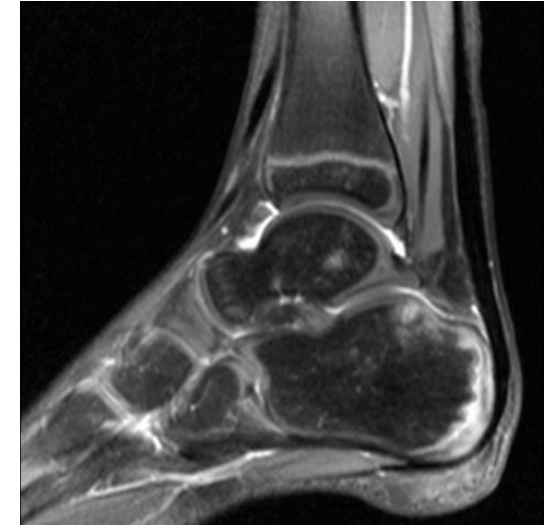
# Haglund deformity

- Protruding superoposterior portion of the calcaneus
- Common in middle-aged women
- Repetitive pressing shoes or the deformity itself causes retrocalcaneal bursitis
  - Erythema, swelling and tenderness
- Treatment includes shoe modification, NSAID, corticosteroid injections and physical therapy.
- **Surgical resection can be applied in resistant cases.**



# Sever's disease (calcaneal apophysitis)

- It is especially common in children aged 8-12, and especially in runners and jumpers.
- It can be seen in the sports initiation period or at the age of rapid growth.
- Pain occurs at the Achilles insertion with palpation and passive dorsiflexion.
- The radiograph is usually normal, but sclerotic or fragmented calcaneal apophysis may be seen.
- It is preferred in sports modification, Gastrocnemius stretching-strengthening, ice, medical treatment, heel support treatment.



# Diabetic neuropathy (Charcot's foot)

- Decreased peripheral sensation and proprioception
  - Bone destruction in loaded joints
  - Bone resorption and deformities
- 7% of DM, neuropathy patients have Charcot foot
  - 9-35% bilateral.





- There are 2 theories in pathophysiology;
  - **Neurotraumatic theory**
    - Bone destruction caused by repetitive traumas as a result of loss of pain and proprioception sense.
  - **Neurovascular theory**
    - Bone destruction as a result of autonomic stimulation, hyperemia and periarticular osteopenia + trauma.
- Confused with infection
  - WBC and fever do not elevate
- It has 4 stages (**Eichenholtz classification**)
  - Acute inflammatory phase
  - Development and fragmentation stage
  - Subacute-Charcot fusion phase
  - Chronic Charcot-consolidation-repair phase



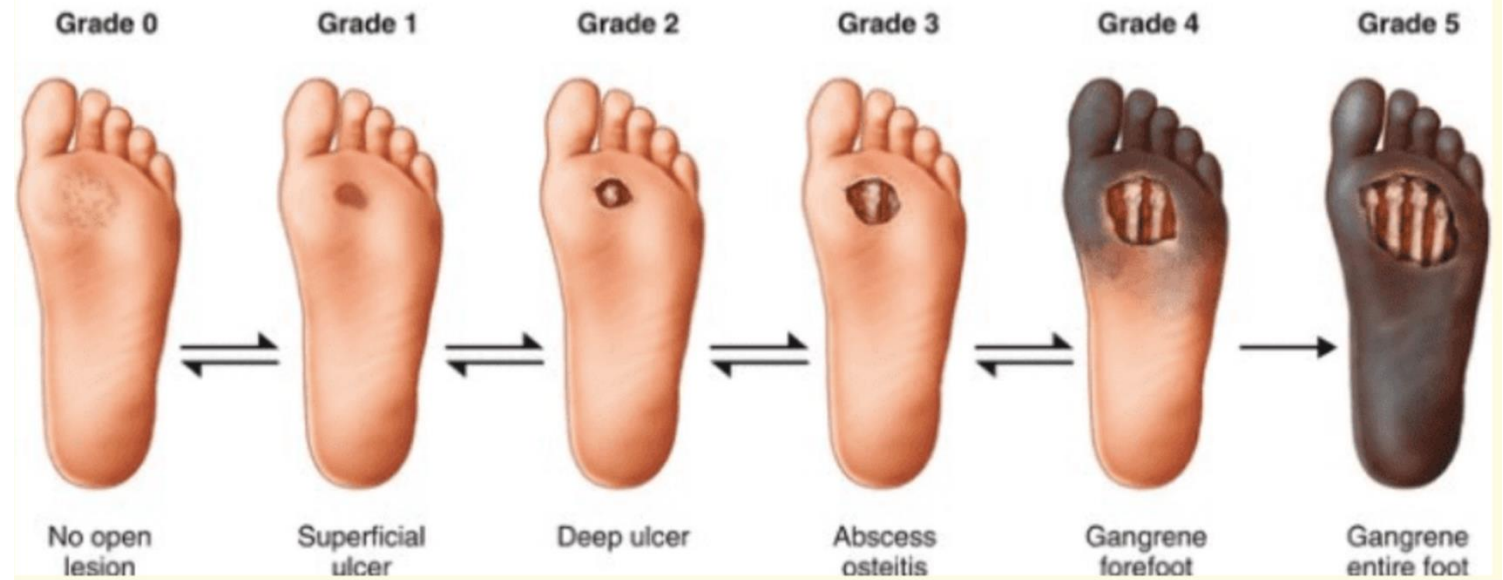
- **Purpose of treatment:** to obtain a stable and plantigrade foot that is compatible with the shoe without recurrent ulcerations.
- Total contact cast (most of the time sufficient)
  - Changed every 2-4 weeks
  - Approximate treatment 4 months
- Surgical
  - Not applicable in the acute stage
  - It is applied for bone deformities that occur in the late period.



# Diabetic foot

- It is the development of foot ulcerations **due to protective sensory loss**.
- Diabetic Foot Ulcers are very common lower extremity wounds that occur in diabetics with peripheral neuropathy and are responsible for 85% of lower extremity amputations.
- Treatment depends on the location of the ulcer and the presence of arterial disease are factors affecting the process.

- Uncontrolled hyperglycemia
- Continuous load on the affected area
- Infection
- Malnutrition
- Albumin 3gr/dl>
- WBC>1500



- Classification is made according to its depth and the area it affects (**Wagner class.**)

- Stage 1: bone and skin intact
- Stage 2: localized superficial ulcer without tendon and bone involvement
- Stage 3: deep ulcer/abscess formation/osteomyelitis with exposing tendons
- MRI studies are useful to assess for presence and extent of osteomyelitis.

- **Presence of ischemia** worsens the prognosis

- Treatment **multiple debridement and V therapy**

- Amputation is the last option

