PLEASE CLICK ON THE FOLLOWING LINK TO WATCH THE LECTURE ONLINE:-

https://www.youtube.com/watch?v=X604YSTLRPg&list=PLuBRb5B7fa_cjuGL06zhWXRxCDRoGpJlh&index=5

FLAT FOOT

- POSTERIOR TIBIAL TENDON DYSFUNCTION (PTTD)
- ADULT ACQUIRED FLATFOOT DEFORMITY (AAFD)
- ACQUIRED PES PLANOVALGUS
- PERITALAR SUBLUXATION (PTS)
- POSTERIOR TIBIAL TENDON DYSFUNCTION (PTTD)
- PROGRESSIVE COLLAPSING FOOT DEFORMITY” (PCFD)

Abdullah Alkhawaldah MD, FACS
RMS Jordan

Objectives

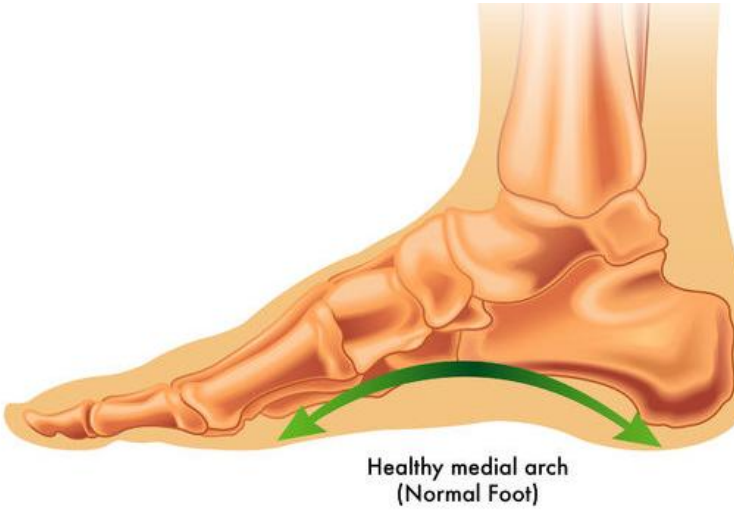
- Define and diagnose adult acquired flat foot deformity
- explain the classification of flat foot deformity
- define the mainstay methods of treatment

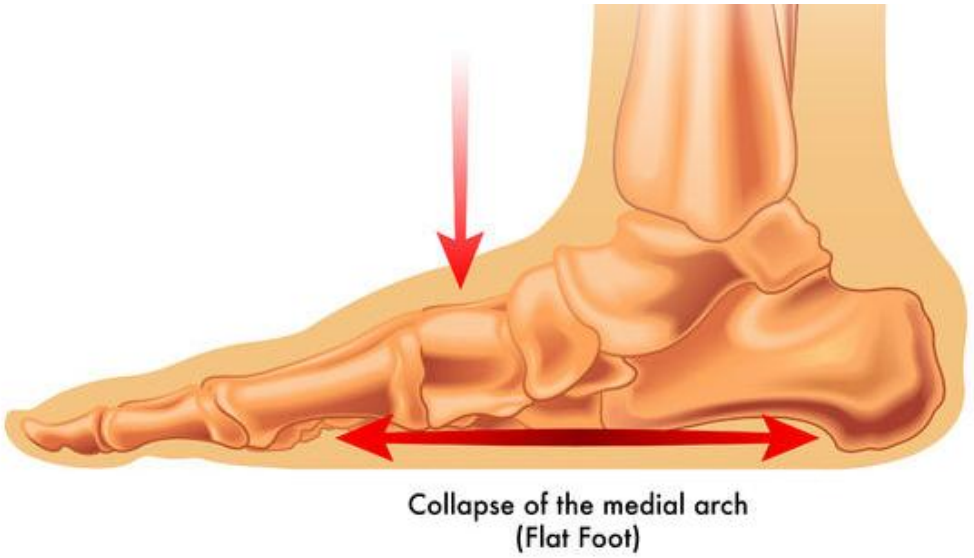
Flat foot

- Medial border of the foot is abnormally in contact with the floor during weight bearing

- Low or absent medial longitudinal arch

- When associated with deformities of the hind, mid and fore foot – Pes Planovalgus





Deformity analysis

AAFD

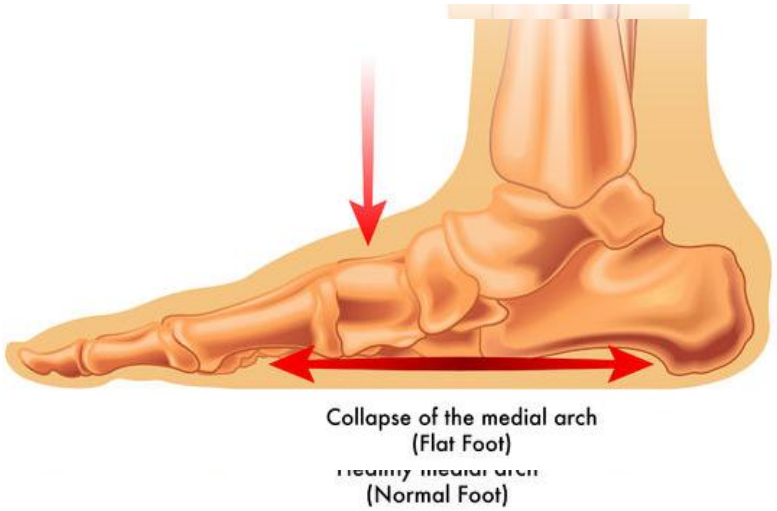
- Pathophysiology
  - Tendon attenuation, tear
  - Medial ligaments weaken
    - **Spring Ligament**
      - **Calcaneonavicular**
  - Heel valgus
  - Arch collapse
  - Midfoot supination, abduction
  - **Gastrocemius/Achilles contracture**

Flat foot

- Medial border of the foot is abnormally in contact with the floor during weight bearing

- Low or absent medial longitudinal arch

- When associated with deformities of the hind, mid and fore foot – Pes Planovalgus



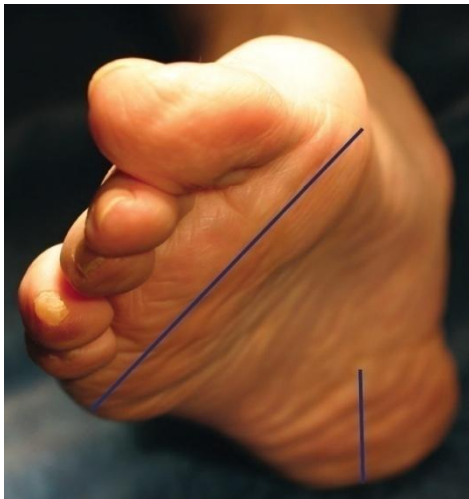
Flat FOOT

- Pathology

  Resulting in:
  - Hindfoot Valgus
  - Forefoot Abduction
  - Forefoot supination
- Mechanical Effect
  - Loose Foot
  - Lever arm dysfunction

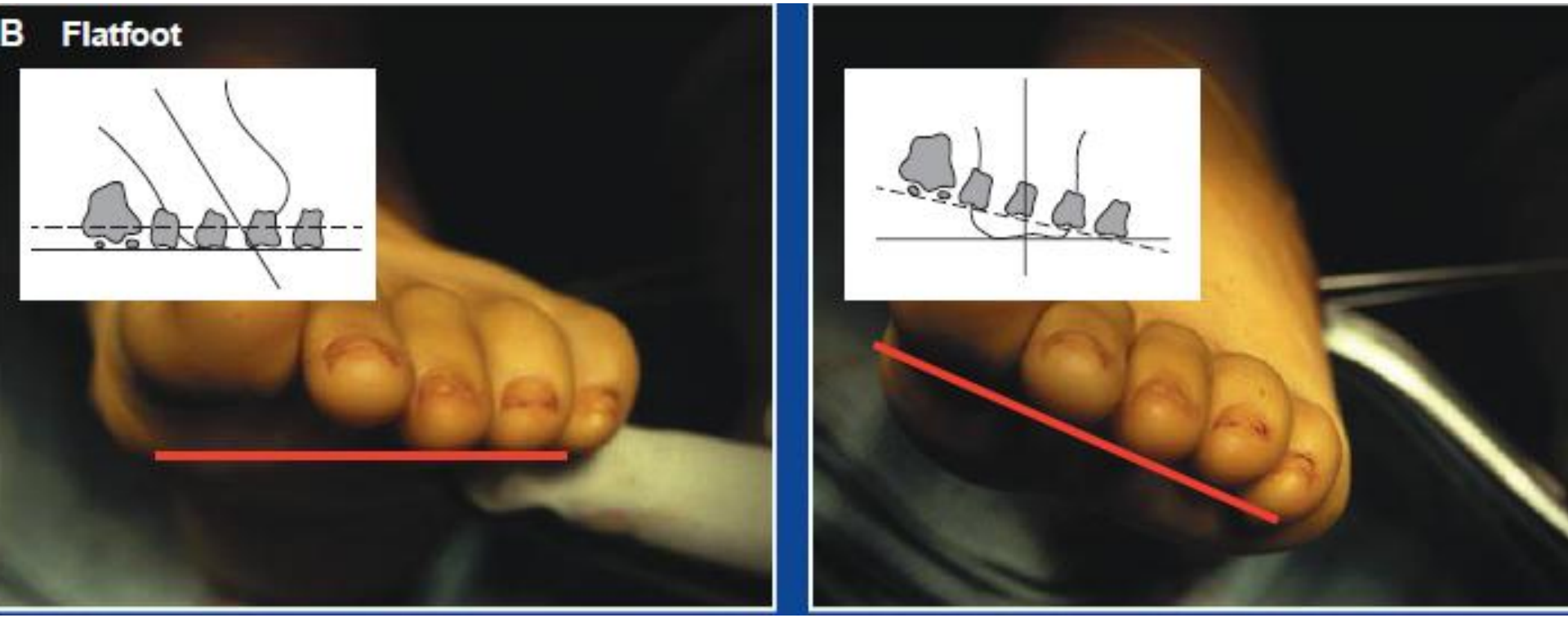
H.-G. Jung (ed.), *Foot and Ankle Disorders: An Illustrated Reference*

Supination Twist



• When the hind foot pronates substantially in weight bearing, the transverse tarsal joint generally will supinate to some degree to counter rotate the forefoot and keep the plantar aspect of the foot in contact with the ground.

• If the range of transverse tarsal supination is not sufficient to meet the demands of the pronating hind foot then the medial forefoot will press into the ground, and the lateral forefoot will tend to lift.



Mosca, Principles and Management of Pediatric Foot and Ankle Deformities and Malformations

Clinical assessment

Presentation

- The presenting symptoms of AAFD vary according to the stage of disease.
- Early on, a patient presents with pain and swelling medially over the posterior tibial tendon. The tendon failure is a degenerative process. Even though the tendon may not rupture, it often becomes dysfunctional.

Presentation

- With progression of hindfoot deformity:
- **Lateral pain from bony impingement at the lateral subtalar joint and distal tip of the fibula**.

- There may be a significant period of time between resolution of medial pain and the development of lateral pain, when the symptoms may consist more of a weakness in the foot than pain. However, **pain eventually returns when the deformity progresses.**

Physical examination

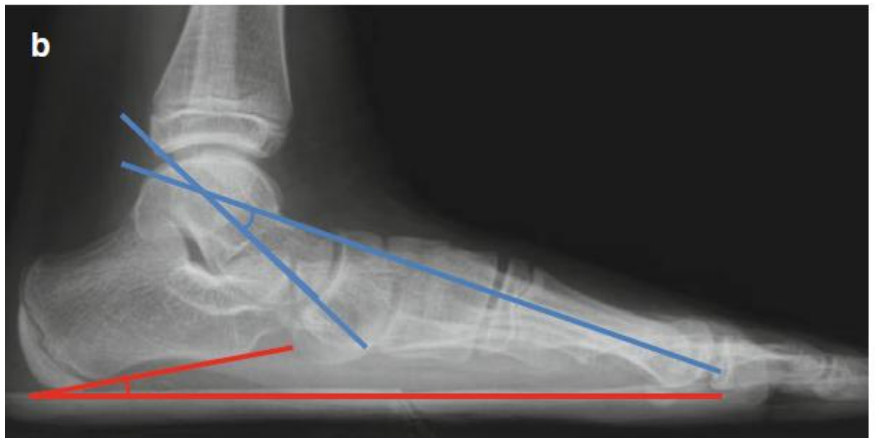
- • Standing examination demonstrates asymmetric hindfoot valgus, depressed arch, and an abducted forefoot.
- • “Too many toes” when the foot is viewed posteriorly
- • **Pain or inability to perform single-limb heel rise**
- **indicates insufficient PTT.**

PHYSICAL EXAMINATION

- Examine the **tendo-achilles** for tightness (TA contracture tends makes flexible flatfoot symptomatic)
- Short tendo-achilles: limited dorsiflexion(not able to walk on heels)
- Harris and Beath documented that presence or absence of the longitudinal arch did not correlate with the disability and a flatfoot was compatible with normal function unless associated with a tight tendo-achilles
- Examine **ROM** of ankle, subtalar, midtarsal joints
- Examine the gait
- Generalized ligamentous laxity
- Hypermobility of the subtalar and mid-tarsal joints: the forefoot can be bent outwards and upwards to an unusual degree

Radiographic analysis

standing views



Meary's angle - between long axis of talus and long axis of first metatarsal on a standing lateral Xray

- 0 degrees – normal
- 0 – 15 degrees – mild
- 15 – 30 degrees – moderate
- > 30 degrees – severe

The location of the **sag**, talo-navicular, naviculo-cuneiform or both can also be determined

H.-G. Jung (ed.), *Foot and Ankle Disorders: An Illustrated Reference*

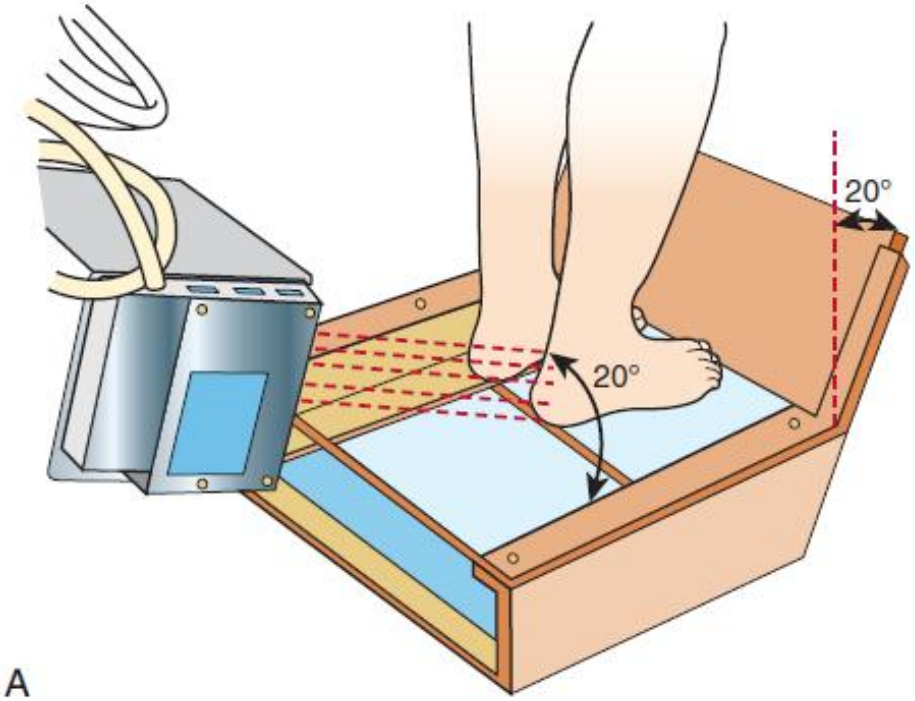
Talonavicular coverage angle (*asterisk) is the* angle between the anterior articular surface of the
talus and the proximal articular surface of the navicular
bone

H.-G. Jung (ed.), *Foot and Ankle Disorders: An Illustrated Reference*

- WB xrays ankle
  - Rule out arthritis
  - Rule out valgus tilt

J Am Acad Orthop Surg 2008;16:399- 406

Hindfoot alignment view. **A, The hindfoot alignment view is obtained with the patient standing on an elevated platform with the x-ray beam posterior to the heel, angled 20 degrees caudal from the horizontal. The cassette is placed in front of the patient, perpendicular to the beam, angled 20 degrees off the vertical. It is critical that the long axis of second metatarsal is oriented rectangular to the film cassette because rotation of the foot will alter the measurement of hindfoot alignment angle. B, The midline of the calcaneal tuberosity *(arrow) normally lies slightly lateral to the middiaphyseal axis of the tibia, giving a normal hindfoot angle of 0 to 5 degrees valgus. (Drawing A modified from Jones CP, Younger ASE: Imaging of the foot and ankle.***



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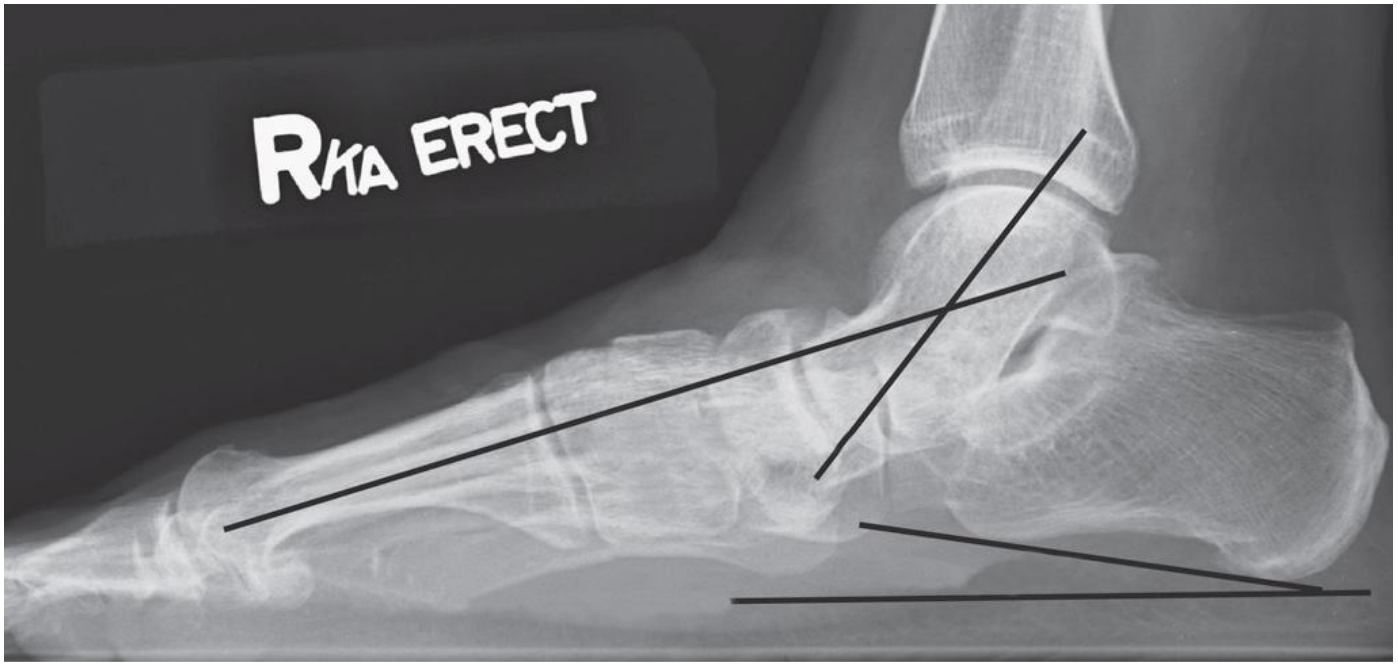
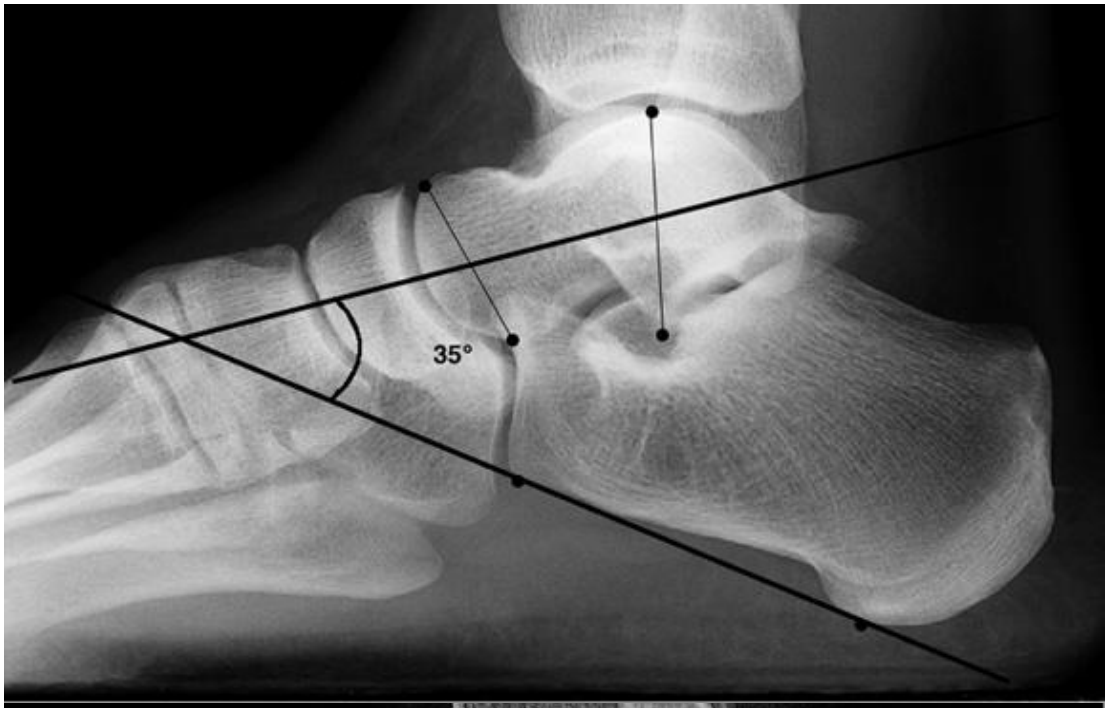


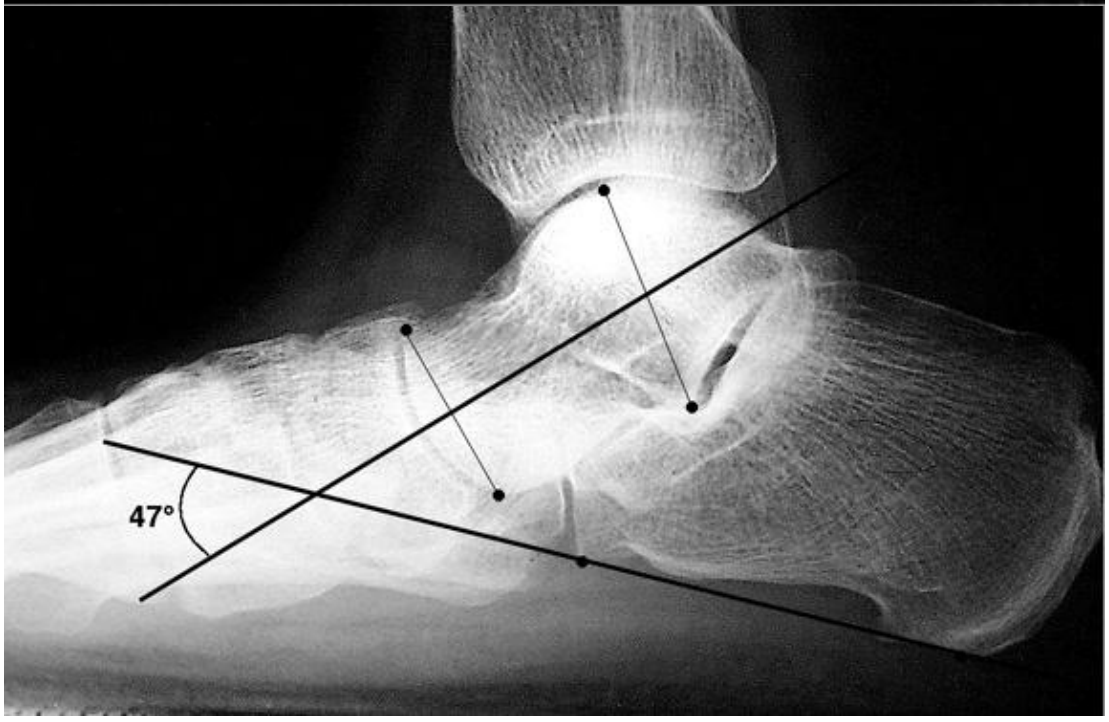
Calcaneal pitch - angle between the plantar surface of the calcaneum and horizontal on a lateral x-ray

- Normal 15 degrees , in flat foot is decreased
- May be 0 or negative in case of tightened TA

The talocalcaneal angle on an AP view is a marker of hind foot valgus

- Talus much more vertical than normal


35°

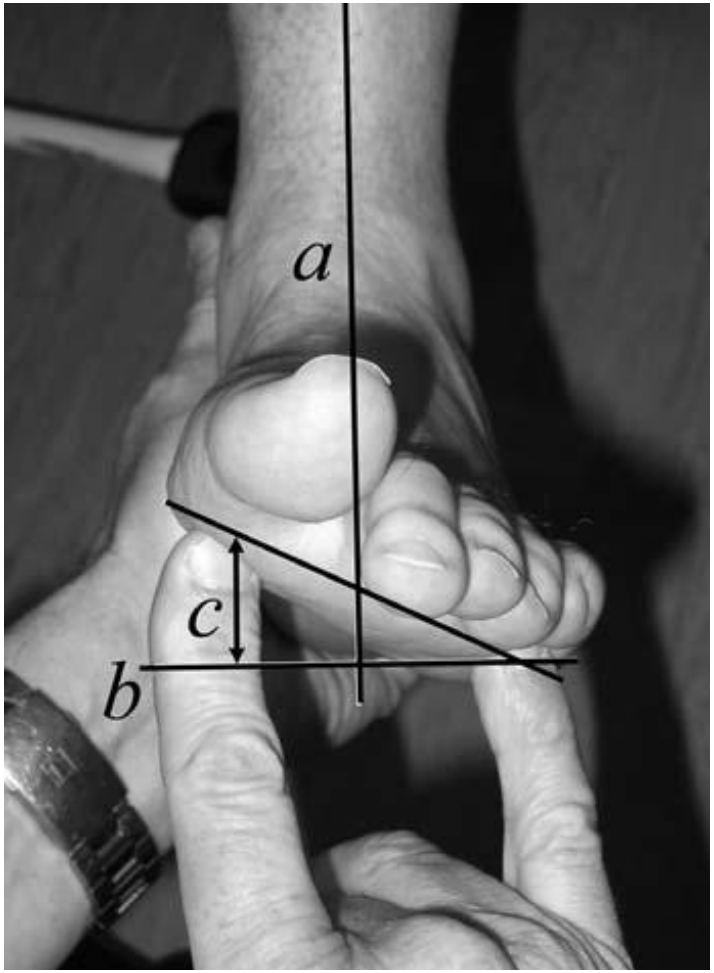

47°

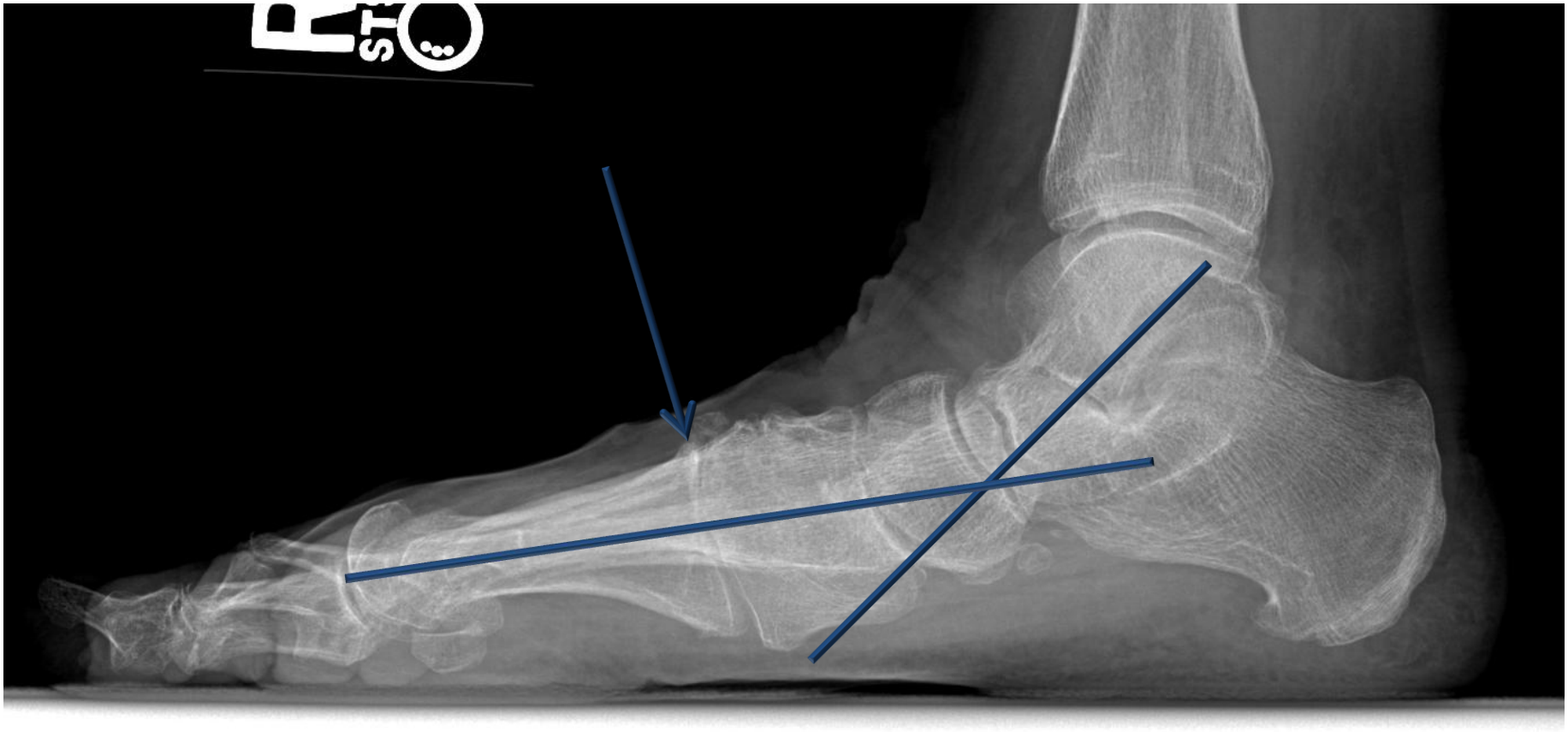
FOOT & ANKLE INTERNATIONAL

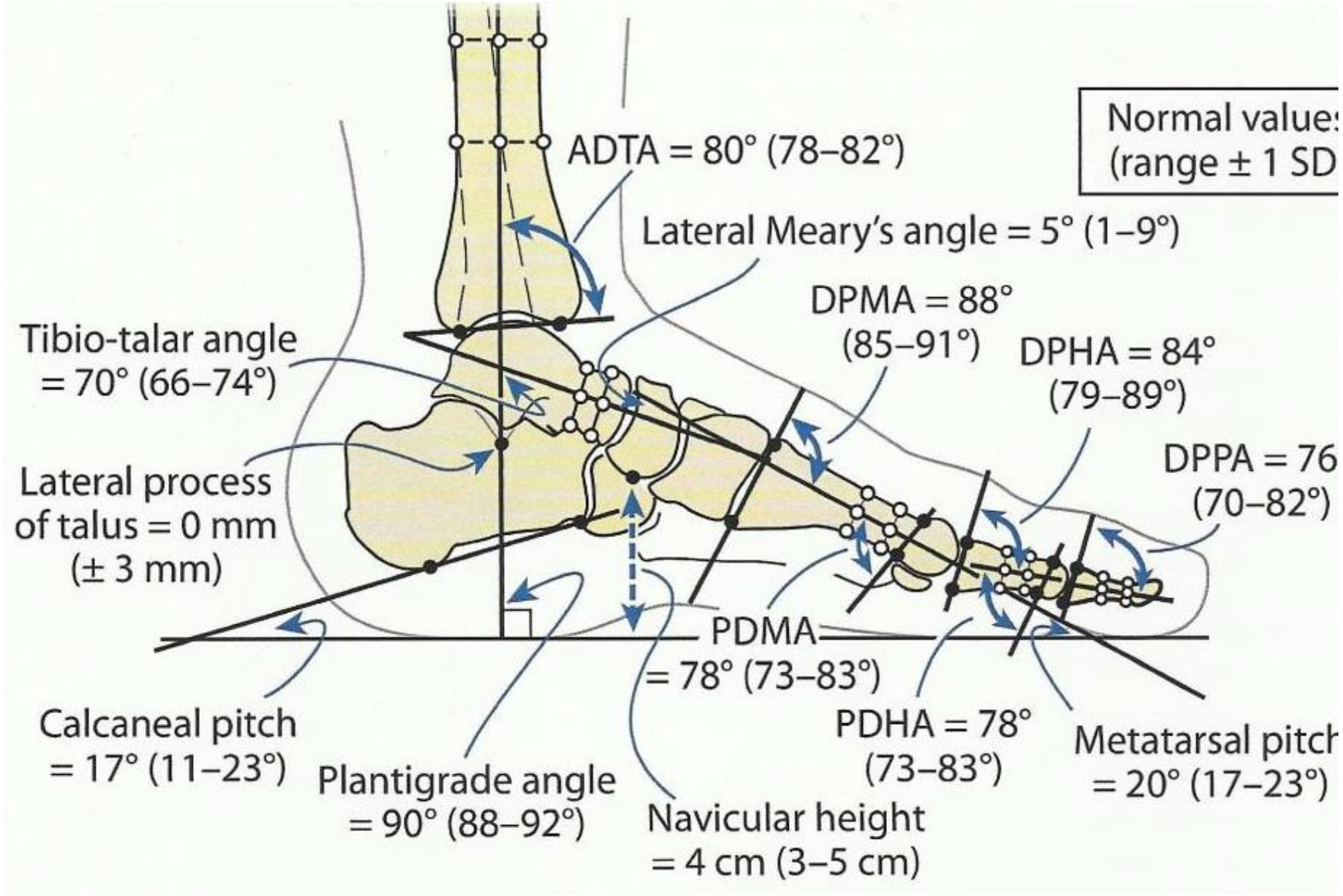
DOI: 10.3113/FAI.2009.0708

Clinical Tip: The Reverse Coleman Block Test Radiograph

Edward V. Wood, FRCS(Tr&Orth); Asad Syed, FRCS, FRCS(Tr&Orth); Nicholas P. Geary, FRCS






Normal values
(range ± 1 SD
ADTA = 80° (78–82°)
Lateral Meary's angle = 5° (1–9°)
DPMA = 88°
(85–91°)
DPHA = 84°
(79–89°)
DPPA = 76
(70–82°)
Tibio-talar angle
= 70° (66–74°)
Lateral process
of talus = 0 mm
(± 3 mm)
PDMA
= 78° (73–83°)
PDHA = 78°
(73–83°)
Metatarsal pitch
= 20° (17–23°)
Calcaneal pitch
= 17° (11–23°)
Plantigrade angle
= 90° (88–92°)
Navicular height
= 4 cm (3–5 cm)

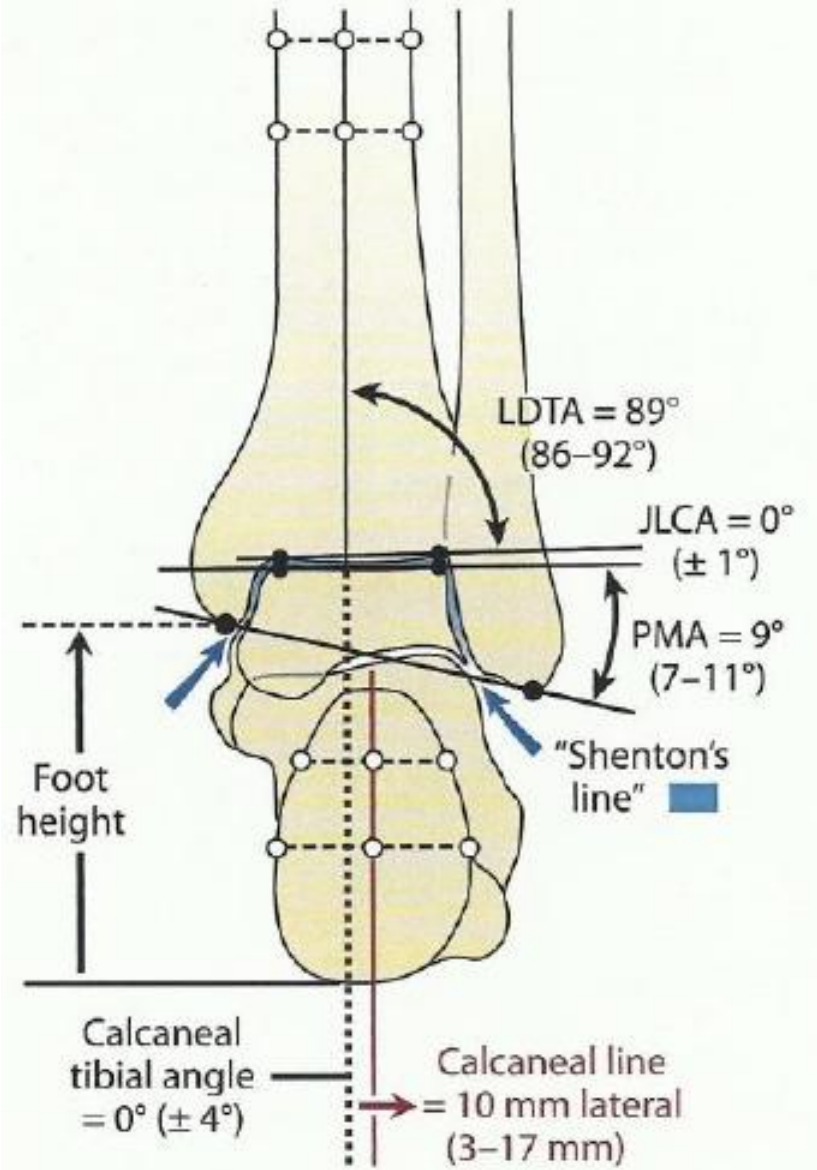


Fig. 5: Axial view measurements of the foot.

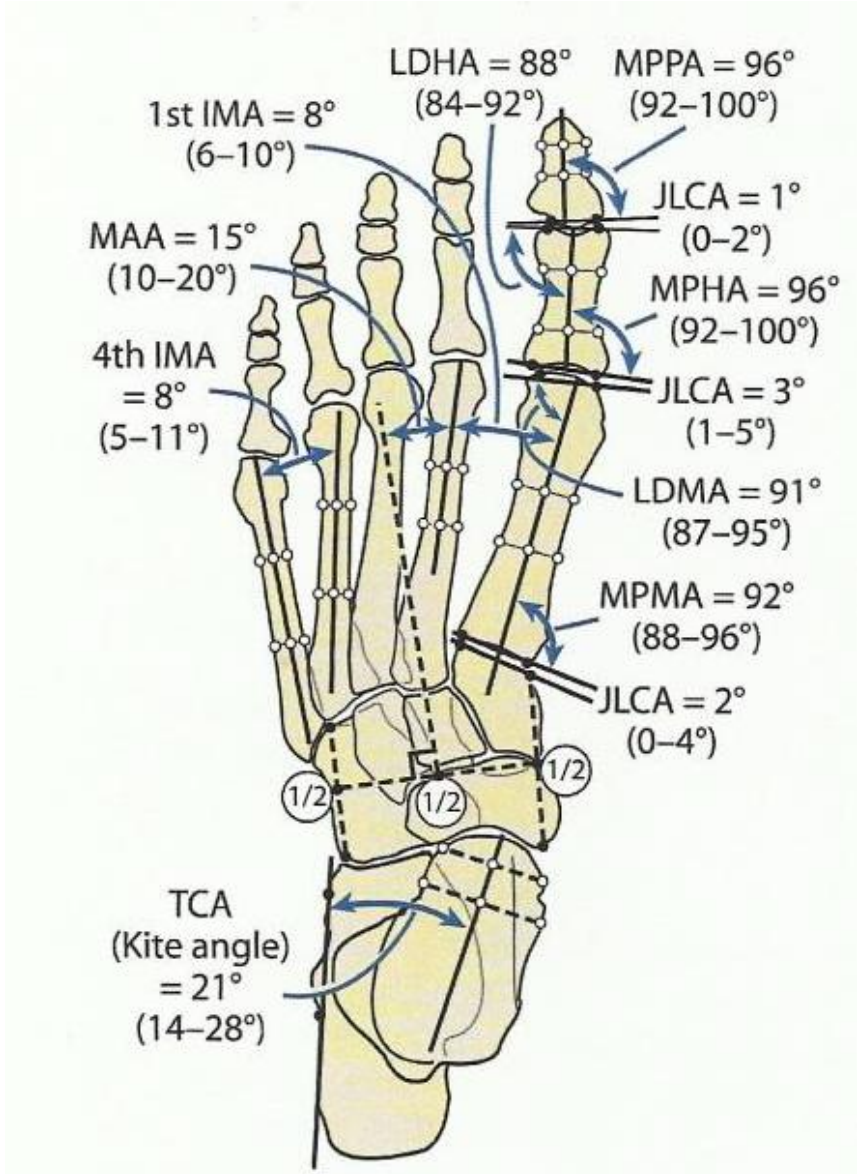


Fig. 4: AP view measurements of the foot.

AAFD

- Originally known as posterior tibial tendon dysfunction or insufficiency, AAFD was first described as tendon failure.
- However, failure of the ligaments that support the arch also occurs, often resulting in progressive deformity of the foot.
- Deformities vary in severity, rate of progression, and location along the arch.

Posterior Tibial Tendon Dysfunction

- Classification
  - Stage I – tenosynovitis, **no deformity**
  - Stage II – tenosynovitis or tear, **flexible** flatfoot
    - Stage IIA – < 30% uncoverage of TN
    - Stage IIB – abduction deformity + > 30% uncoverage of TN
  - Stage III – **rigid** flatfoot +/- arthritis
  - Stage IV – F&A deformity or Lateral talar tilt

Posterior Tibial Tendon Dysfunction

- Nonoperative Treatment
  - Stage I
    - Immobilization – Cast/Boot WBAT
  - **Stage II – Initial Presentation**
    - **Based on Current Literature!**
      - **This is a change!**
    - **AFO**
    - **Physical Therapy**
  - Stage II – Recurrence Prevention
    - Orthotic
      - Medial Hindfoot Post/Inversion
      - Arch Support
      - Medial Forefoot Support
        - » **Supports Forefoot Varus if present**
  - Stage III/IV
    - AFO
    - Arizona Brace

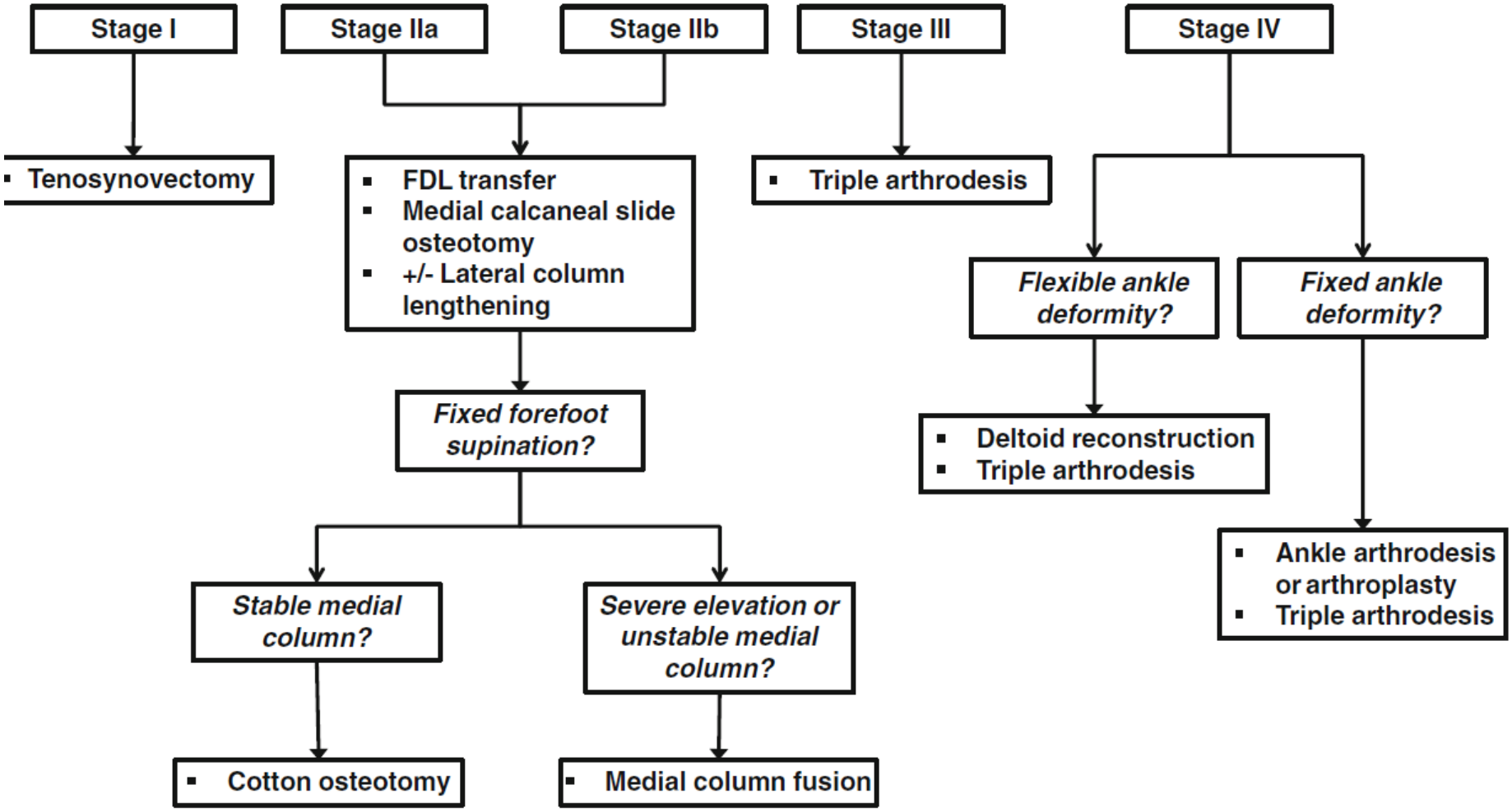
Original Images

Elsevier: Foot Ankle Clin N Am. 6:341-369, 2001

Figure 25-13 **A,** University of California Biomechanics Laboratory (UCBL) orthosis. This orthosis functions by stabilizing the heel in neutral and by building up the lateral wall of the device to prevent abduction of the forefoot, thereby helping to reestablish a longitudinal arch in the flexible foot. **B,** Note higher heel counter allowing better control of heel valgus. **C,** Note posting of posterior orthosis to assist with hindfoot correction.

Figure 25-14 **A,** The Arizona brace is a lace up corset that crosses the ankle joint to provide increased stability preventing collapse of the medial column. **B,** Clinical use of the Arizona brace.

posterior tibial tendon dysfunction



H.-G. Jung (ed.), *Foot and Ankle Disorders: An Illustrated Reference*

Classification Systems

Stage	Deformity	Treatment
I	No deformity, although a preexisting flatfoot may be present	Orthotics or bracing with an articulated AFO. Tenosynovectomy is rarely required
IIa	Mild to moderate flexible deformity with <30 % talonavicular uncoverage	FDL transfer, medial calcaneal slide osteotomy. Cotton osteotomy or medial column fusion may be needed for fixed forefoot supination
IIb	Severe flexible deformity with >30 % talonavicular uncoverage	FDL transfer, medial calcaneal slide osteotomy. Cotton osteotomy or medial column fusion as needed for fixed forefoot supination. Lateral column lengthening utilized by some surgeons
III	Fixed deformity involving the triple joint complex	Correction of foot deformity with triple arthrodesis
IV	Foot and ankle deformity with lateral talar tilt	For fixed ankle deformities with significant arthritis, ankle arthrodesis with correction of the foot deformity. Ankle arthroplasty may be considered as alternative to fusion without contraindications due to obesity or medical comorbidities. For flexible ankle deformities, deltoid reconstruction with correction of the foot deformity may be a consideration

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DOI: 10.1177/1071100720950722
journals.sagepub.com/home/fai

Classification and Nomenclature: Progressive Collapsing Foot Deformity

Mark S. Myerson, MD[1], David Thordarson, MD[2], Jeffrey E. Johnson, MD[3], Beat Hintermann, MD[4], Bruce J. Sangeorzan, MD[5], Jonathan T. Deland, MD[6], Lew C. Schon, MD[7,8,9,10], Scott J. Ellis, MD[6], and Cesar de Cesar Netto, MD, PhD[11]

Table 3. Consensus Group Classification of Progressive Collapsing Foot Deformity.

Stage of the deformity		
Stage I (flexible)		Stage II (rigid)
Types of deformity (classes – isolated or combined)		
	Deformity type/location	Consistent clinical/radiographic findings
Class A	Hindfoot valgus deformity	Hindfoot valgus alignment Increased hindfoot moment arm, hindfoot alignment angle, foot and ankle offset
Class B	Midfoot/forefoot abduction deformity	Decreased talar head coverage Increased talonavicular coverage angle Presence of sinus tarsi impingement
Class C	Forefoot varus deformity/medial column instability supination	Increased talus–first metatarsal angle Plantar gapping first TMT joint/NC joints Clinical forefoot varus
Class D	Peritalar subluxation/dislocation	Significant subtalar joint subluxation/subfibular impingement
Class E	Ankle instability	Valgus tilting of the ankle joint

Abbreviations: NC, naviculocuneiform; TMT, tarsometatarsal.

consensus group has recommended renaming the condition to Progressive Collapsing Foot Deformity (PCFD),

AAFD includes far more than a rupture of the PTT, most importantly the spring and deltoid ligaments

not to use acquired flatfoot as the terminology, because a lot of people are born with flatfeet and are never symptomatic

progressive and collapsing because they give a better idea of the worsening and evolving nature of the complexity of this 3D deformity

management

Topical Review

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DOI: 10.1177/1071100720950759
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Progressive Collapsing Foot Deformity: Consensus on Goals for Operative Correction

Bruce J. Sangeorzan, MD[1], Beat Hintermann, MD[2], Cesar de Cesar Netto, MD, PhD[3], Jonathan Day, MS[4], Jonathan T. Deland, MD[4], Scott J. Ellis, MD[4], Jeffrey E. Johnson, MD[5], Mark S. Myerson, MD[6], Lew C. Schon, MD[7,8,9,10], and David Thordarson, MD[11]

- maximize preservation of joint range of motion
- BMI equal to or higher than 30, will generally do worse with reconstructive surgery when compared to hindfoot fusions
- coronal plane deformity correction of the hindfoot
- correcting the forefoot abduction.
- In more severe PCFD when the deformity is uncorrectable and there is degeneration in the triple joint complex, TN and ST fusion may be indicated

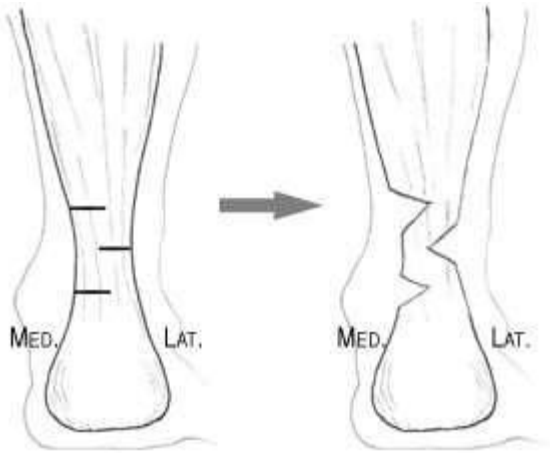
Equinus

Strayer

- Gastroc
- Sural nerve
- Larger incision
- More time

TAL

- Quick
- Atrophy of gastroc
- Loss strength



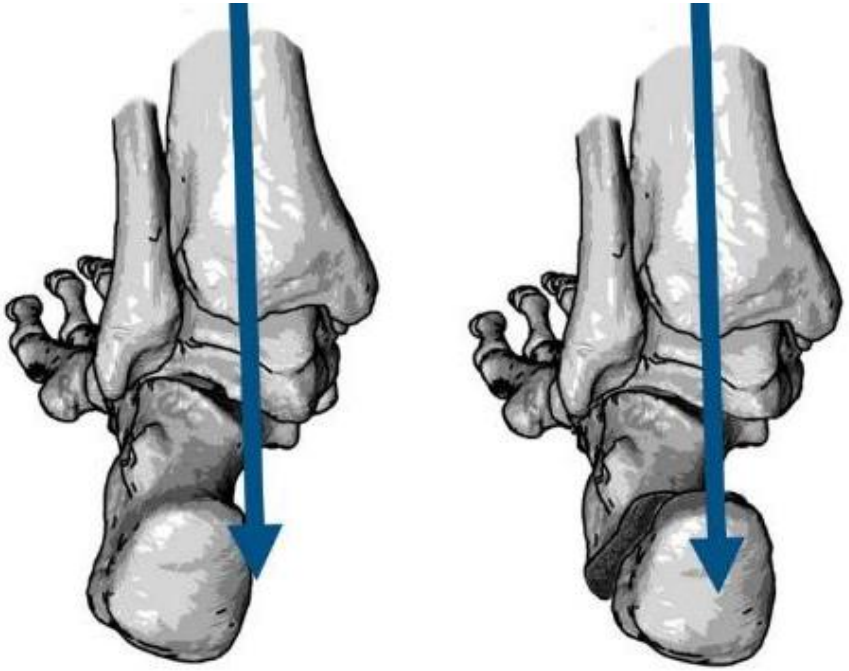
flexible

osteotomies

Medial Displacement Calcaneal osteotomy

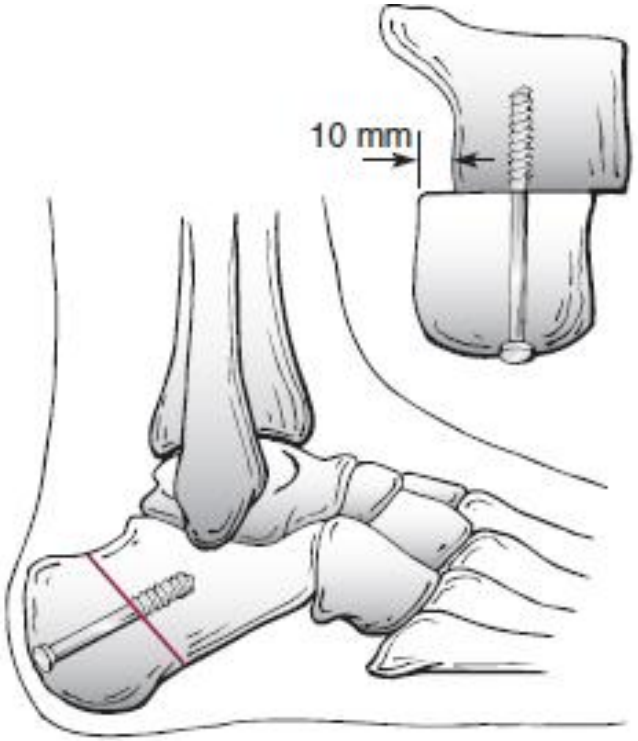
- Hindfoot valgus deformity

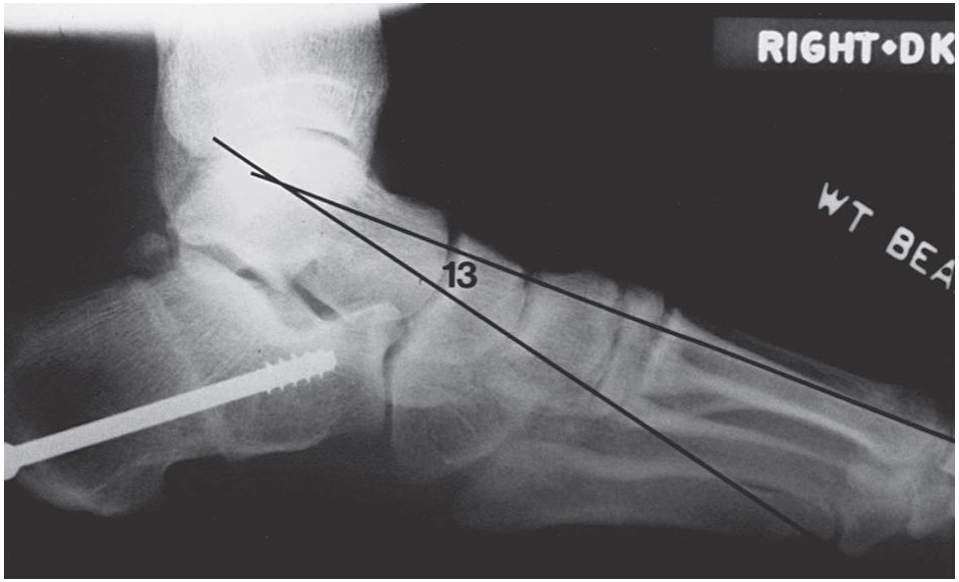
Theory
- Change the mechanical axis of the Achilles
- Improves inversion power
- Shifts weight bearing axis towards long axis of tibia



- shift of Achilles tendon insertion medially
- shift of beginning of plantar aponeurosis medially

- Different techniques fixation (screws, plates, staples)





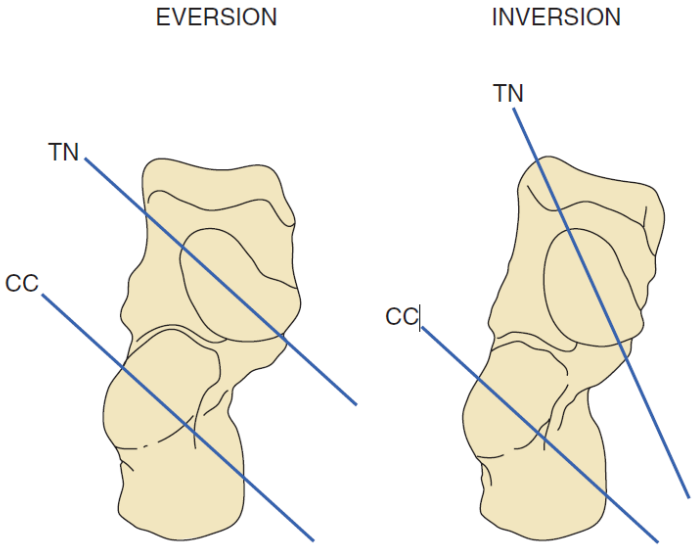
MANN'S SURGERY OF THE FOOT AND ANKLE

Preferred Technique – Hindfoot Valgus

- **<u>Medial Displacement Calcaneal Osteotomy (MDCO)</u>**
  - Corrects Hindfoot Valgus
  - Reliable Union Rate
- **<u>Subtalar Fusion</u>**
  - Obese Patient – BMI >30 (Clinical Judgment)
  - Subluxated Subtalar Joint

Abduction

- > 50% Talonavicular Uncovering
  - Lateral Column Lengthening
    - **Most Reliable Radiographic Correction**


EVERSION
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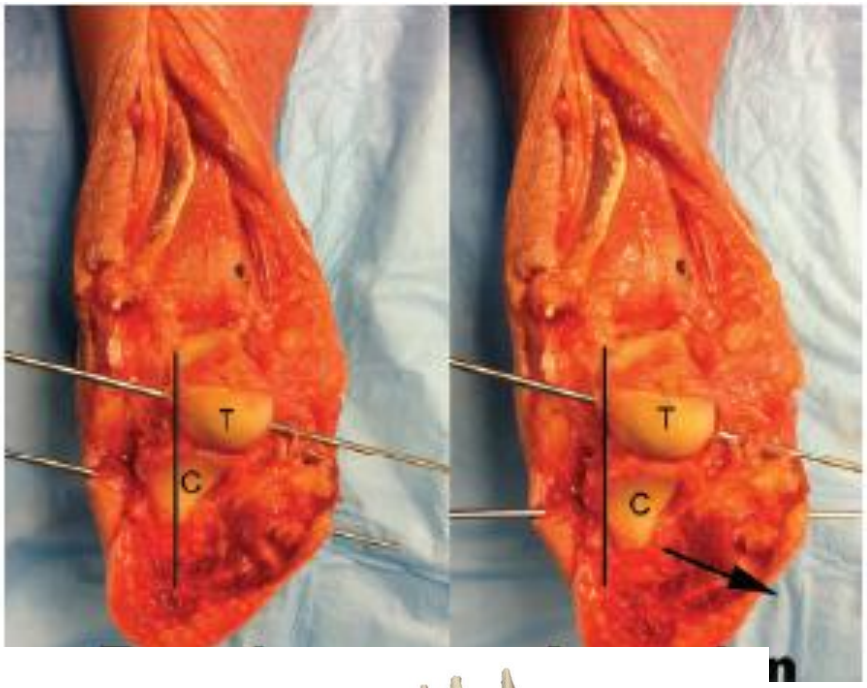
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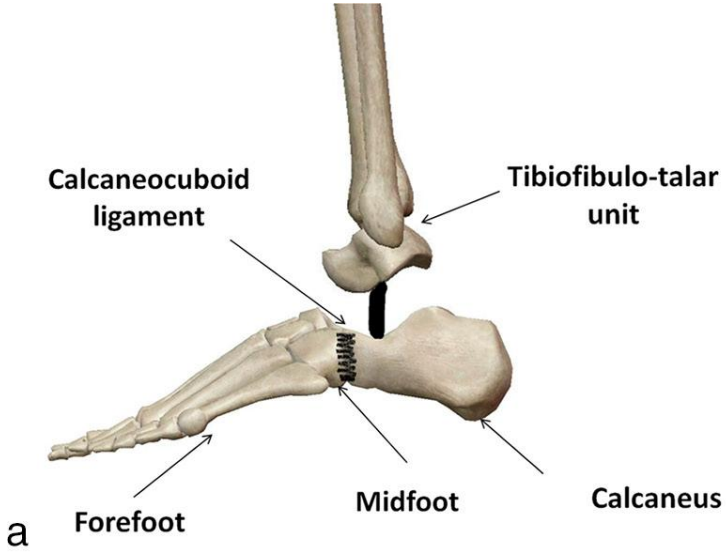
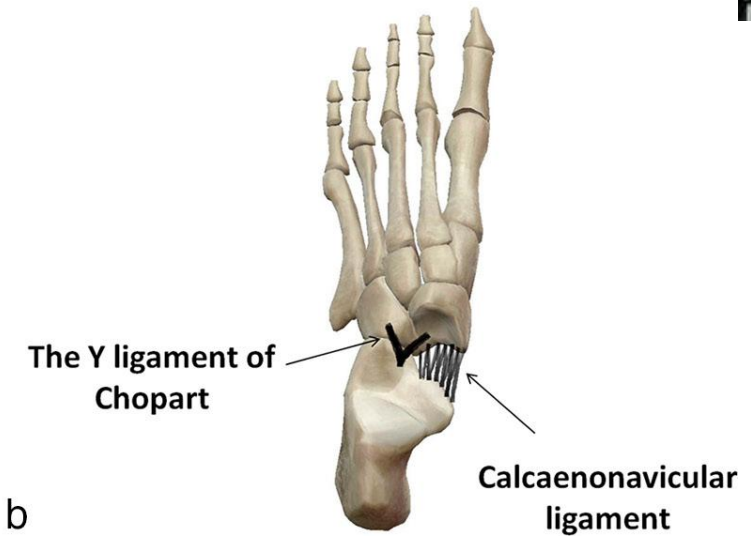
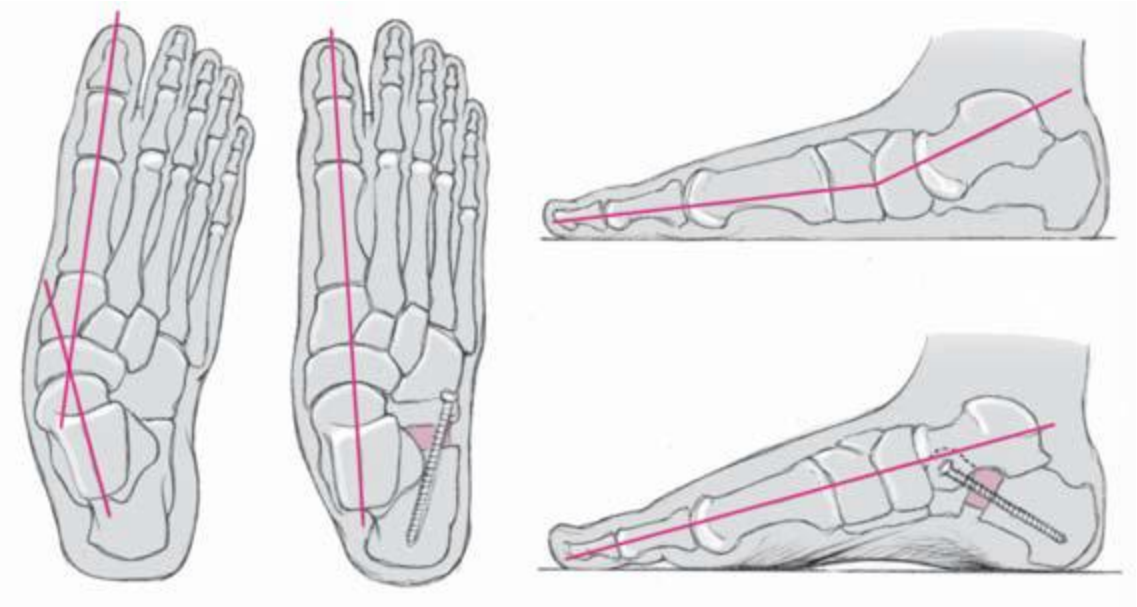

Calcaneocuboid ligament
Tibiofibulo-talar unit
Forefoot
Midfoot
Calcaneus
a


The Y ligament of Chopart
Calcaenonavicular ligament
b

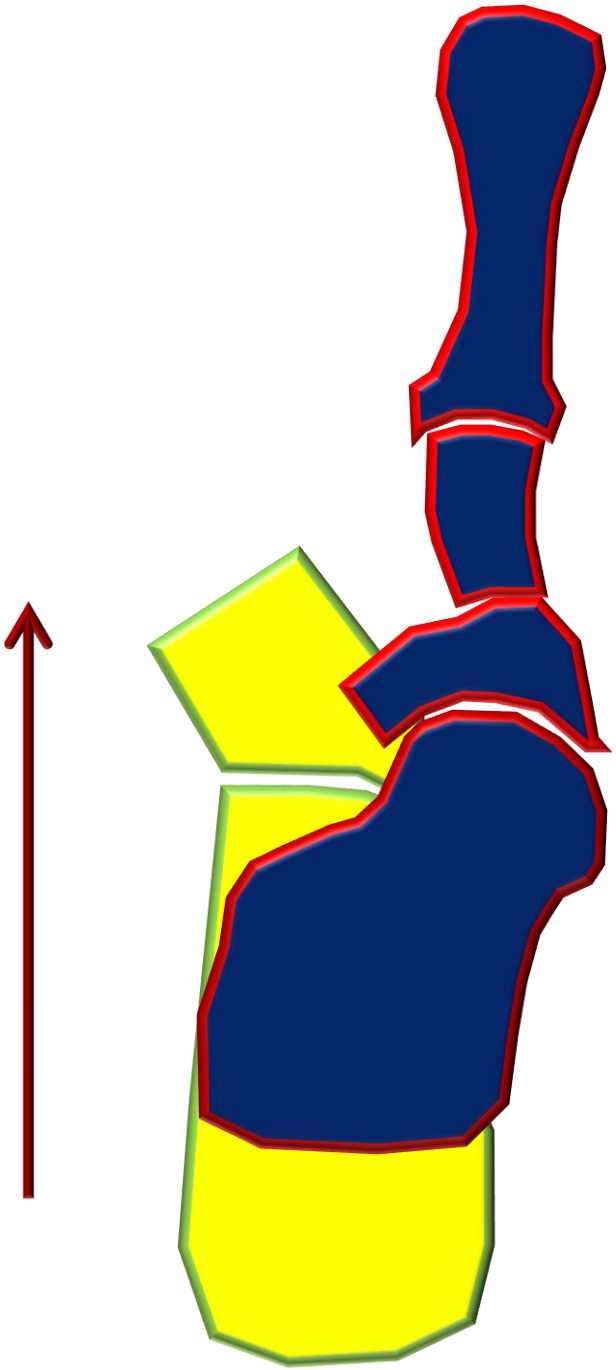
Evans Osteotomy for the Operative Treatment of Acquired Pes Planovalgus

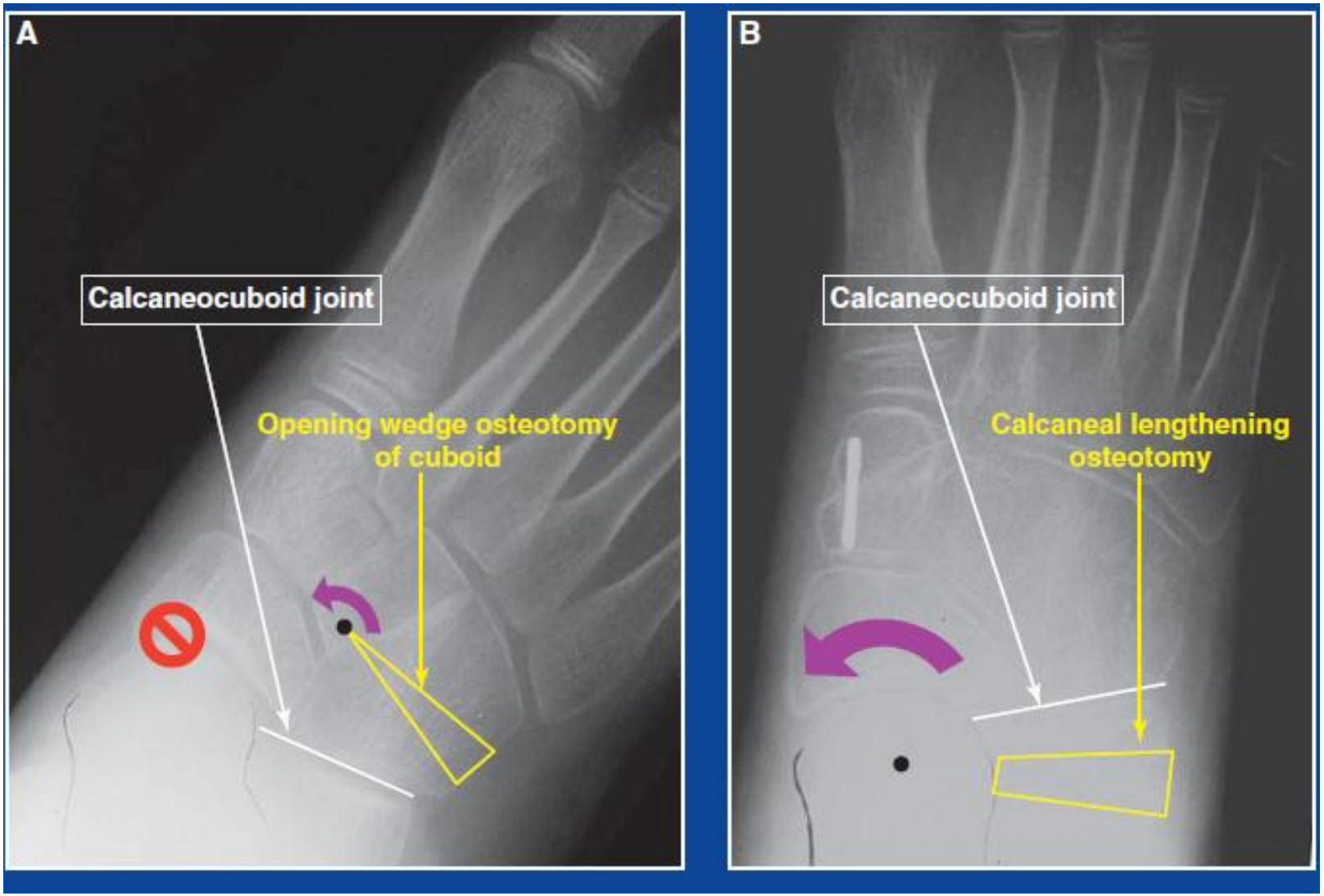


Zwipp H, Rammelt S. Modifizierte Evans-Osteotomie bei Knick-Platt-Fuss

Lateral Column is NOT Short!

- No difference in Lateral Column lengths (Kang et. al. Foot Ankle Int. 2013)
  - Flatfoot vs. Normal





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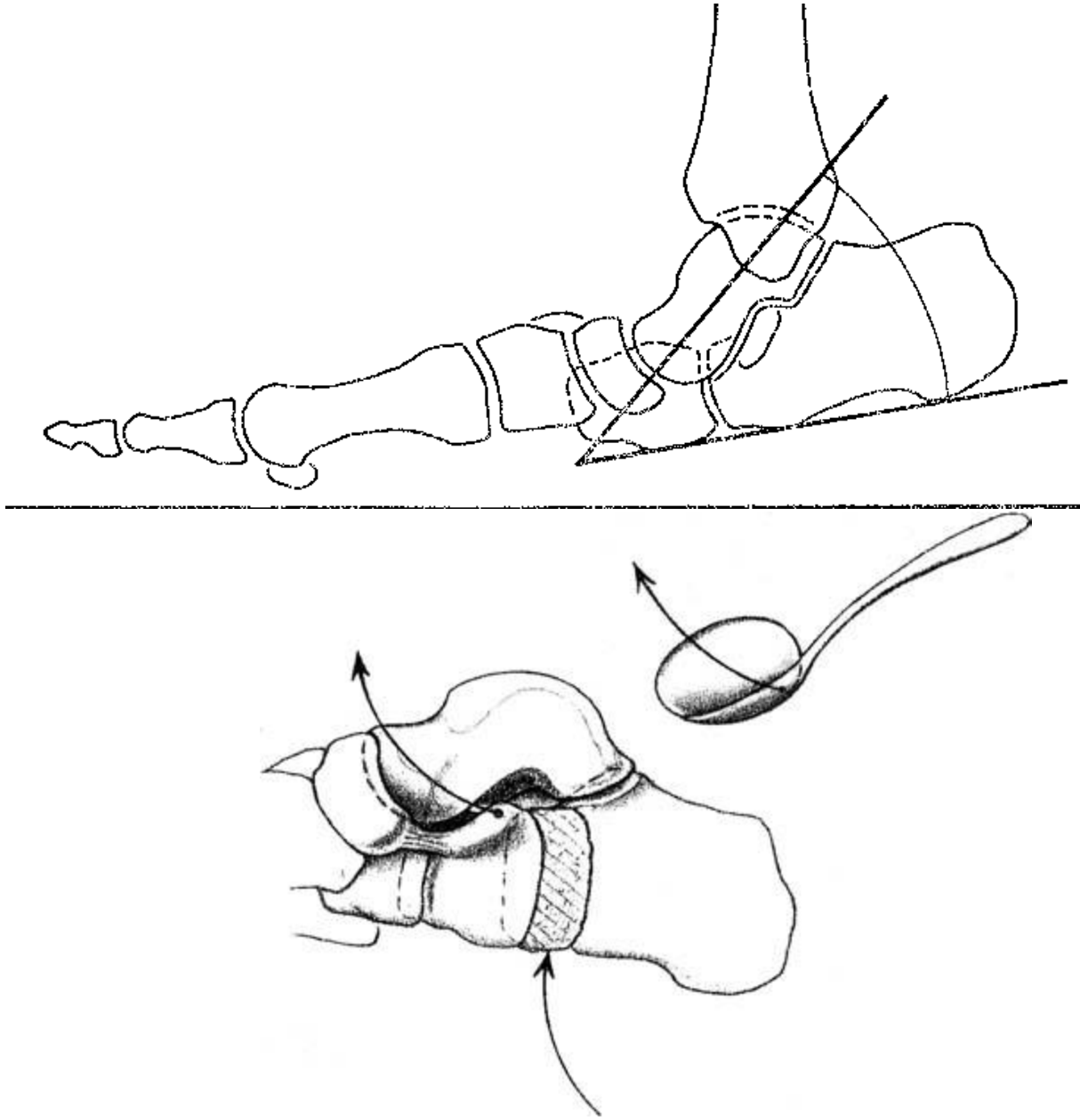
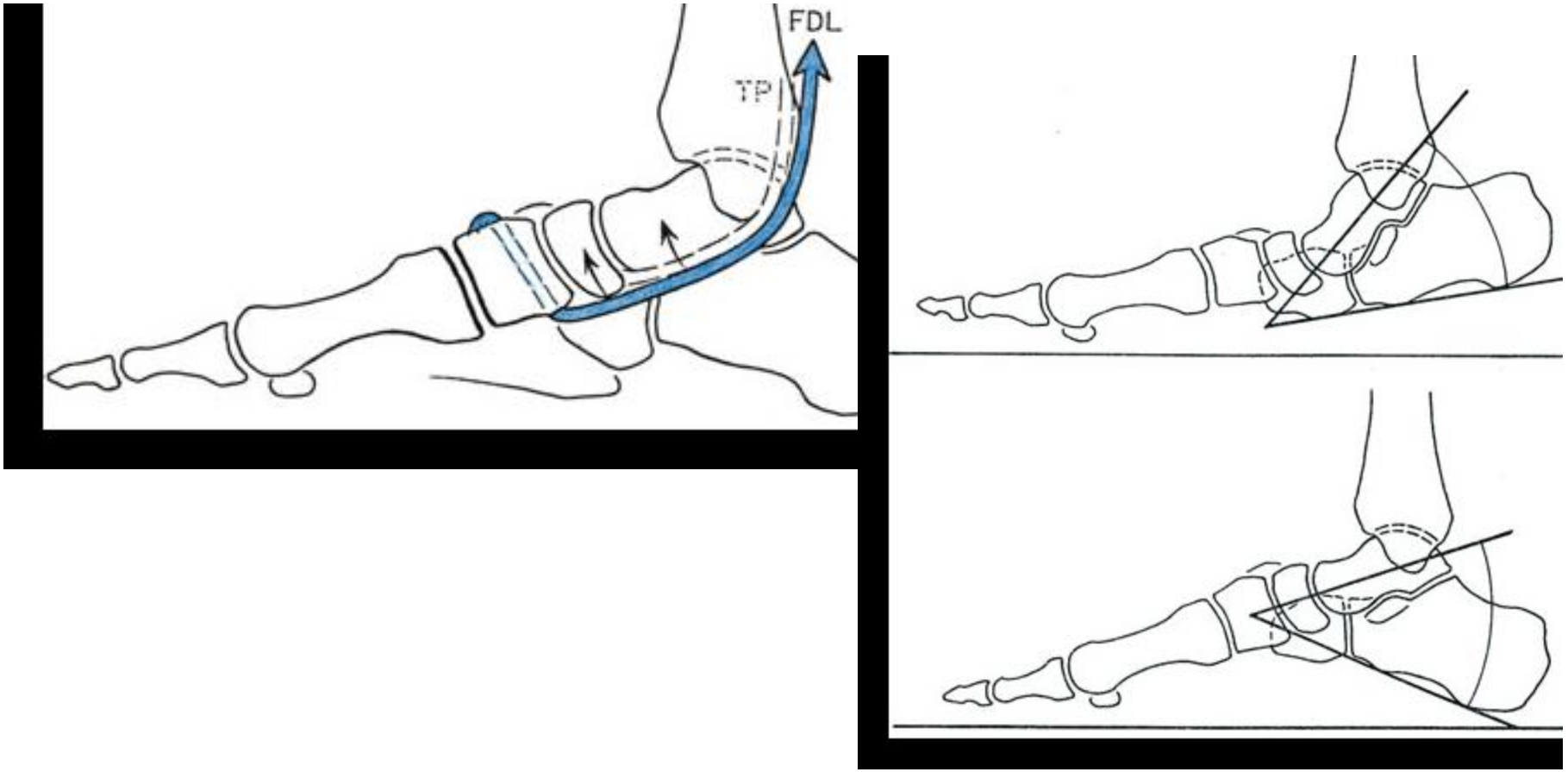


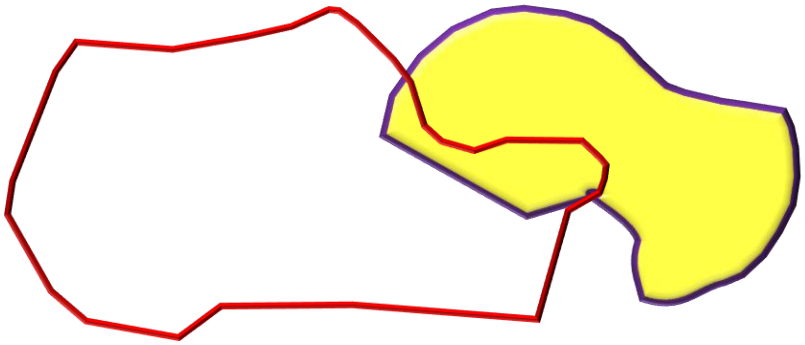
K. Klaue,

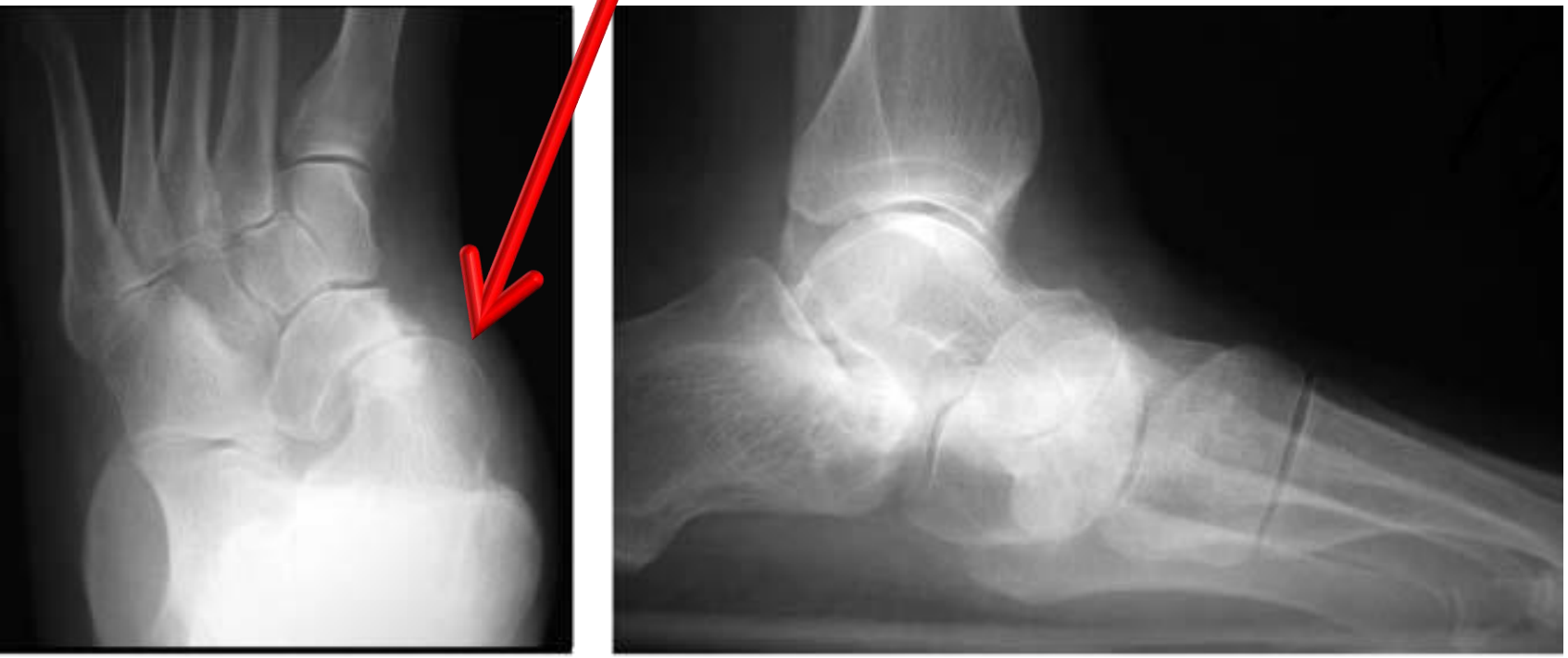


Kaj Klaue The Foot

fixed

rigid

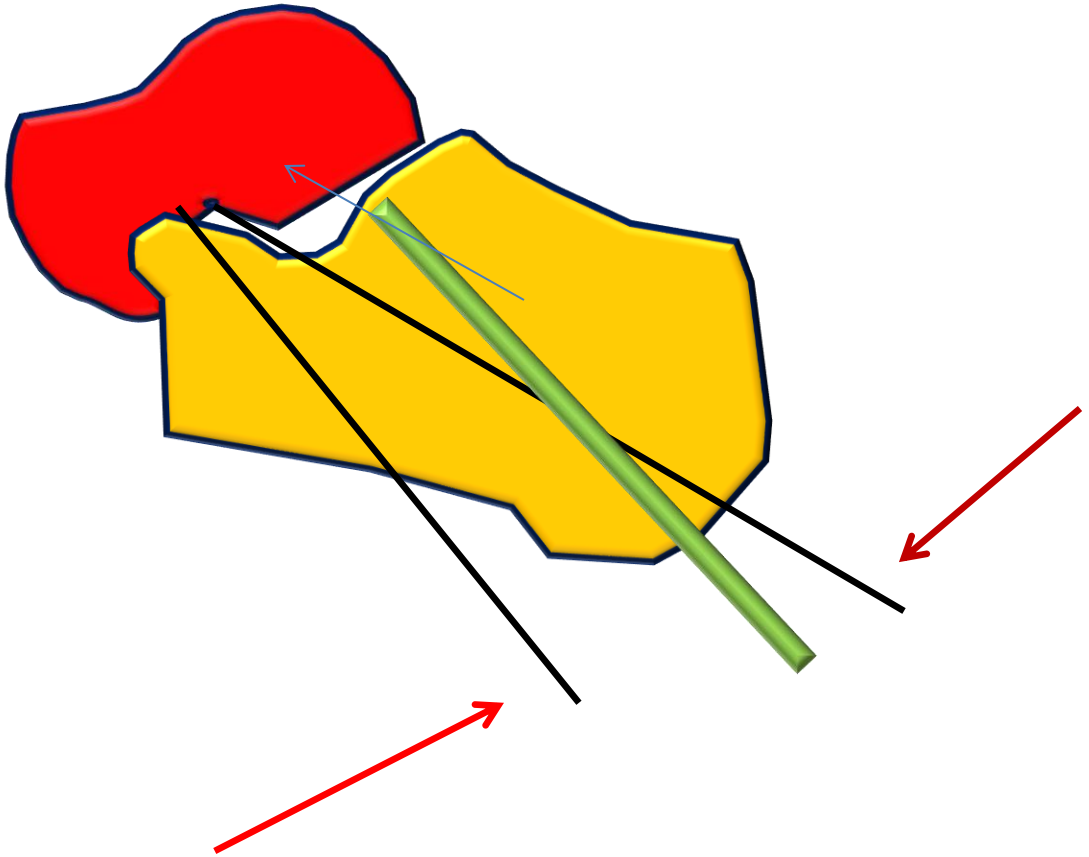


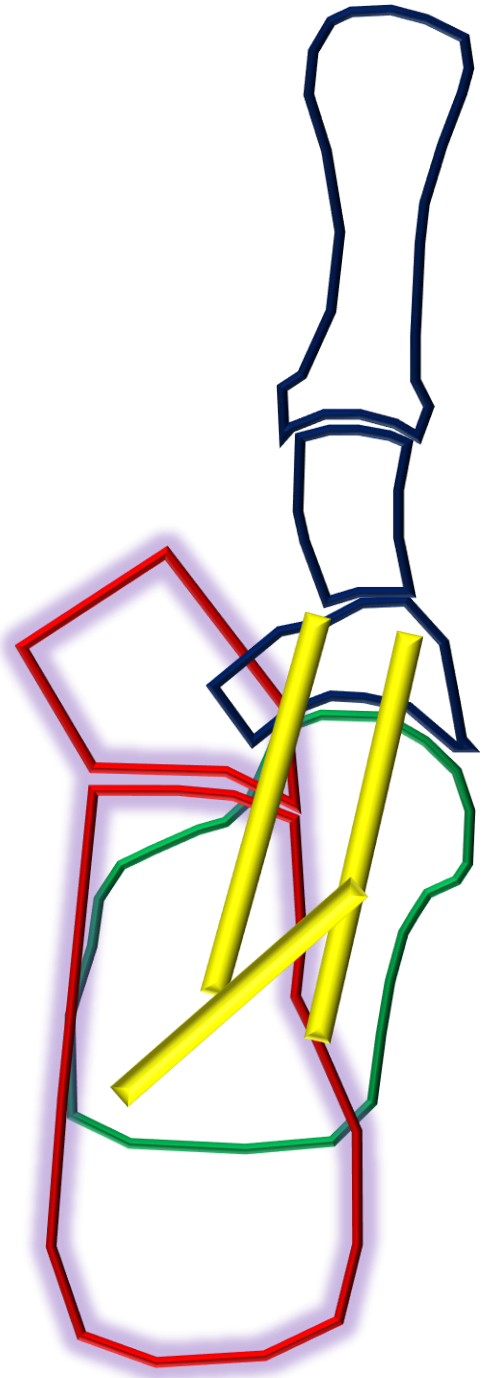


A B

J Am Acad Orthop Surg 2008;16:399- 406

Lamina spreader – Lateral process talus to anterior process calcaneus





H.-G. Jung (ed.), *Foot and Ankle Disorders: An Illustrated Reference*

With Naviculocuneiform Fusion

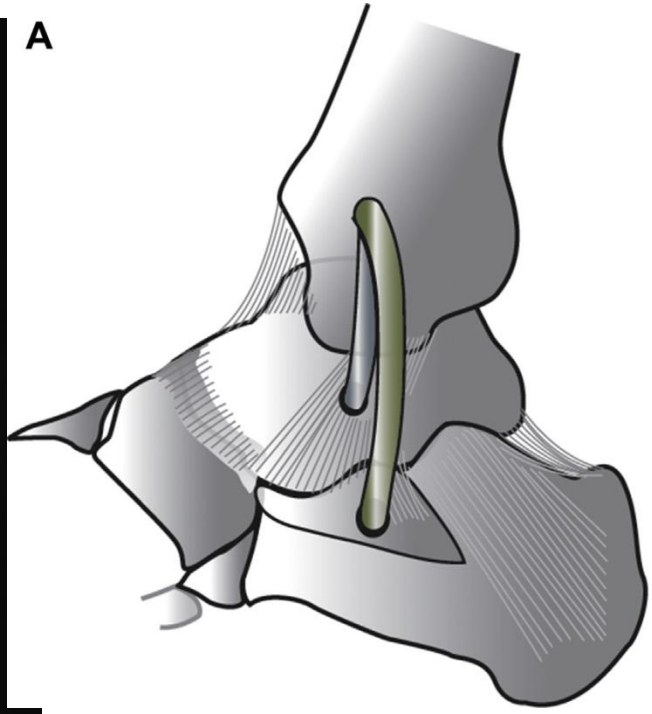
Ajis and Geary

Stage IV

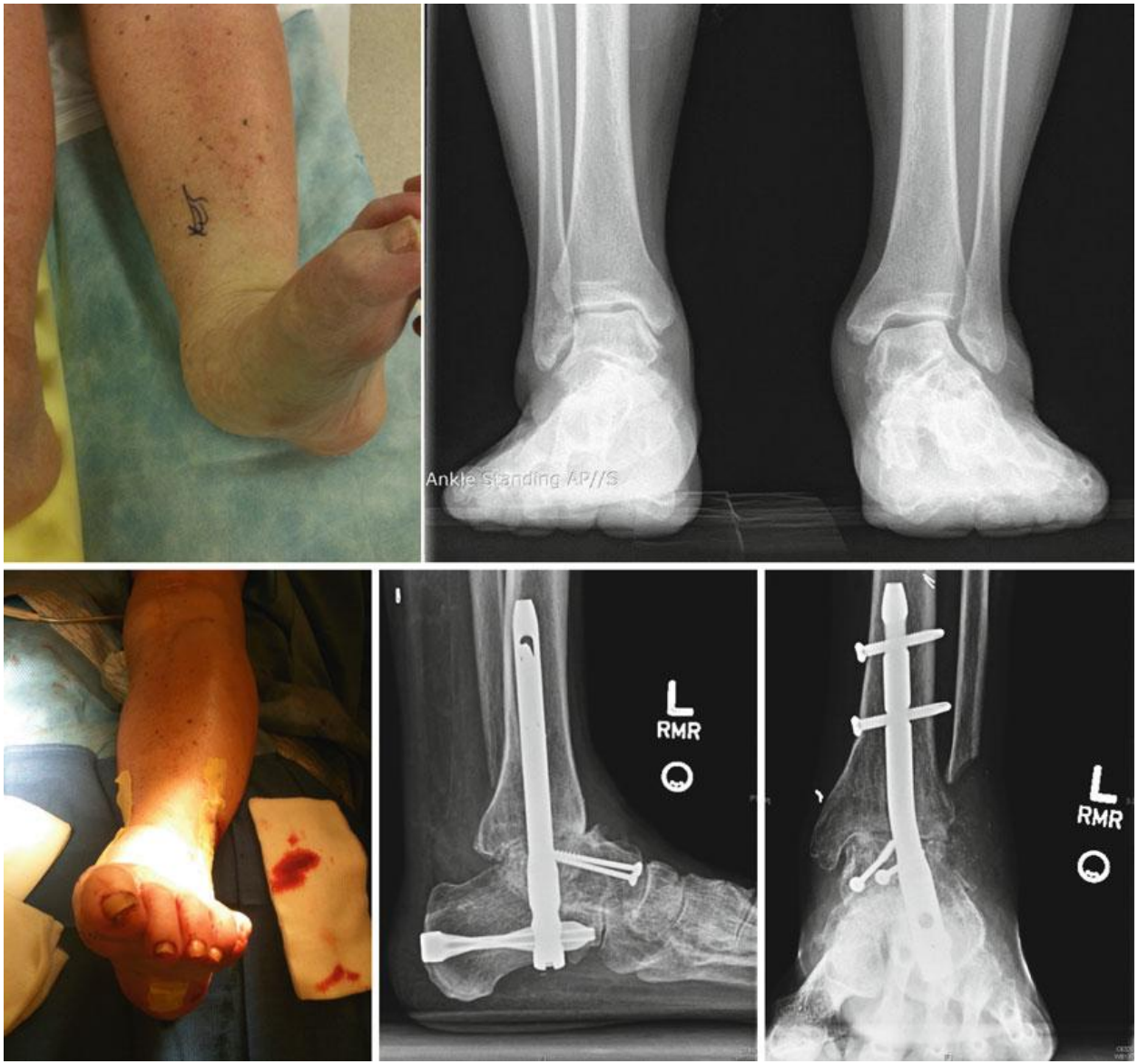
- WB xrays ankle
  - Rule out arthritis
  - Rule out valgus tilt

J Am Acad Orthop Surg 2008;16:399- 406

Deltoid Ligament Repair in Flatfoot Deformity

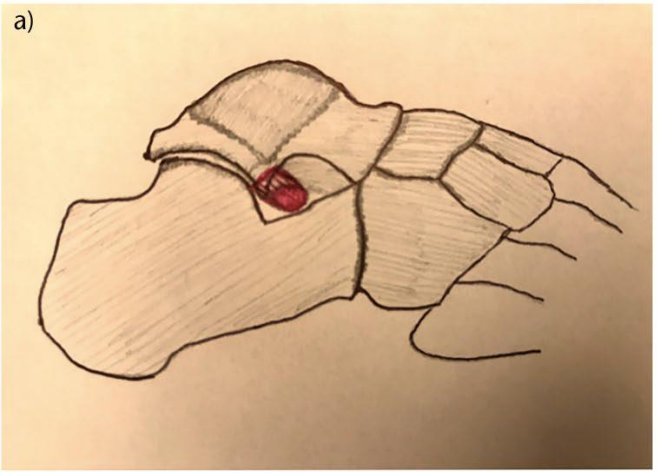


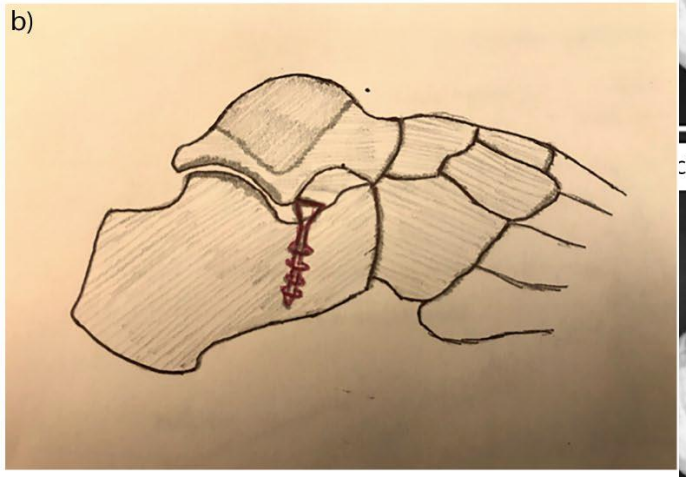
Oburu & Myerson

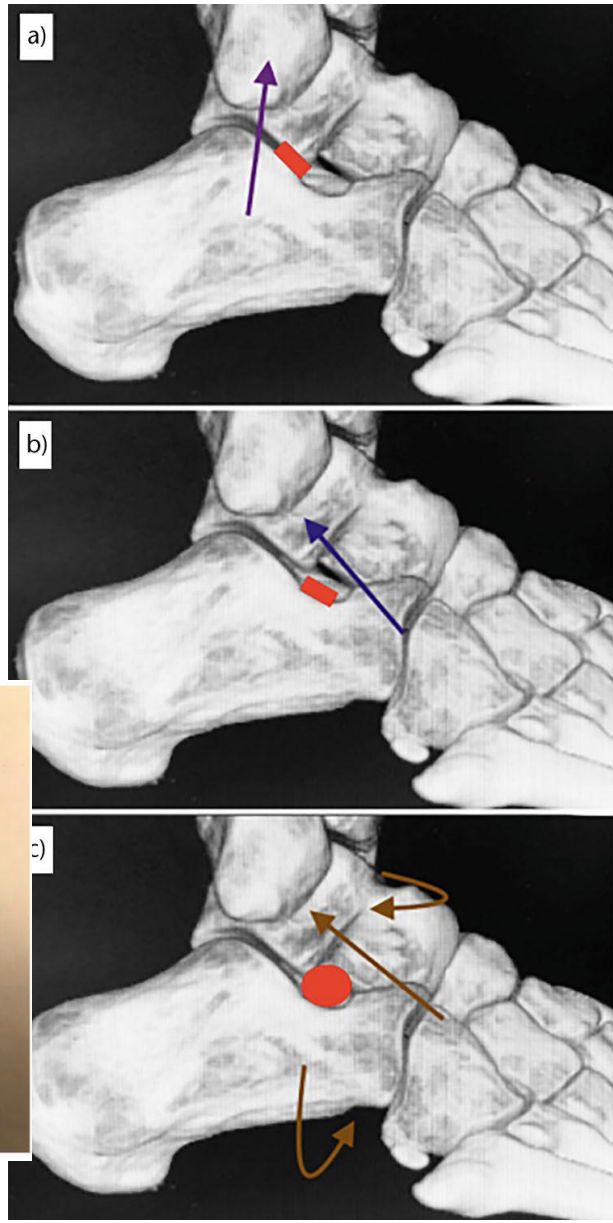


H.-G. Jung (ed.), *Foot and Ankle Disorders: An Illustrated Reference*

Benefits	Drawbacks
Compared with open traditional surgery - lower invasiveness (mini-incision) - decreased post-operative oedema - shorter hospital stays - possibility of performing associated soft-tissue and bony procedures	Quality of studies available is poor Data uncertain regarding: - complication rate - implant removal rate - need (and timing) of removal in absence of symptoms - comparison between implants - long-term results







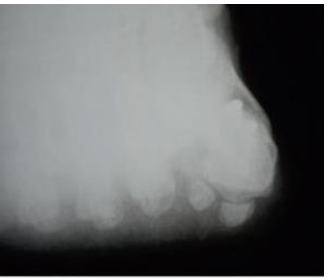
Conclusion

- Treatment according to deformity parts
- Fexible . Osteotomis
- Rigid fusion
- Don’t forget ankle
- Its not about PTTD only

HALLUX VALGUS

Hallux Valgus “bunion”

a triplane deformity with components in the transverse, sagittal, and frontal planes



Abdullah Alkhawaldah MD FACS
RMS Jordan

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objectives

- Explain pathoanatomy of hallux valgus.
- Understand clinical and radiographic assessment.
- Outline Modalities of management surgical and conservative.

IMA < 13

HVA < 25

Risk factors

Intrinsic

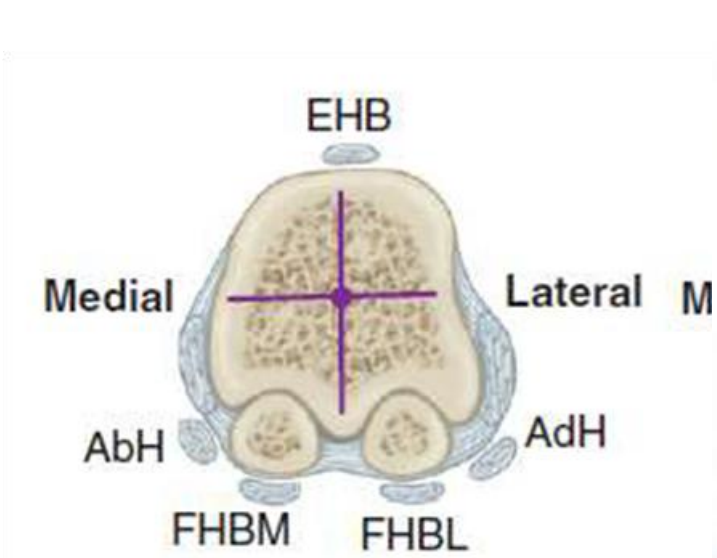
- • Genetic predisposition.
- • Ligamentous laxity.
- • Pes planus.
- • Rheumatoid arthritis.
- • Cerebral palsy.
- Amputation 2nd toe
- Trauma

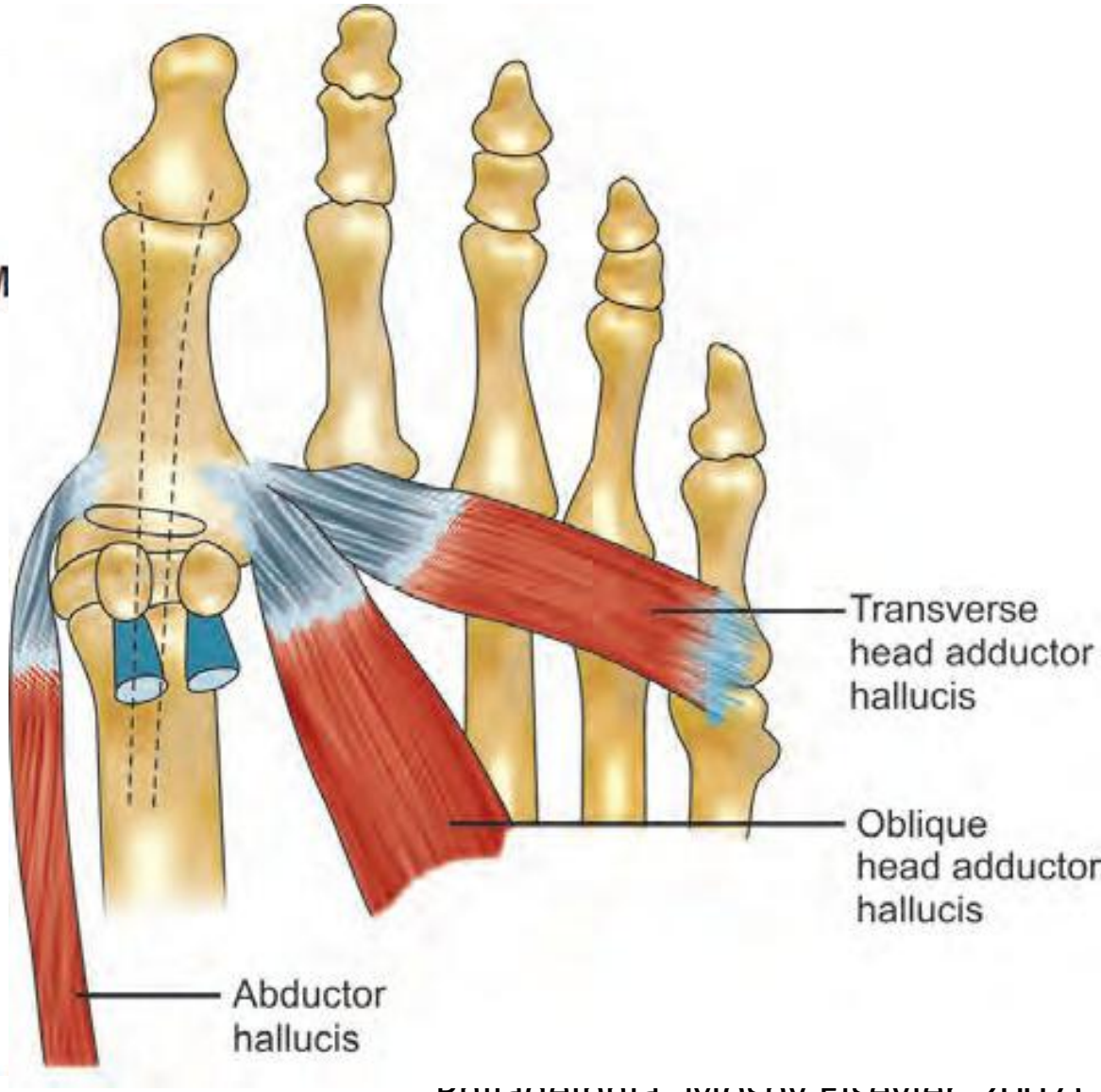
Extrinsic

- Shoes with high heel, or narrow toe box.

hallux valgus more common in wom

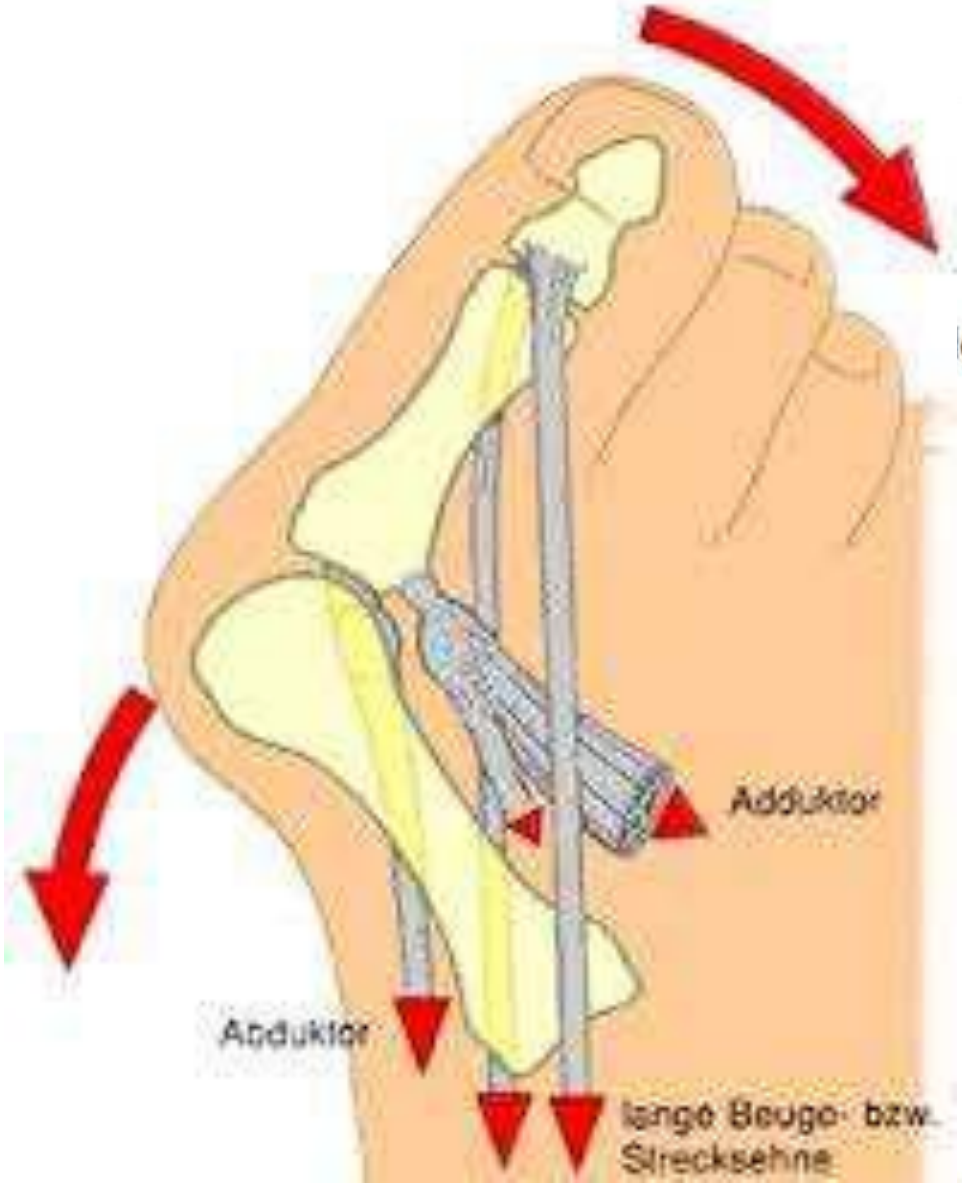
Anatomy

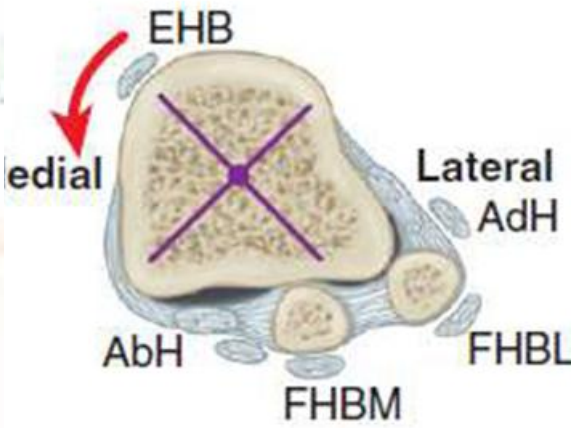




Philadelphia, Mosby Elsevier, 2007)

Pathoanatomy

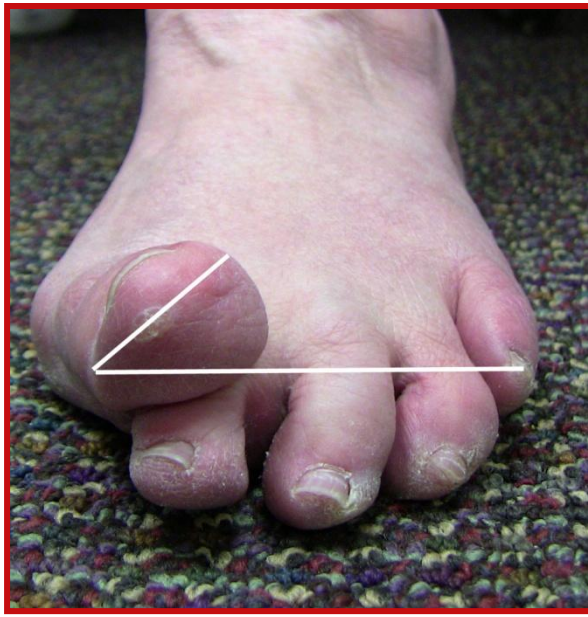




Hallux valgus

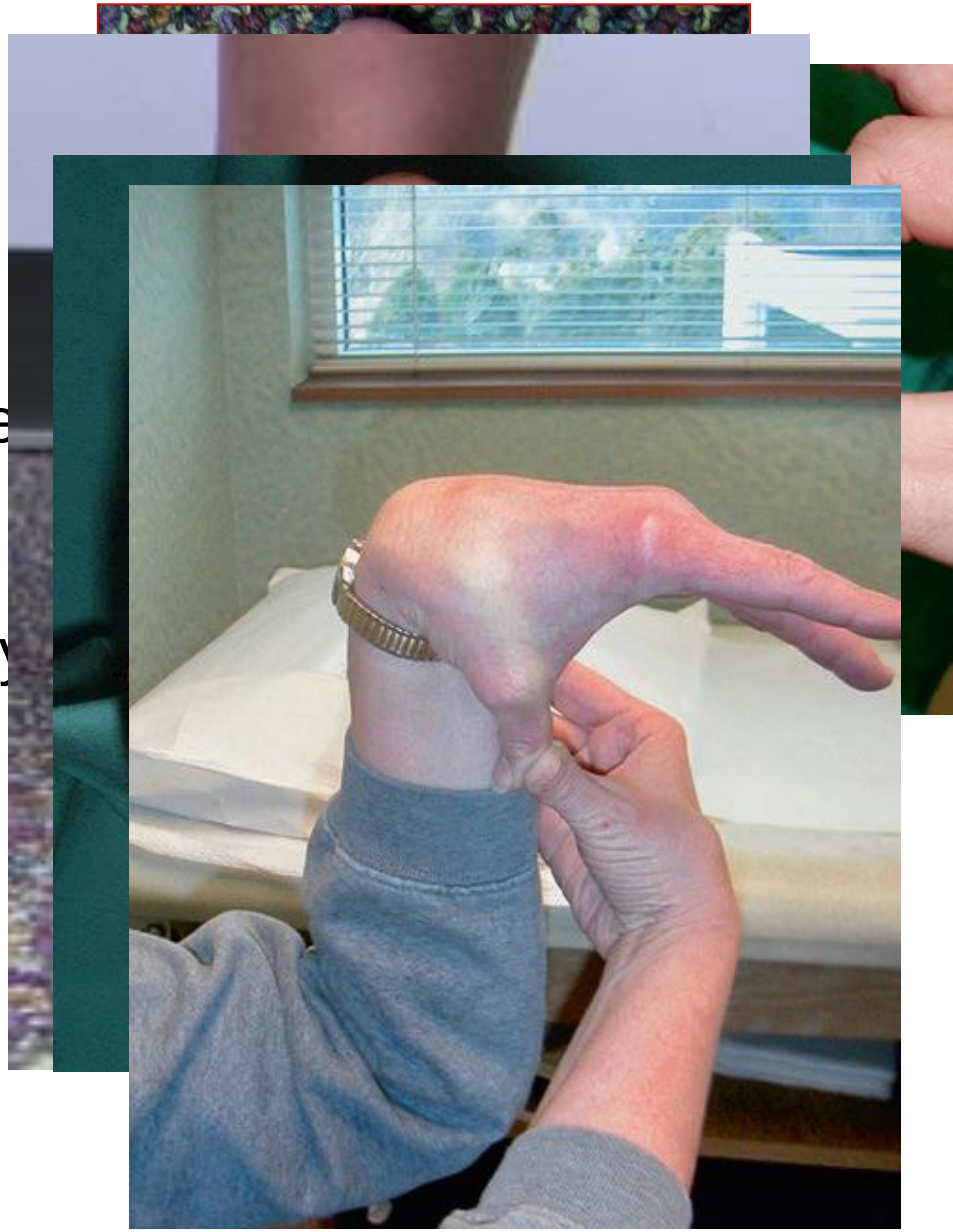
Hallux Valgus “bunion” definition

It is clear that a bunion is in reality a triplane deformity with components in the transverse, sagittal, and frontal planes



Clinical Assessment

- **Examine entire first ray for**
  - 1st MTP ROM
  - 1st TMT hypermobility
- Evaluate associated deformitie
  - Pes planus
  - Corns, calluses,
  - Generalized ligamentous laxity



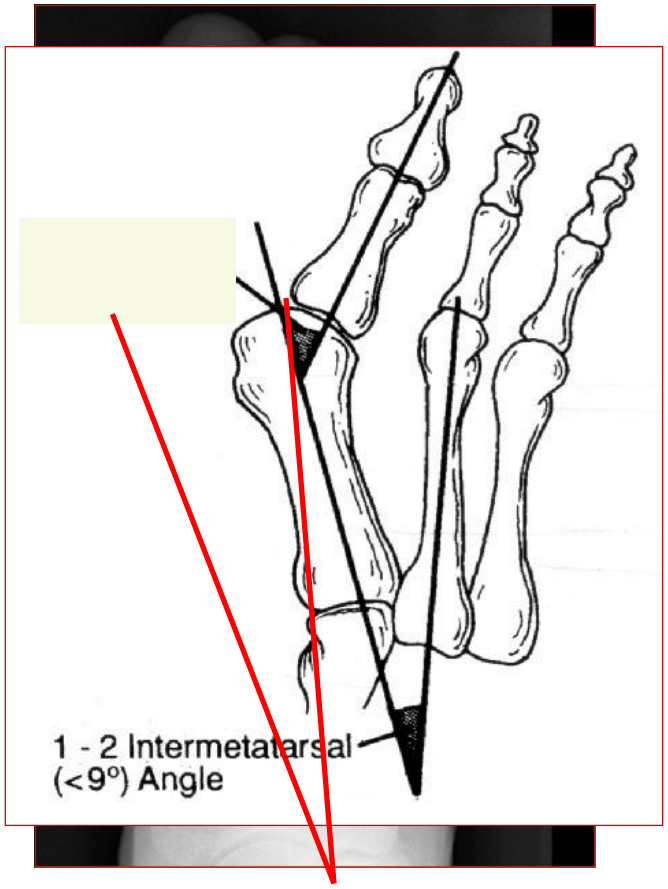
Radiographic Assessment

- Radiographs
  - views
    - standard series should include **weight bearing** AP, Lat, and oblique views
    - sesamoid view can be useful

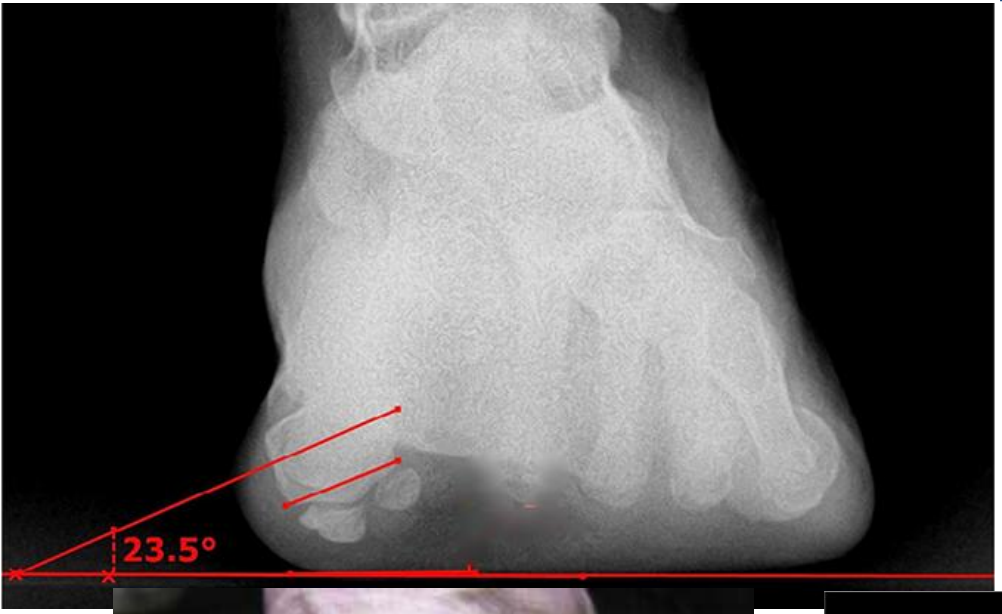
Transverse plane

Hallux Valgus Angle (HVA)

Intermetatarsal Angle (IMA)



Frontal plane



Sagittal plane

Mann ™s Surgery of the Foot and Ankle

management

Nonsurgical Treatment

- Shoewear counseling
- Bunion splint
- Orthotic arch support
- NSAIDs

Surgical Indication

- **Pain.**
- **Difficulty with footwear**

- **But remember, we should never operate for cosmetic reasons alone**

Operative Considerations

IMA ≤ 15° **AND** HV ≤ 40°

- Distal metatarsal osteotomy (Chevron)

IMA > 15° **OR** HV > 40°

- Proximal or shaft metatarsal osteotomy

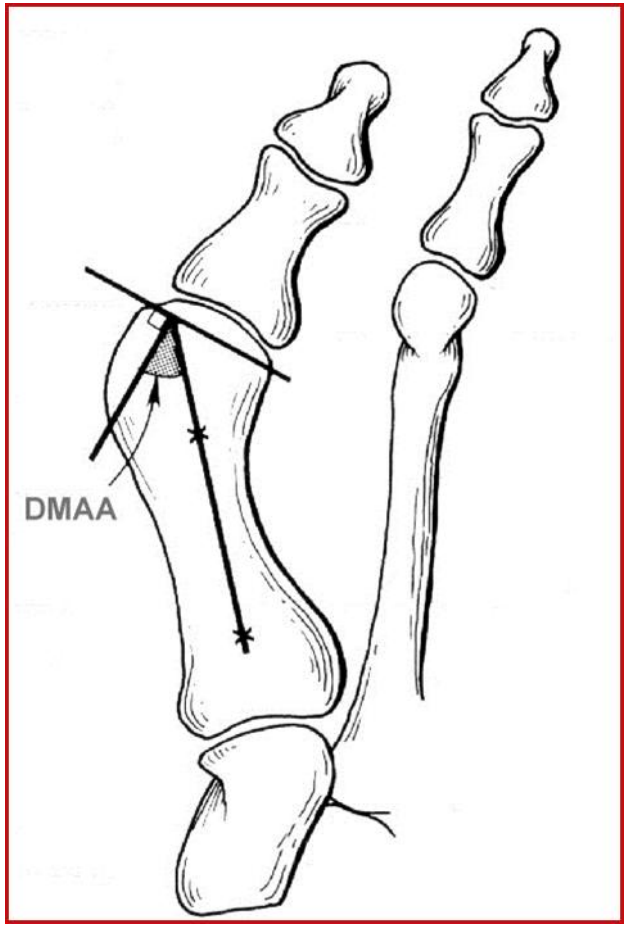
Instability of the 1st TMT/Joint laxity

- Lapidus (Fusion of 1st TMT joint)

Arthritis, Rigid deformity or Spasticity

- 1st MTP fusion

Distal Metatarsal Articular Angle (DMAA)????



Obliquity of the first metatarsal-medial cuneiform articulation

Contents lists available at ScienceDirect

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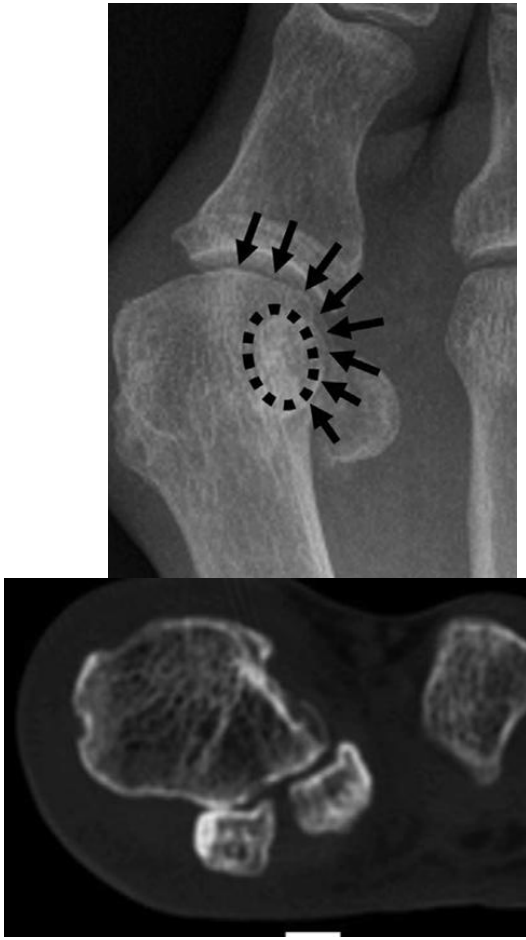
Review Article

Triplane Hallux Abducto Valgus Classification

Daniel J. Hatch, DPM, FACFAS [1,2], Robert D. Santrock, MD [3], Bret Smith, DO, MSc [4,5], Paul Dayton, DPM, MS, FACFAS [6,7], Lowell Weil Jr., DPM, MBA, FACFAS [8]

"lateral round sign



Sesamoid Position in Hallux Valgus in Relation to the Coronal Rotation of the First Metatarsal Jin Su Kim, MD, PhDa, Ki Won Young, MD, PhD

Evidence-Based Bunion Surgery 2018 A Critical Examination of Current and Emerging Concepts and Technique Paul D. Dayton

first MT pronation

Pronation deformity

Proximal osteotomy

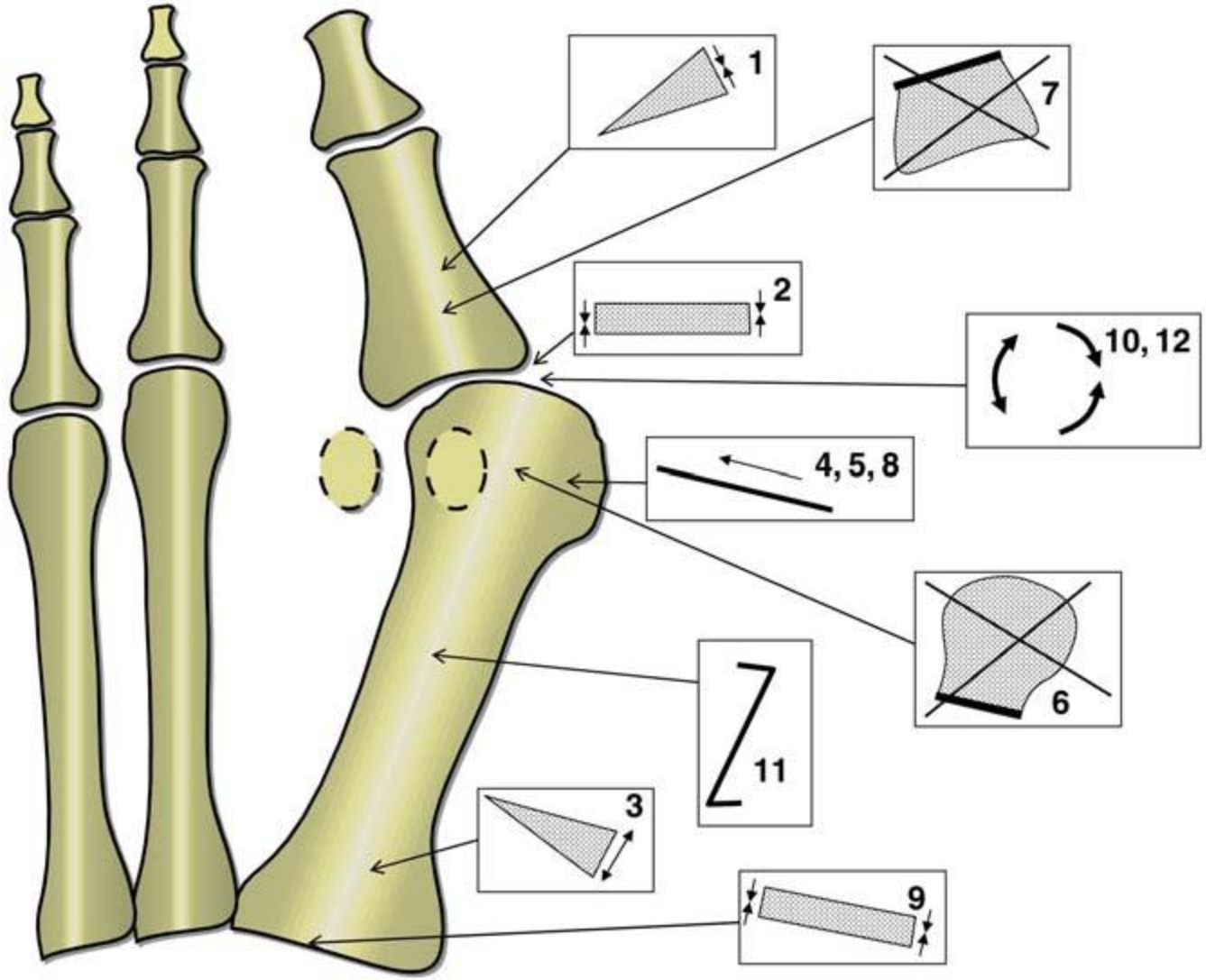
Incongruent joint

Distal soft tissue realignment

Proximal Supination Osteotomy of the First Metatarsal for Hallux Valgus Ryuzo Okuda, MD, PhDFoot Ankle Clin N Am - (2018

Triplane hallux valgus classification & treatment algorithm			
Class	**Anatomic findings**	**MTP joint status**	**Treatment recommendation**
1	Increased HVA and IMA **No first metatarsal pronation evident on AP and Sesamoid axial Radiograph** Sesamoids may be subluxed.	No clinical or radiographic evidence of DJD	Transverse plane corrective procedure +/-Distal soft tissue procedures
2A	Increased HVA and IMA **First metatarsal pronation evident on AP and Sesamoid Axial Radiograph** No sesamoid subluxation on Axial	No clinical or radiographic evidence of DJD	Triplane correction with first metatarsal supination/inversion
2B	Increased HVA and IMA **First metatarsal pronation evident on AP and Sesamoid Axial Radiograph** With sesamoid subluxation on Axial	No clinical or radiographic evidence of DJD	Triplane correction with first metatarsal supination/inversion + Distal soft tissue procedures
3	Increased HVA and IMA >15 degrees MTA	No clinical or radiographic evidence of DJD	Metatarsal 2 and 3 transverse plane correction. Followed by 1st metatarsal correction per class 1 & 2 recommendations
4	Increased HVA and IMA +/-First metatarsal pronation	**Clinical and or radiographic evidence of DJD**	First MTP arthrodesis

Santrock RD, Smith B, Hatch DJ, Dayton PD. Anatomic triplane hallux abducto valgus classification: PVB working group recommendations. 2017


1
7
2
10, 12
4, 5, 8
6
11
3
9

class 1 deformity, HAV is present and the IMA is increased only in the transverse plane

Class 2 HAV is subdivided into class 2A and class 2B and is defined by an increased HVA and increased IMA with the concurrent presence of frontal/coronal plane pronation/eversion of the firstmetatarsal

Class 3 is a unique HAV condition associated with the much more global foot deformity of metatarsus adductus (MTA

Class 4 is characterized by degenerative health of the MTP joint, often referred to as the “degenerative bunion.

Take home message

- Hallux valgus is a triplane deformity .
- Surgery is indicated if the pain persists.
- Clinical and radiographic assessment is very critical in management of hallux valgus.