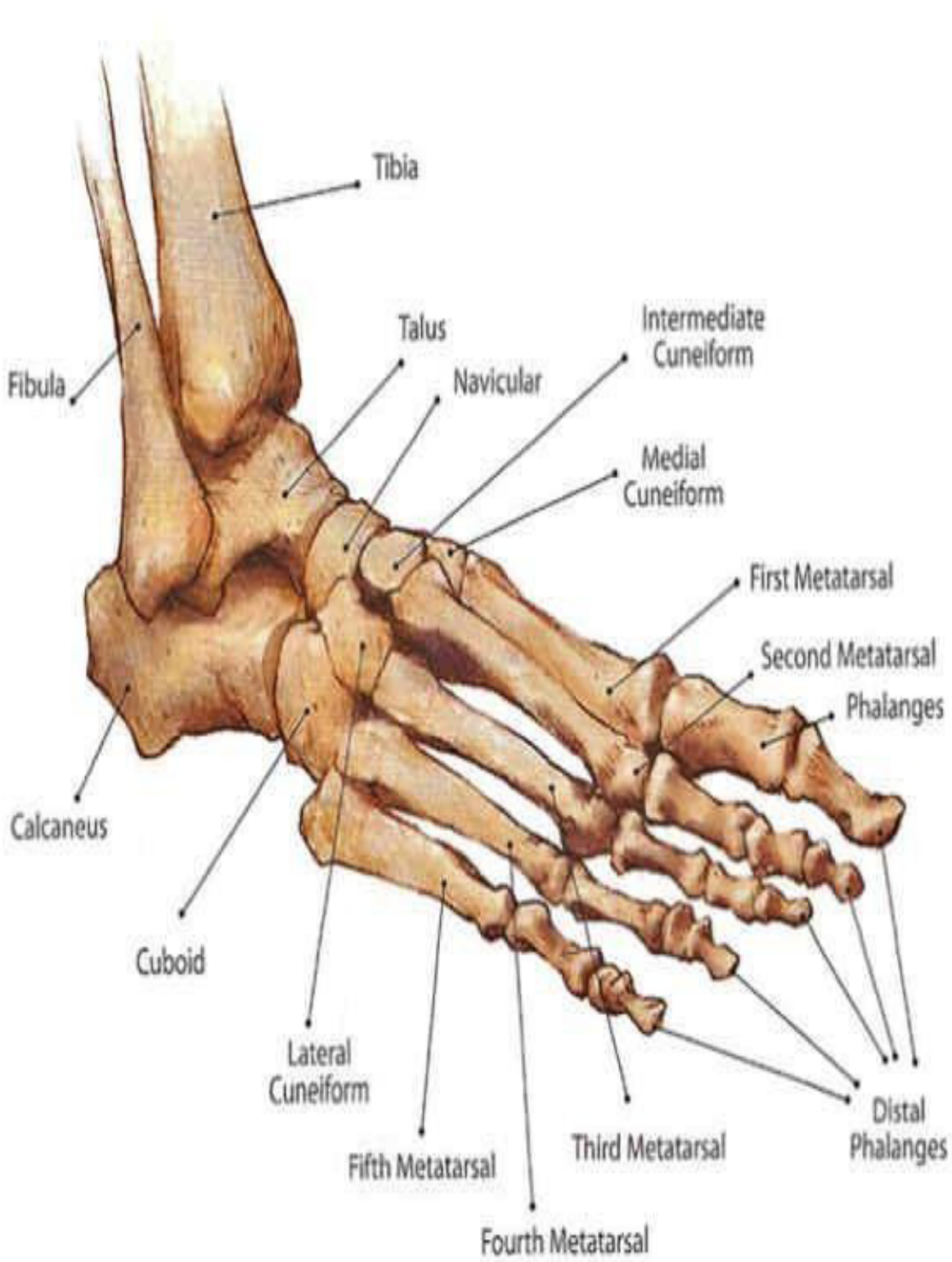
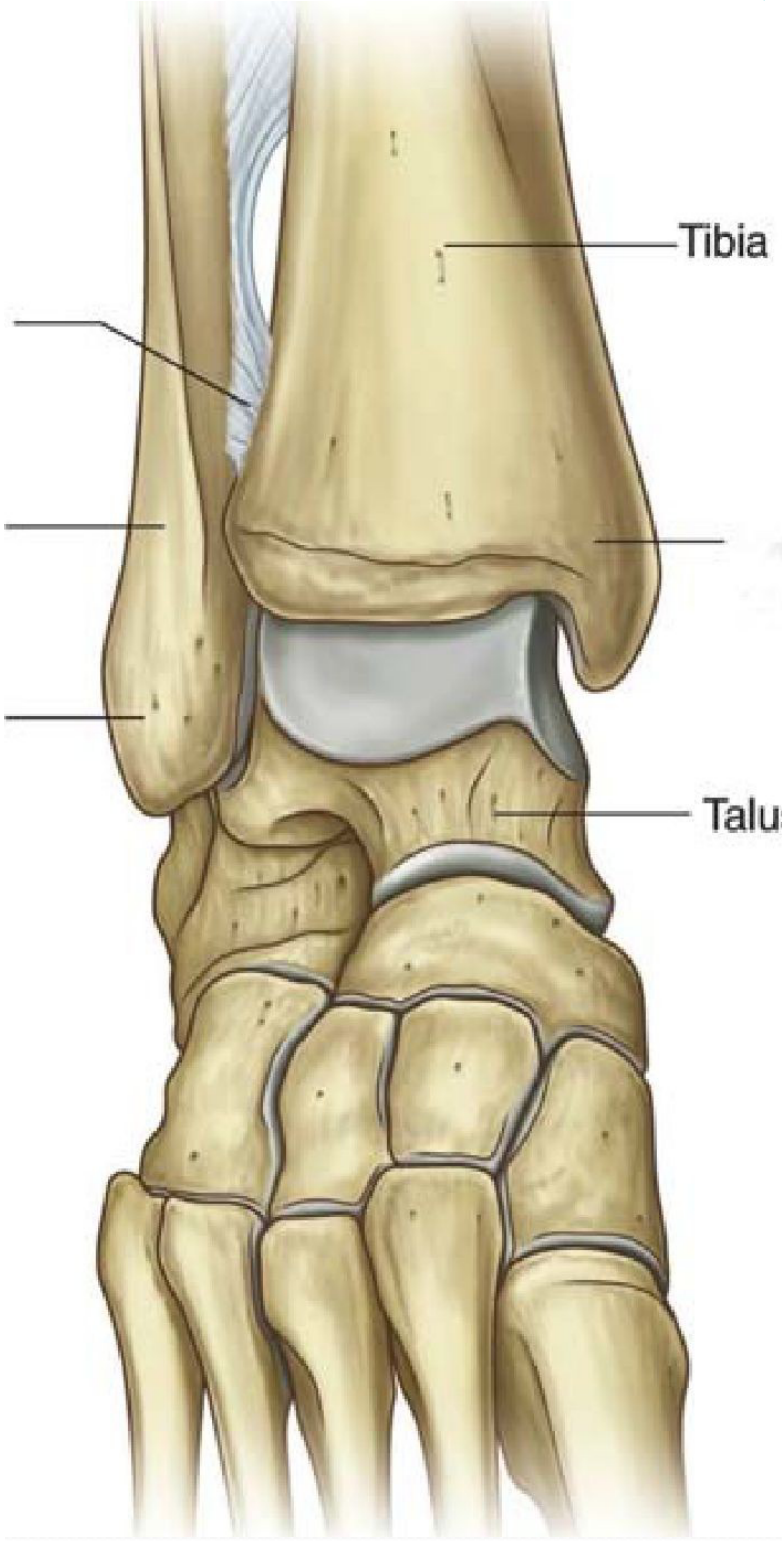
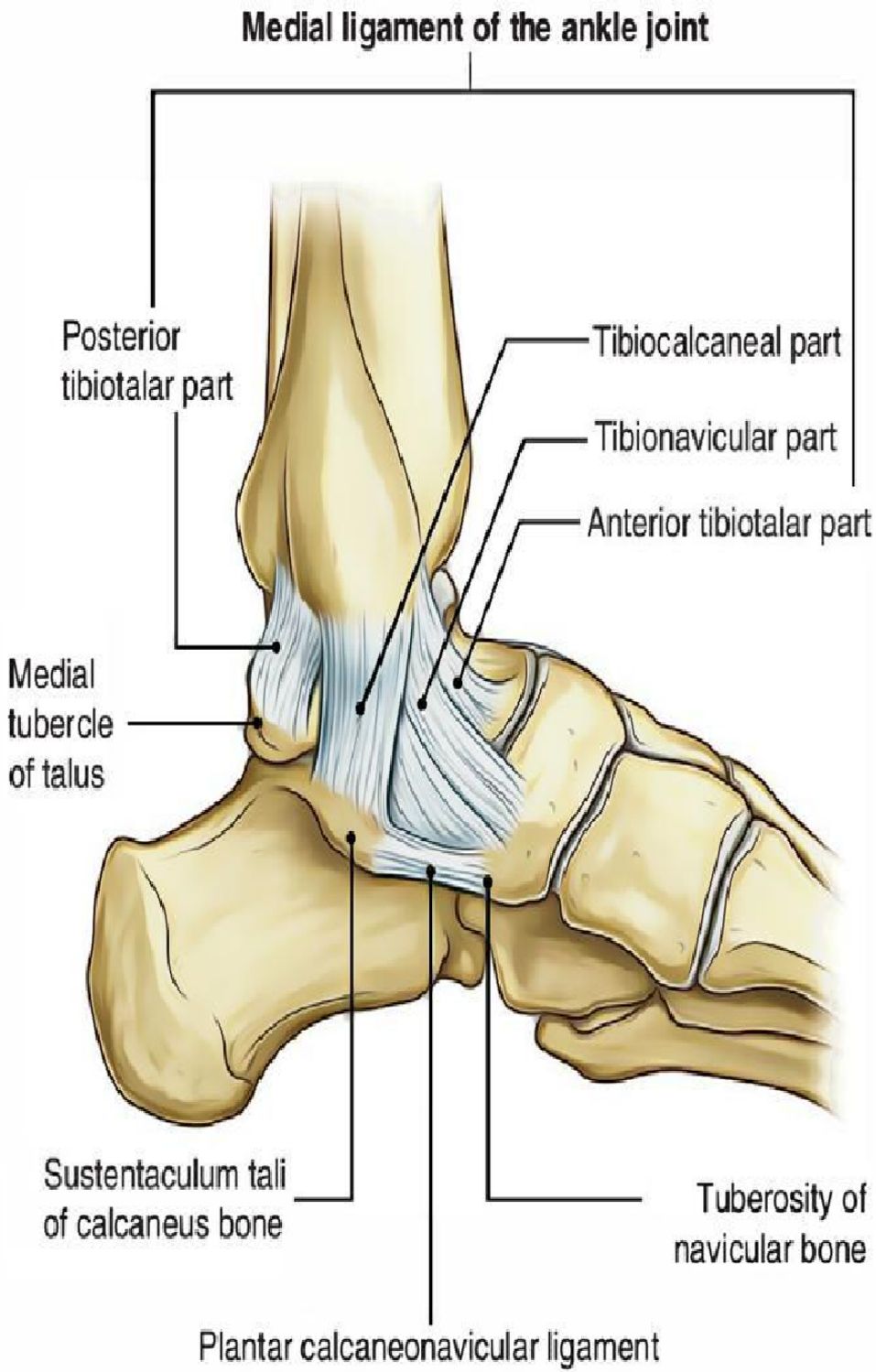
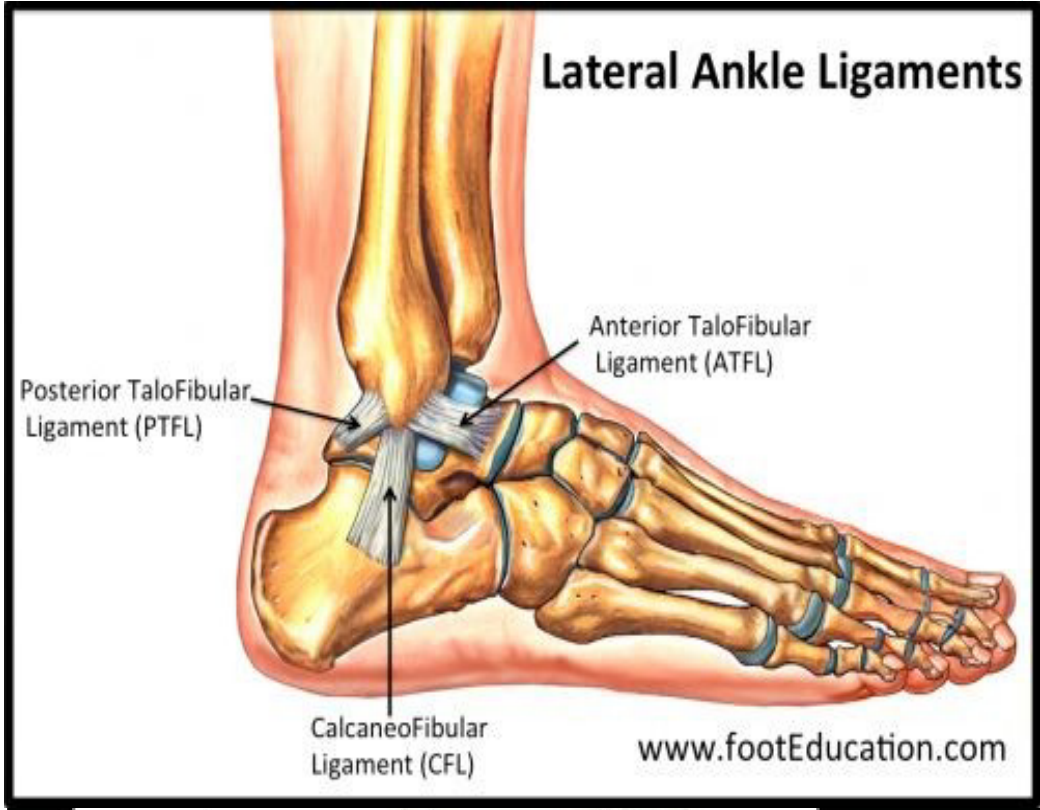
ANKLE AND FOOT

Samer Salah


Tibia
Fibula
Talus
Navicular
Intermediate Cuneiform
Medial Cuneiform
First Metatarsal
Second Metatarsal
Phalanges
Calcaneus
Cuboid
Lateral Cuneiform
Fifth Metatarsal
Fourth Metatarsal
Third Metatarsal
Distal Phalanges


Tibia
Talu


Medial ligament of the ankle joint
Posterior tibiotalar part
Tibiocalcaneal part
Tibionavicular part
Anterior tibiotalar part
Medial tubercle of talus
Sustentaculum tali of calcaneus bone
Tuberosity of navicular bone
Plantar calcaneonavicular ligament


Lateral Ankle Ligaments
Anterior TaloFibular Ligament (ATFL)
Posterior TaloFibular Ligament (PTFL)
CalcaneoFibular Ligament (CFL)
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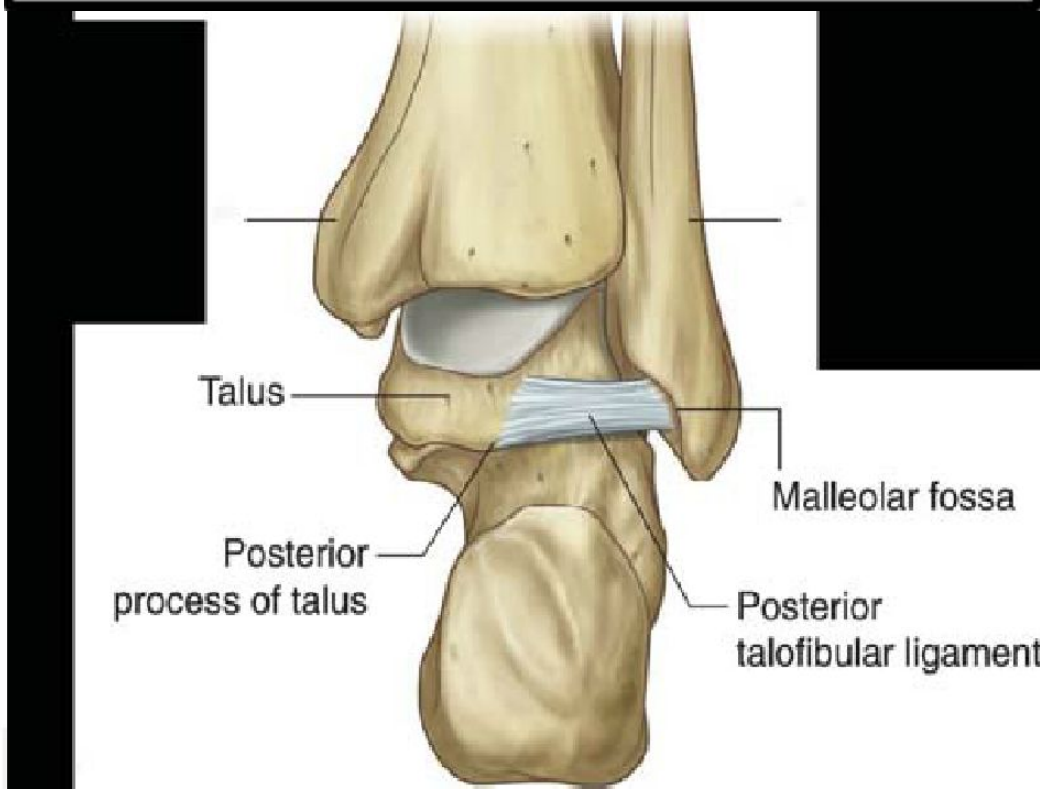

Talus
Malleolar fossa
Posterior process of talus
Posterior talofibular ligament

Anatomy of the ankle and foot

The ankle joint is the connection between the tibia , fibula and the talus bones

It is a synovial hinge joint.

The joint permits dorsiflexion , planter flexion .

The tibia joins the fibula to form a socket into which the upper part of the talus joins.

All the articular surfaces are covered by hyaline cartilage

The talus bone when viewed from above the anterior part is wider than the posterior so when the foot is dorsiflexed the bone fits ti ghter and therefore is more stable in that position .

The joint is stabilized by a capsule and ligaments

On the medial side :

The bones are connected by the deltoid ligament which is formed by 4 ligaments connected together :

1) Anterior tibiotalar ligament
2) Posterior tibiotalar ligament
3) Tibionavicular ligament
4) Tibiocalcaneal ligament

On the lateral side :

The bones are connected by three ligaments :

1) The anterior talofibular ligament
2) The posterior talofibular ligament
3) The calcaneofibular ligament

There are three groups of bones that form the foot

1) The 7 tarsal bones (talus , calcaneus , navicular , cuboidal , 3 cuneiform bones the medial , intermediate, lateral)
2) 5 metatarsal bones
3) Phalanges

Group 1: the tarsal bones

The tarsal bones are formed of 3 groups proximal and distal and intermediate

The proximal group are the talus and the calcaneus

The talus bone : is the largest one , articulates superiorly with tibia , inferiorly with calcaneus , anteriorly with navicular bone.

The calcaneus bone : is under the talus , long irregular box shaped bone with the long axis generally in the midline but deviates laterally in the anterior part , this bone projects backwards and is devided into upper , middle , inferior parts and the achilles tendon is attached to the middle part . Articulates anterior with cuboidal , superiorly with talus

The intermediate group is the navicular bone which is attached posteriorly with the talus , laterally and anteriorly with the distal group

The distal group are the cuboidal , the 3 cuneiform bones

the cuboidal bone lies in front of the calcaneus and attached to it , and is attached anteriorly with the bases of the bases of the lateral two metatarsal bones

The cuneiform bone : they are attached to each other and anteriorly with the bases of the medial 3 phalanges , posteriorly with navicular bone

Group 2 : the metatarsals

The metatarsals are 5 bones , metatarsal 1 lies most medially and associated with the big toe and is the shortest and thickest .

The second one is the longest

Each metatarsal has a proximal base ,middle body ,distal head

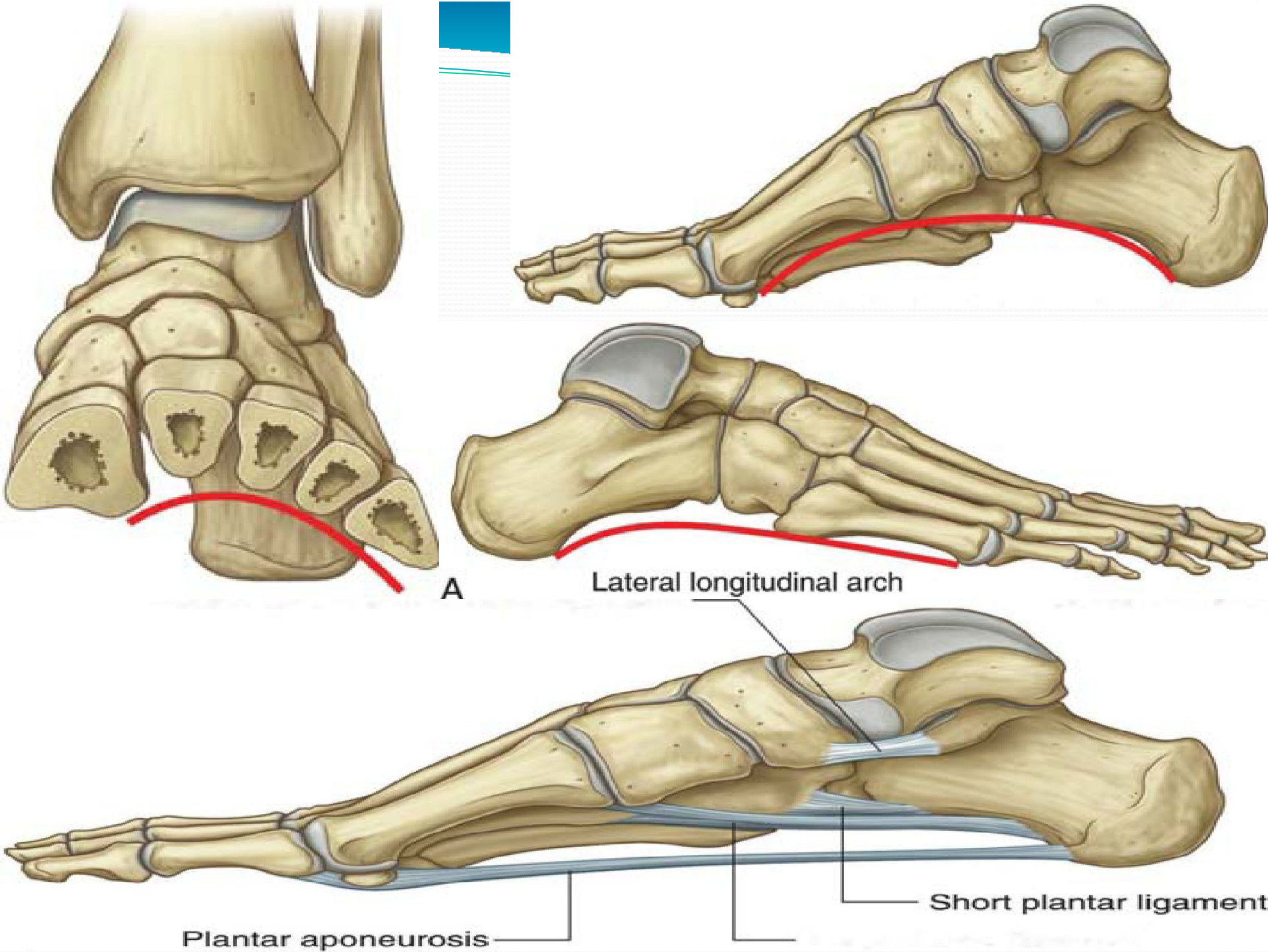
The head of each meta articulates with the proximal part of the phalanges

Group 3 : the phalanges

They form the toes of the foot.

Each toe has three phalanges (proximal, middle, distal) except the big toe which has only 2 (proximal, distal).

The proximal parts articulate with the heads of the metatarsals.


A
Lateral longitudinal arch
Short plantar ligament
Plantar aponeurosis

Arches of the foot :

The bones of the foot do not lie in a horizontal plane . Instead the form longitudinal and transverse arches relative to the ground , which absorbs band distribute downward forces from the body during standing and moving on different surfaces .

Longitudinal arches :

The longitudinal arch of the foot is formed btw the posterior end of the calcaneus and the head of the metatarsals . It is highest on the medial side where it forms the medial part and lowest on the lateral side where it form the lateral part.

Transverse arch :

The transverse arch of the foot is highest in a coronal plane that cuts through the head of the talus and disappears near the heads of the metatarsals where these bones are held together by the deep transverse metatarsal ligament.

ligaments that hold the arches :

1) Planter Calcaneonavicular ligament
2) Planter calcaneocuboidal ligament
3) Longer planter ligament
4) Planter aponeurosis

*muscles that hold the arches

1) Tibialis anterior and posterior
2) Fibularis longus

Talipes Equinovarus "Idiopathic Club-Foot"

In the full-blown equinovarus deformity the heel is in equinus, the entire hind-foot in varus and the mid and forefoot adducted and supinated.

Relatively common, the incidence ranging from 1– 2 per thousand births

Boys are affected twice as often as girls

The condition is bilateral in 1/3 of cases.

Etiology

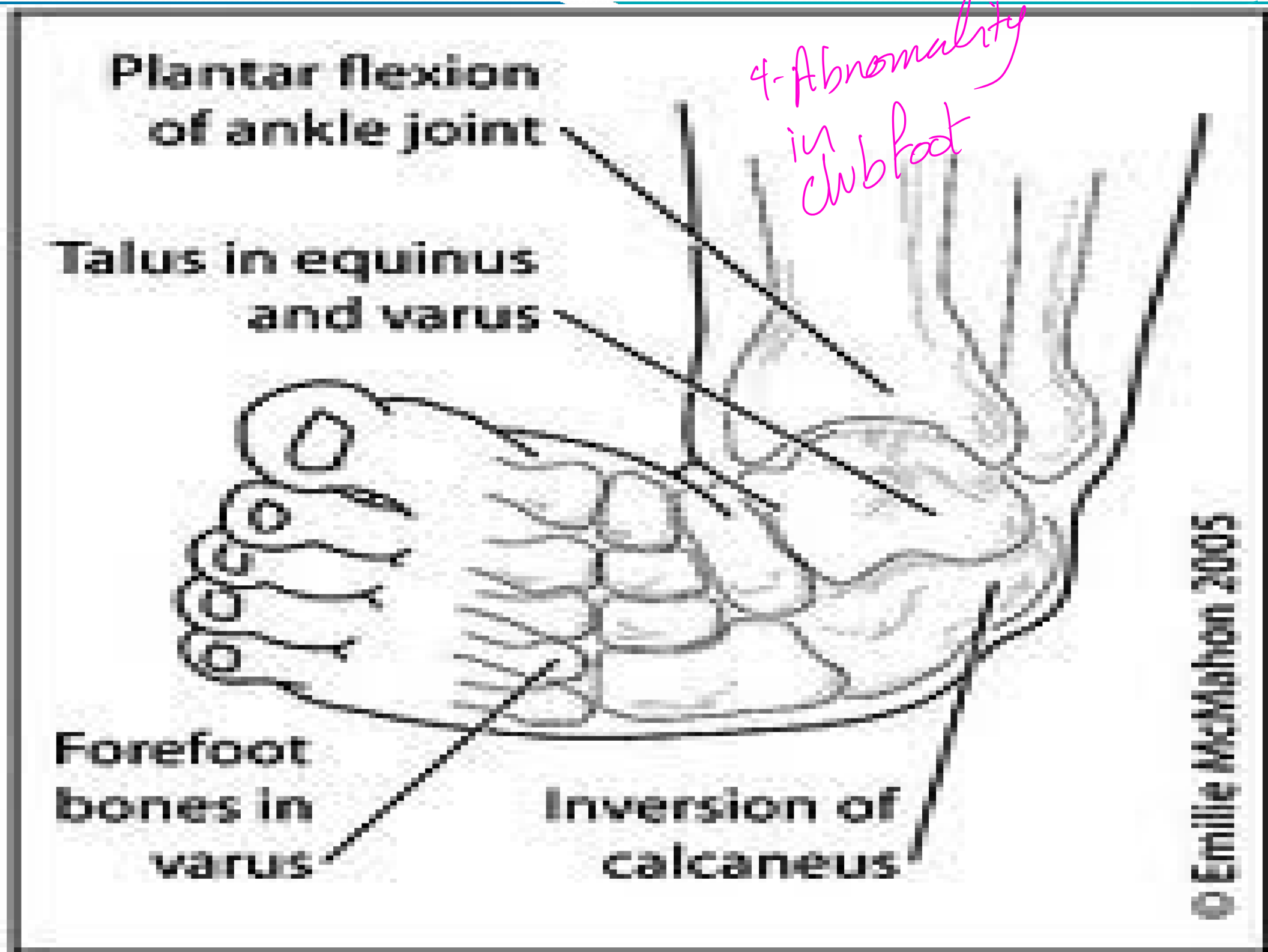
The exact cause is not known, although the resemblance to other disorders suggests several possible mechanisms .

- It could be a germ defect
- A form of arrested development.
- Its occurrence in neurological disorders and neural tube defects (e.g. myelo - meningocele and spinal dysraphism) points to a neuromuscular disorder.

Pathological Anatomy:

- The neck of the talus points downwards and deviates medially, whereas the body is rotated slightly outwards.
- The posterior part of the calcaneus is held close to the fibula by a tight calcaneo-fibular ligament, and is tilted into equinus & varus; it is also rotated medially beneath the ankle.
- The navicular and entire forefoot are shifted medially and rotated into supination.
- The skin and soft tissues of the calf and the medial side of the foot are short and underdeveloped.

4- Abnormality in clubfoot



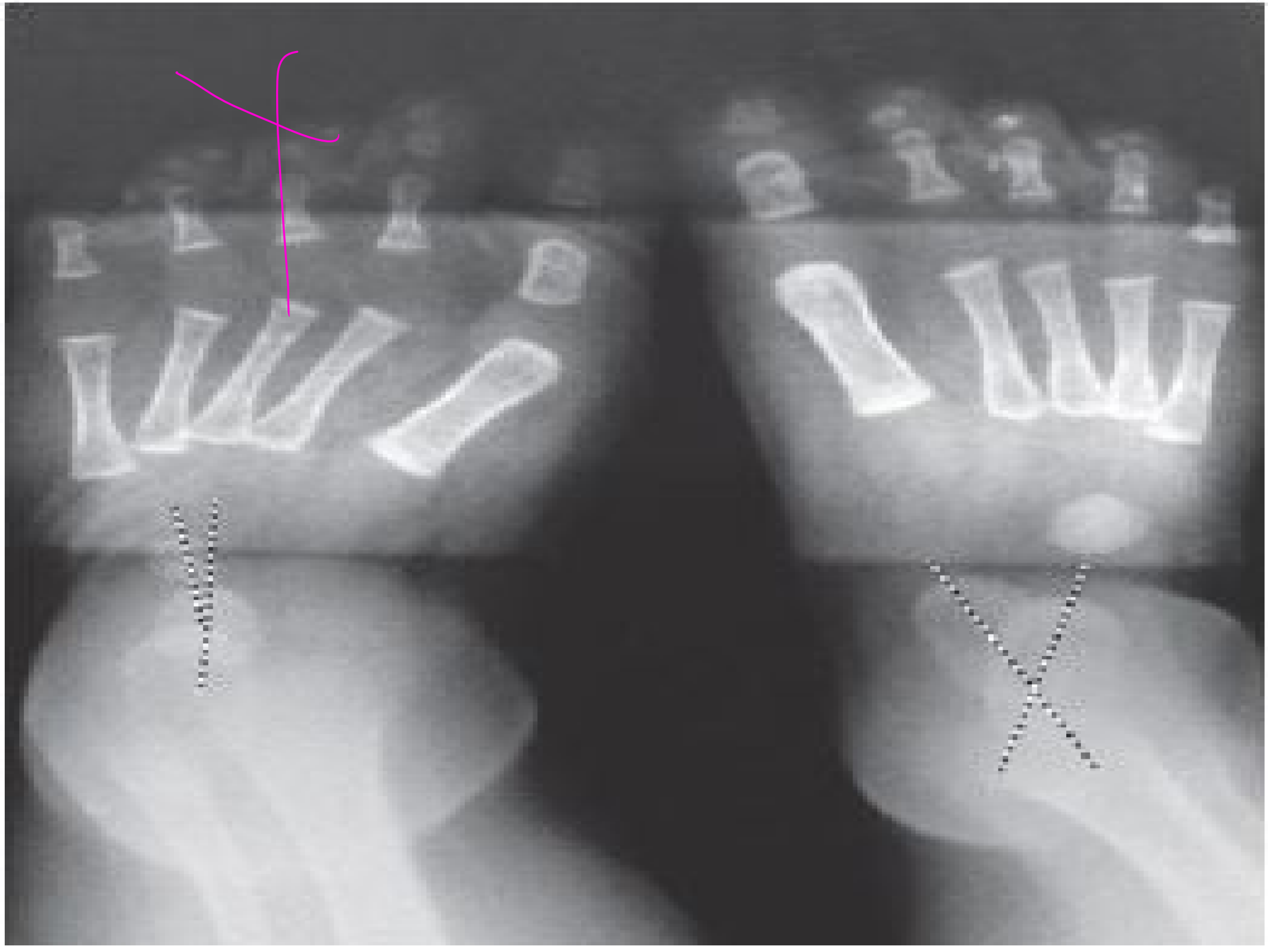
At Birth:

- the ankle is in equinus
- the heel is inverted and the forefoot is adducted and supinated
- sometimes the foot also has a high medial arch (cavus)
- the talus may protrude on the dorsolateral surface of the foot.
- In some cases the calf is abnormally thin

- X-ray: are used mainly to assess progress after treatment.

- The anteroposterior film is taken with the foot 30 degrees Plantarflexed

Lines can be drawn through the long axis of the talus parallel to its medial border and through that of the calcaneus parallel to its lateral border; they normally cross at an angle of 20– 40 degrees (Kite's ang le) but in club-foot the two lines may be almost parallel.



- The lateral film is taken to the foot .Lines drawn through the midlongitudinal axis of the talus and the lower border of the calcaneus , they should meet at an angle of about 40 degrees.

  Anything cannot less than 20 degrees shows that the calcaneus be tilted up into true dorsiflexion

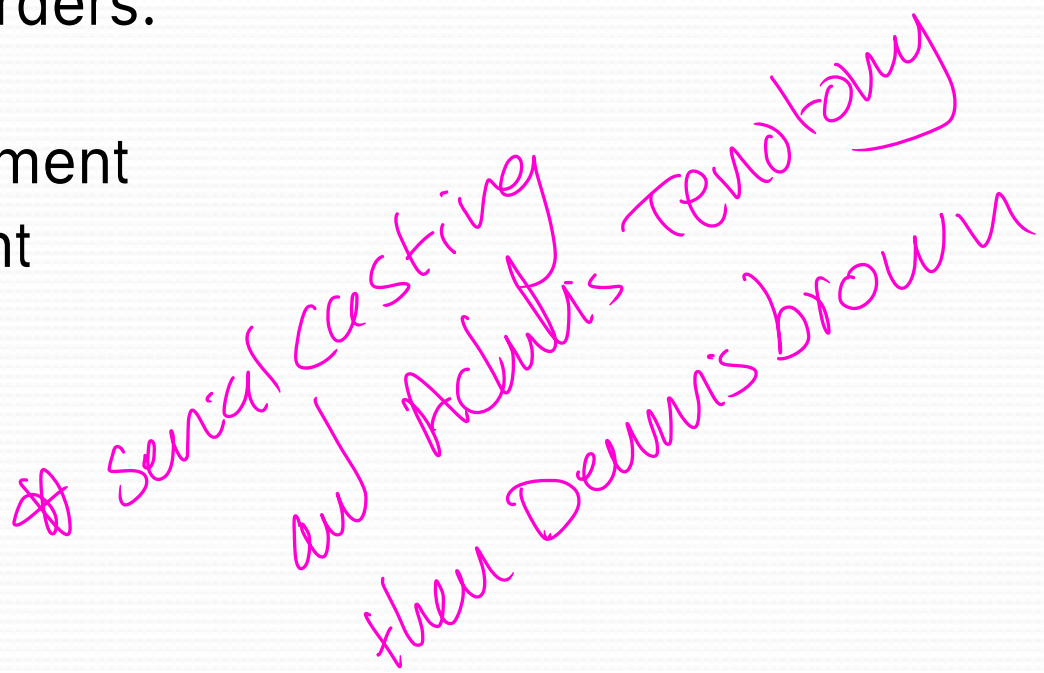
In the normal foot the talocalcaneal angle is 44 degrees in plantarflexion.

The talocalcaneal angle is 10 degrees in plantarflexion

Treatment

There are several methods of treatment but relapse is common, especially in babies with associated neuromuscular disorders.

- Conservative Treatment
- Operative Treatment



Conservative Treatment

- Treatment should begin early, preferably within a day or two of birth. This consists of repeated manipulation and adhesive strapping that maintains the correction:
- First the forefoot must be brought into rotational alignment with the hindfoot; paradoxically this is done by increasing the supination deformity of the forefoot so that it corresponds with the relatively more supinated hindfoot.
- Next, both hindfoot and forefoot are together gradually brought out of varus and supination; correction is assisted by keeping the fulcrum on the lateral side of the head of talus.
- Finally, equinus is corrected by bringing the heel down and dorsiflexing the foot.

Operative Treatment

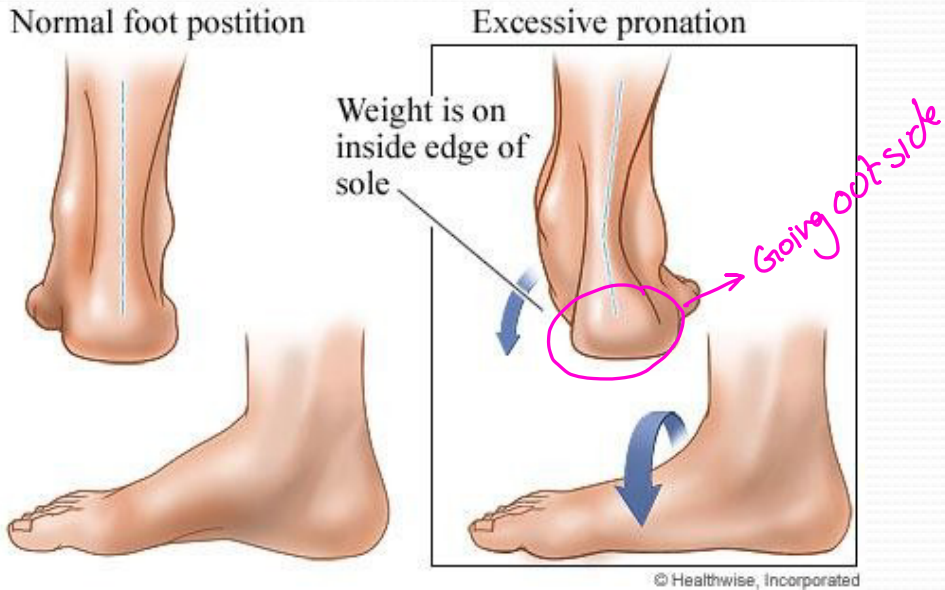
Resistant cases will usually declare themselves after 8– 12 weeks of serial manipulations and strapping.

After successful correction of deformity, relapses may be prevented by using Dennis Browne boots in infants

Pes Planus And Pes Valgus

"Flat-foot"

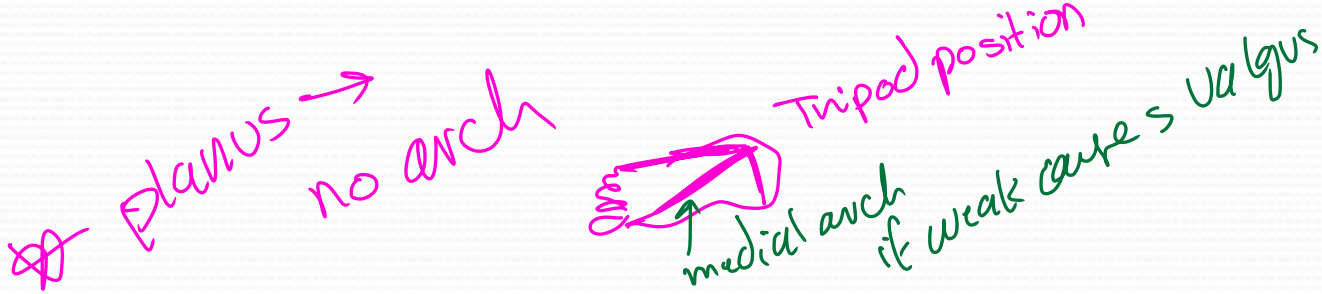
The term 'flatfoot' applies when the apex of the arch has collapsed and the medial border of the foot is in contact (or nearly in contact) with the ground; the heel becomes valgus and the foot pronates at the subtalar–midtarsal complex

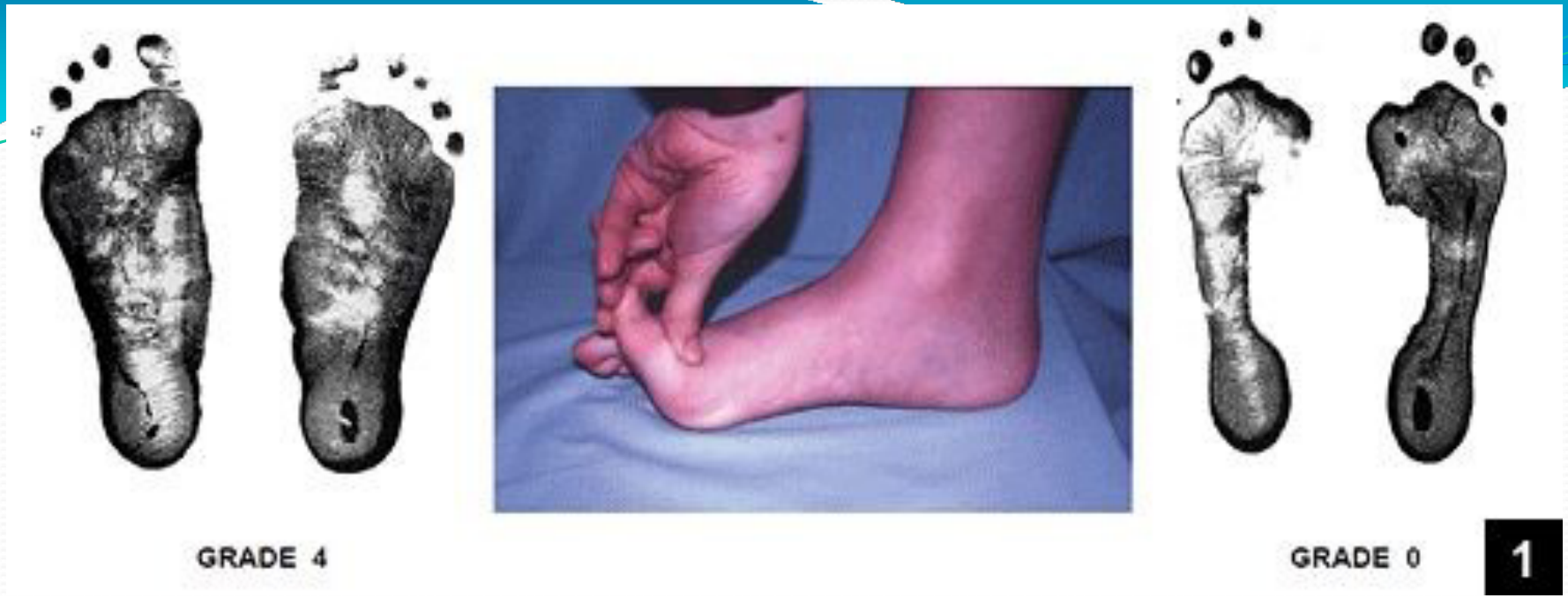


Flexible flat-foot

Flexible pes valgus appears in toddlers as a normal stage in development, and it usually disappears after a few years, when medial arch development is complete; occasionally, though, it persists into adult life. The arch can often be restored by simply dorsiflexing the great toe (Jack's test), and during this maneuver the tibia rotates externally.

Many of these children have ligamentous laxity and there may be a family history of both flat feet and joint hypermobility.





Example of footprint correction during Jack's test.

elevate the big toe the foot is back to normal

- Stiff (or ‘rigid’) flat-foot

A deformity that cannot be corrected passively should alert the examiner to an underlying abnormality.

In older children, conditions to be considered are:

(1) tarsal coalition;
(2) an inflammatory joint disorder;
(3) a neurological disorder.

The abnormal union of 2 or more bones in the hind foot and midfoot.

- Clinical Assessment:

  Although there is usually nothing to worry about, the parents' concerns should not be dismissed without a proper assessment of the child. Enquire about neonatal problems and a family history.

Watch the child stand and note the position of the heels from behind.

Are they in neutral or valgus, and do they invert when the child stands on tiptoe?

The tiptoe test will confirm a mobile subtalar joint and functioning tibialis posterior tendon.

Let the child walk: is the gait normal for the child's age?

Try to correct the flat-foot by gentle passive manipulation.

Perform Jack's test (see earlier) to distinguish between a flexible and a stiff ('rigid') deformity.

The spine, hips and knees also should be examined.

The clinical assessment is completed by a swift general examination for joint hypermobility and signs of neuromuscular abnormalities.

Imaging:

X-rays are unnecessary for asymptomatic, flexible flat feet.

For pathological flat feet (which are usually painful or stiff) standing anteroposterior, lateral and oblique views may help to identify underlying disorders.

On the lateral view, 'beaking' of the head of the talus suggests the presence of a tarsal coalition.

Narrowing of the talocalcaneal joint, which is sometimes seen in talocalcaneal coalition, is easily mistaken for 'arthritis'.

- CT scanning is the most reliable way of demonstrating tarsal coalitions.

Treatment

- Physiological flat-foot

Young children with flexible flat feet require no treatment.

Parents need to be reassured and told that the ‘deformity’ will probably correct itself in time; even if it does not fully correct, function is unlikely to be impaired.

Treatment

- Tight tendo Achillis :

Flat-foot associated with a tight tendo Achillis and restricted dorsiflexion at the ankle may benefit from tendon-stretching exercises.

Treatment

- Accessory navicular :
- Sometimes the main complaint (with a flexible flat-foot) is tenderness over an unusually prominent navicular bone on th e medial border of the midfoot.
- X-rays may show an extra ossicle at this site – the accessory navicular

If symptoms warrant it, the accessory bone can be shelled out from within the tibialis posterior tendon If the medial arch has 'dropped' significantly, the tibialis posterior tendon can be used as a 'hitch' by reinserting it through a hole drilled in the navicular and suturing the loop with the foot held in maximum inversion (Kidner's operation).

Treatment

- Rigid flat-foot (tarsal coalition)

the initial treatment should always be conservative. A walking plaster is applied with the foot plantigrade and is retained for 6 weeks; splintage with an outside iron and inside T-strap may have to be continued for another 3–6 months. Obviouslyi f an inflammatory joint disorder is discovered, this will have to be treated. If symptoms do not settle, operative treatment is needed

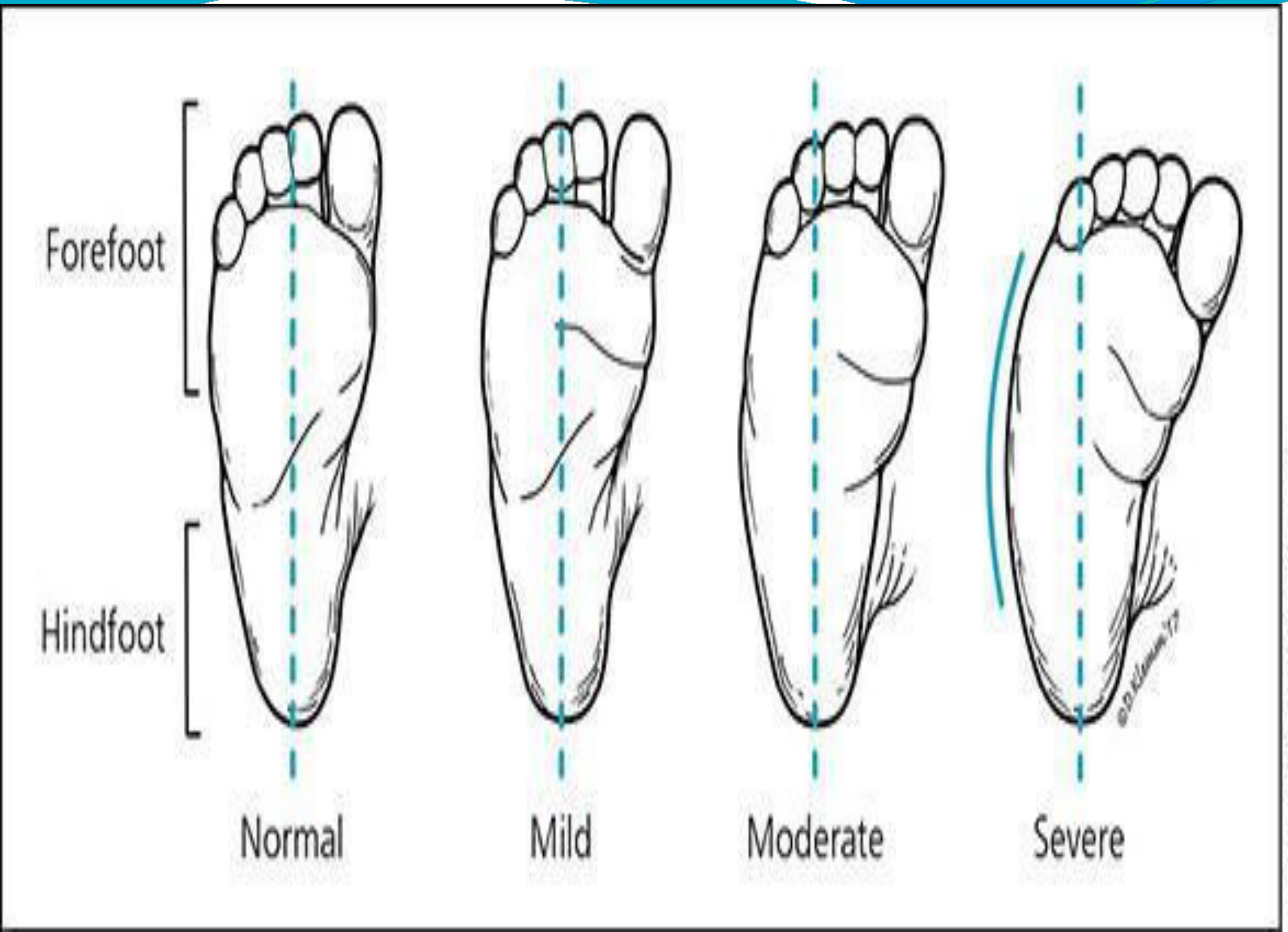
METATARSUS ADDUCTUS

Metatarsus adductus

angulation at the midfoot, with the metatarsals pointing toward the midline relative to the hindfoot.

This gives the foot a “kidney bean” or “C” shape.

Metatarsus adductus is thought to result from intrauterine molding.


Forefoot
Hindfoot
Normal
Mild
Moderate
Severe
ILLUSTRATION BY DAVE KLEMM

epidemiology

estimated to occur in 0.1 to 1 percent of births.

more frequent in girls than boys

It is the most common cause of in-toeing in infants younger than one year of age.

On examination

Metatarsus adductus is often bilateral.

the heel bisector line is lateral to the second toe.

The hindfoot is in the neutral or valgus position, and the range of motion of the ankle and subtalar joint are normal

Classification

Flexibility is determined by whether adduction can be corrected with manipulation back to the normal position.

according to the degree of flexibility ,which has implications for management

Mild/ flexible — Spontaneous active correction when the lateral border of the foot is stimulated

Moderate/ less flexible — Will not correct actively but can be passively corrected to neutral

Severe/ rigid — Unable to be passively corrected to neutral; may have a medial skin crease

Most cases of metatarsus adductus are mild/ flexible and resolve spontaneously by two years of age.

The most important aspect of treatment is parental reassurance.

Even when it persists, metatarsus adductus rarely causes pain or dysfunction