ORTHOPEDIC CONDITIONS

Farjad Afzal

Pediatric physical therapy

WHAT IS ORTHOPEDIC?

- The term ‘orthopedic’ originated with Nicolas André, a French physician who used the combination of two Greek words *orthos (straight) and paidi (child).*
- *In 1741 his book,* entitled *Orthopaedia: Or the Art of Correcting and Preventing Deformities in Children:*

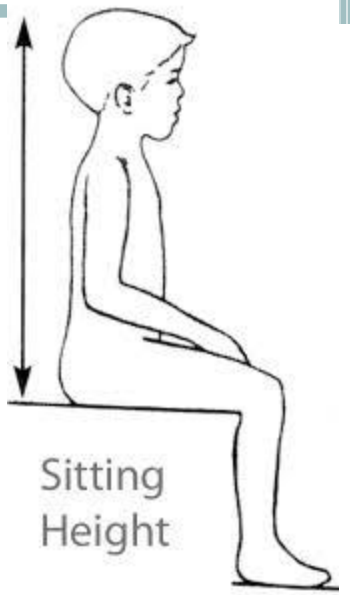
GROWTH

Skeletal growth occurs by adding tissue to its outer surface:

- By **intramembranous ossification** on the surface of the cortex, as in the **scapula and skull**, or to increase circumference of long bones
- By **enchondral ossification** at the growth plates situated

at either end of each **long bone**, increasing length.

- In the first **18 months** of life a baby undergoes the most rapid period of growth and development.
- At the age of 1 year, sitting height is 63% of a child's total height. The **limbs are short** in proportion. This disproportion in sitting height gradually reduces to **52%** in males and **53%** in females **at skeletal maturity.**
- From birth to cessation of growth at maturity, **sitting height increases by 67%,** whereas the **legs increase in length by 145%.**
- In infancy a child's spine lacks the normal adult curve. A long C-curve is replaced by the appearance of cervical lordosis at **3 months** of age as the child develops head control and lumbar lordosis as the child develops sitting balance.



- Skeletal growth is very rapid in infancy, slows down during childhood and increases again during the adolescent pubertal growth spurt.
- At the age of 2 years a child is approximately half adult height and three-quarters adult height by the age of 9

- most people, skeletal growth occurs without problems, ceasing at around 14 years in girls and 16 years in boys, on average.
- Growth plates close at differing times and also grow at differing rates.
- For example, 65% of all growth in the leg occurs at the knee, with 39% taking place at the lower femoral growth plate and 26% at the proximal tibial growth plate. Proportionally less growth takes place at the upper femoral and lower tibial growth plate

ASSESSMENT

- A good understanding of child development is also valuable.
- Many children will experience pain and altered function due to trauma at some stage in their childhood.

Assessment of a baby (under 24 months of age)

- Past history is essential and should include antenatal and birth history, family history and, if the baby is old enough, developmental history
- routinely screened for hip dysplasia in the neonatal period

- Undress the baby, even if the referral is for advice and management of a foot problem.
- check movement at the ankles, knees and hips. If the baby is very young (under 3 months), remember that **physiological neonatal flexion contractures** will be present in the hips and knees and there may be **excessive dorsiflexion**.
- Look for **asymmetry in joint range of movement**, limb lengths and girth as well as asymmetry of active movement

- Turn the baby over and look at the spine. A baby's spine should be straight with a single curve. Scoliosis and sharp angulations require investigation.
- Look for skin changes such as birth marks, skin patches and skin dimples over the spine – these can be an indication of underlying spinal problems such as spina bifida occulta, spinal dysraphism or neurofibromatosis.
- Look for plagiocephaly (flattened appearance of the back or side of the skull) and asymmetry of neck range of movement

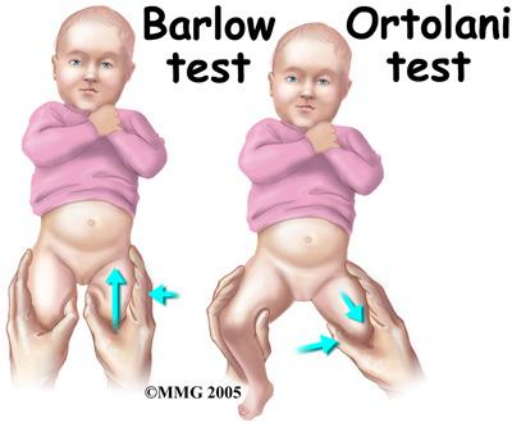
- Examination of the upper limbs – look for asymmetry of active movement and joint ranges.
- Be aware that any baby with asymmetries due to intrauterine moulding, especially at the neck or feet, has an increased risk of hip dysplasia – as well as those where there is a family history of hip problems.

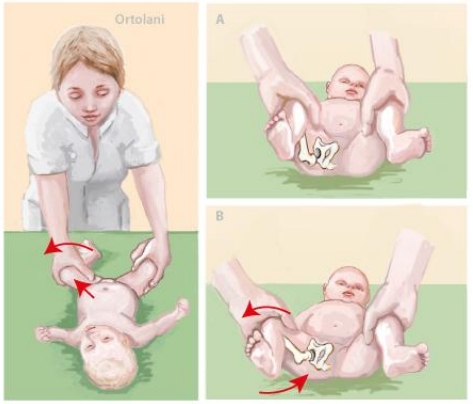
Assessment of a child (over the age of 2 years)

- Birth history, including antenatal history
- History of presenting condition
- Developmental milestones: did the child sit and walk at the right time?
- Family history of similar bone or joint problems: a surprising number of orthopedic problems run in families

- Joint range of movement (active and passive as appropriate)
- Muscle power: grading systems such as the Oxford rating scale
- Muscle length
- Deformity, e.g. scoliosis, club foot

- Limb lengths: traditionally measured from the anterior superior iliac spine (ASIS) to the medial malleolus. For congenital limb-length discrepancies, measurement May be from he ASIS to the base of the heel
- Limb girth: use a bony landmark and measure down from it to ensure consistency between assessment of girth of each limb, e.g. 7 cm below the tibial tubercle to measure calf girth
- Joint stability: such as the **Ortolani and Barlow tests** for hip instability; **anterior draw test** for knee joint stability
- Pain profile:





How child perceives and expresses pain?

- An **infant** may **cry** or avoid moving the painful part. If the pain is severe, continuous crying is usual
- **Children** in pain may avoid using the affected part or will show altered function such as **limping**. They may also be able to voice their discomfort.
- Most **adolescents** have language and perception to describe their pain. An athletic boy may underrepor this pain if there is a sporting event he is keen to take part in; conversely, a boy who hates sport may be exaggerating the problem

How to manage children with Normal variants

such as bow leg, knock knee, in-toeing and flat feet.

The five Ss

- **1. Symmetry: Does the problem under consideration** affect both limbs equally? For example, if both lower limbs in a 3-year-old child are bowed, this is likely to be due to normal physiological bowing and it is safe to watch and wait. However, severe bowing, asymmetric Bowing or bowing in only one lower limb is not normal and warrants further investigation.
- **2. Symptoms: Does the child have symptoms? If a child** is running around happily and not complaining of pain or functional difficulties, then 'treatment' is not required.

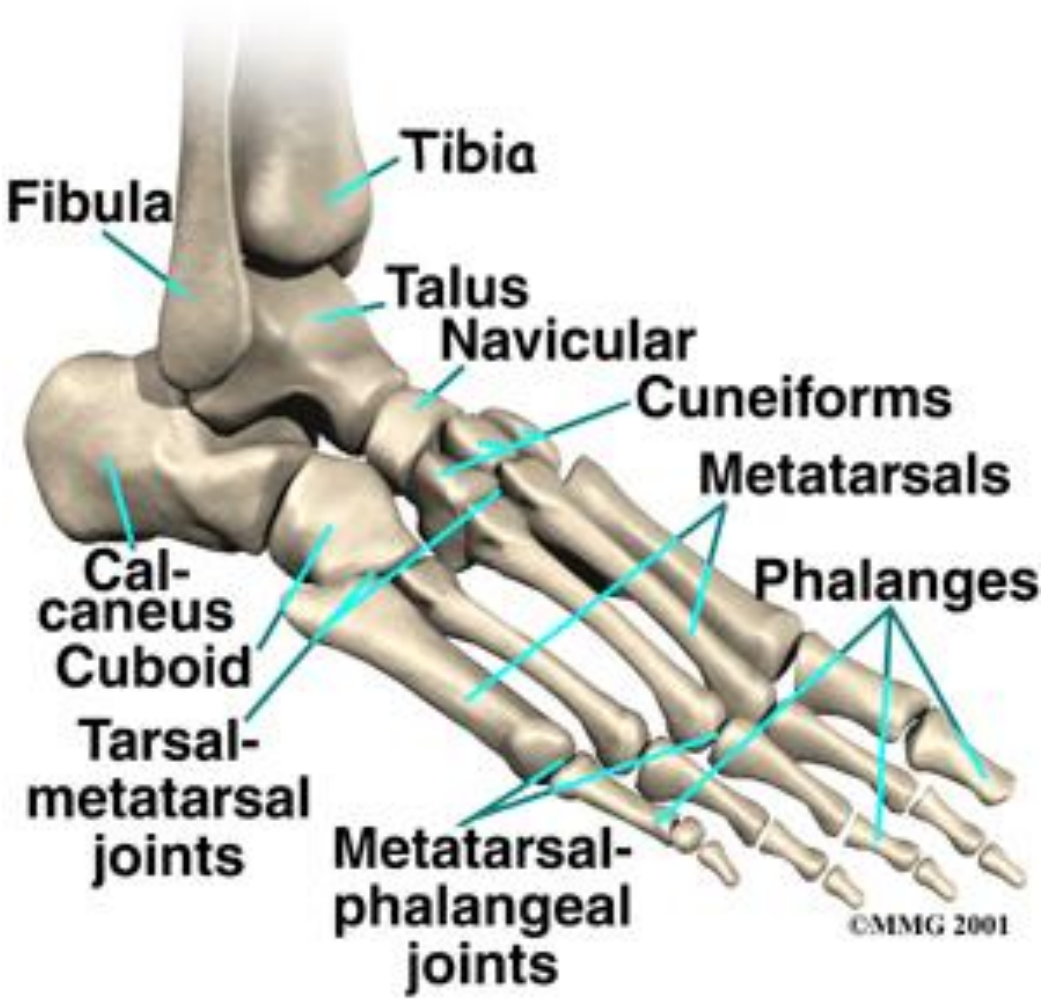
- **3. Stiffness: Is there a full range of movement in all a** child's joints? Joint stiffness in a growing child is not normal and should be investigated further.
- **4. Systemic: Is the child well? It is important to** remember that inflammatory conditions and metabolic Problems can have an impact on skeletal growth. Conditions such as rickets can cause skeletal changes such as bow legs.
- **5. Skeletal dysplasia: Is a child of normal stature and** proportion? Does the child have an unusual face?

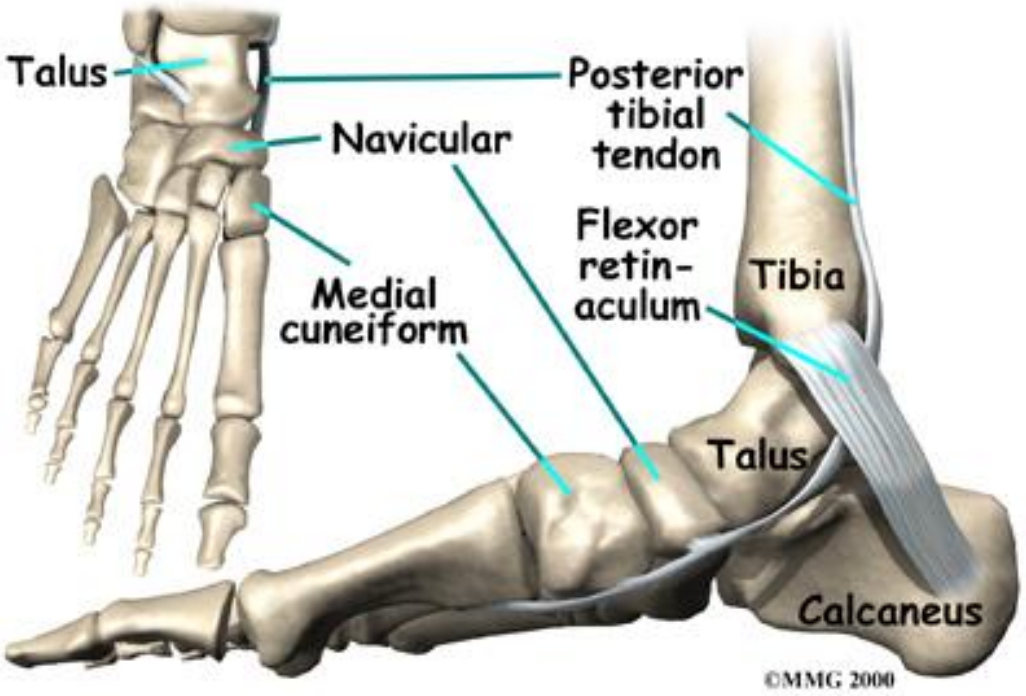
a child who has marked but equal bowing of both lower limbs, with no pain or stiffness, and has no evidence of systemic disease or skeletal dysplasia, is **normal**.

Feet

ANATOMY


Tarsal Bones
Fibula
Calcaneus
Cuboid
Top
Tibia
Talus
Navicular
Cuneiforms
Metatarsals
©MMG 2006
Lateral
Fibula
Tibia
Navicular
Cuneiforms
Talus
Calcaneus
Cuboid
Medial
Tibia
Talus
Calcaneus


Tibia
Fibula
Talus
Navicular
Cuneiforms
Metatarsals
Phalanges
Cal-
caneus
Cuboid
Tarsal-
metatarsal
joints
Metatarsal-
phalangeal
joints
©MMG 2001


Talus
Navicular
Medial cuneiform
Posterior tibial tendon
Flexor retin-aculum
Tibia
Talus
Calcaneus
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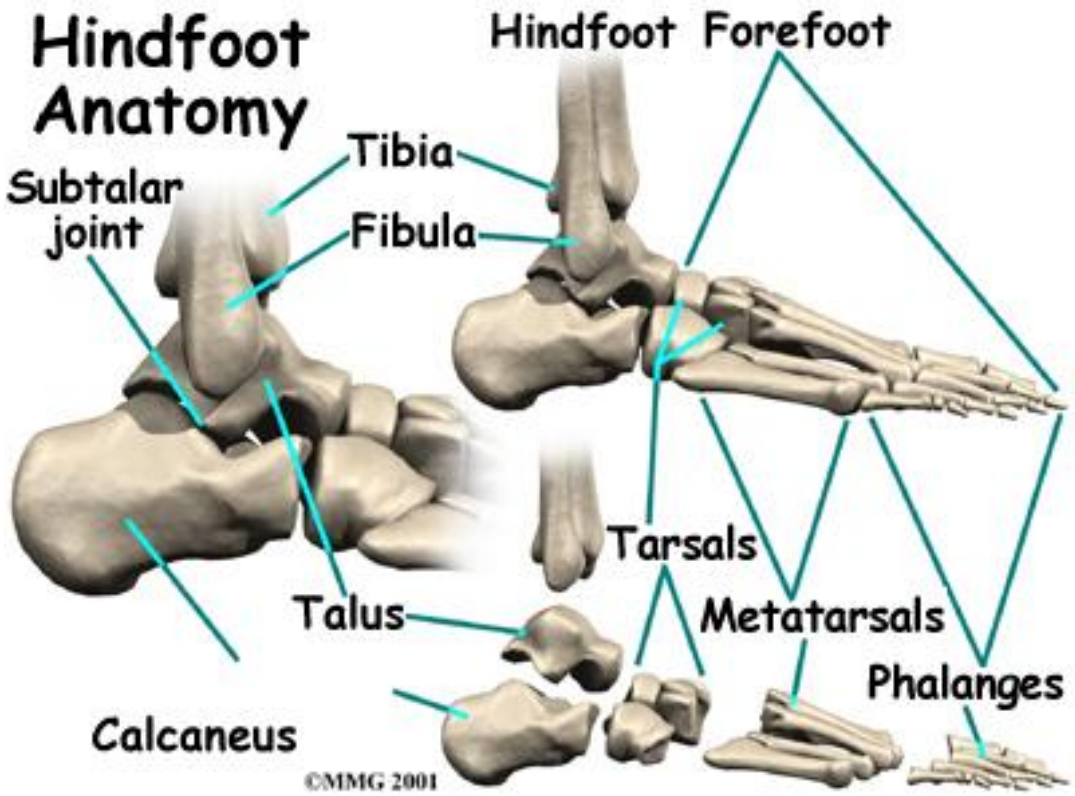
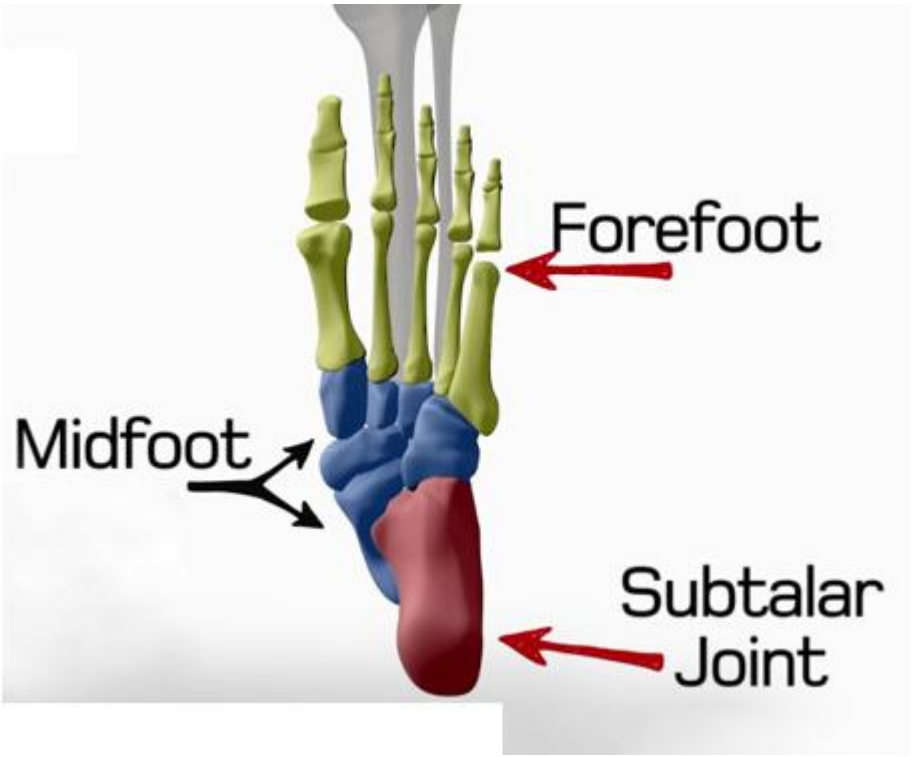

Hindfoot Anatomy
Hindfoot
Forefoot
Tibia
Fibula
Subtalar joint
Tarsals
Talus
Metatarsals
Phalanges
Calcaneus
©MMG 2001


Forefoot
Midfoot
Subtalar
Joint

Children’s shoes

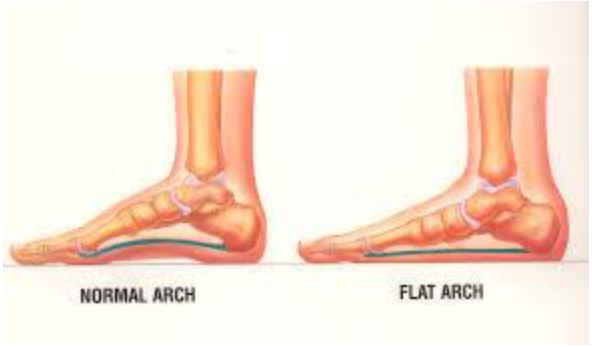
Children's shoes

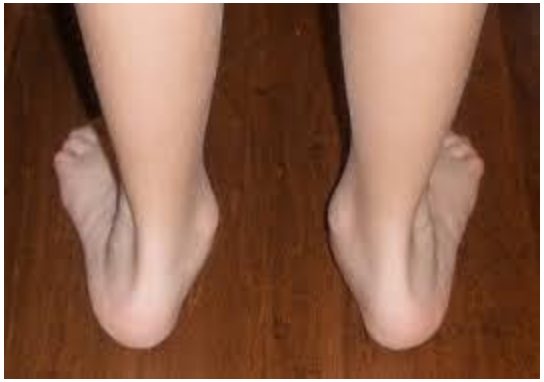
- It has been suggested that children's shoes do not have to be expensive or long-lasting.
- recommend that a child's feet should be measured at 3-monthly intervals and new shoes provided
- optimum foot development occurs in a barefoot environment
- provision of corrective (stiff and compressive) Footwear May cause deformity, weakness and loss of mobility.

wearing corrective shoes or inserts does not influence the course Of Flexible flat foot in children

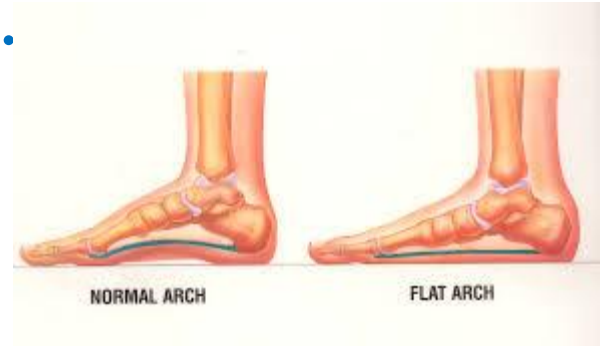
A prospective study to determine whether children with flexible flat feet needed treatment with orthotics or corrective ‘orthopedics’ shoes was carried out with children randomly allocated to one of four groups, Including a control group; the children underwent a minimum of 3 years’ treatment. Final analysis demonstrated significant improvement in all groups, including the controls, with no significant difference between the controls and the intervention group.

Flat foot (pes planus)





- Flat foot simply means a foot with a large plantar contact area.
- Often the longitudinal arch is not visible and there may be some valgus of the heel.
- Flat foot can be flexible (physiological) or rigid (pathological).

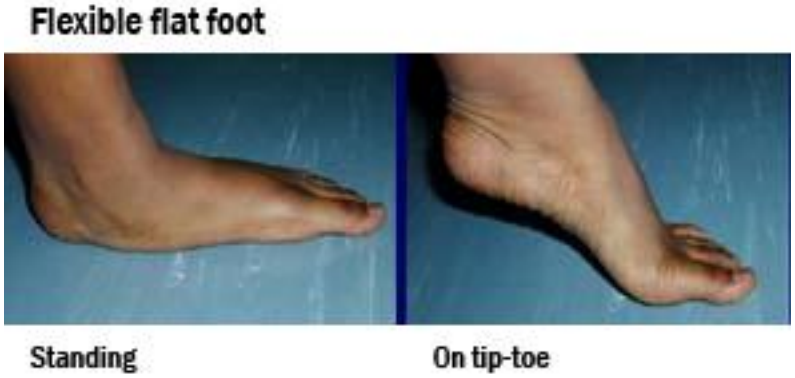


Physiological flat foot

- Physiological flat feet are very common, flexible, benign and a normal variant.
- Flexible flat foot can be divided into two types: developmental and static

Developmental flat foot

- Developmental flat foot is apparent when the child starts to walk And Disappears spontaneously at around the age of 3–5 years.
- Asking the child to stand on tiptoe or using the great-toe extension test will demonstrate Restoration of the medial arch



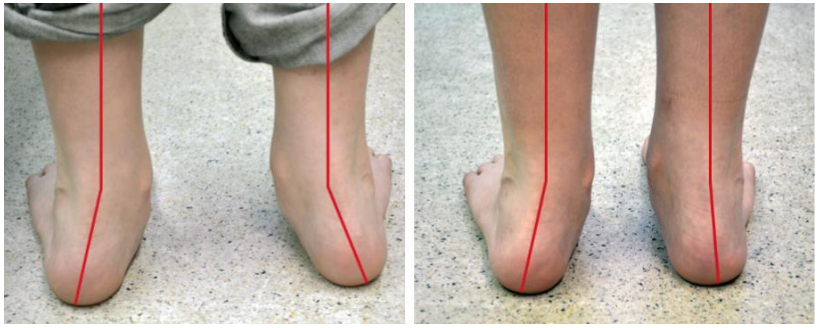
Static flat feet

- Static flat feet are associated with generalized laxity and often other family members have flat feet.
- Some children with ligamentous laxity due to conditions such as Down's Syndrome or Marfan's Syndrome May need orthotic Support or high-top trainers to help Them Achieve stability for weight-bearing activity.

Treatment

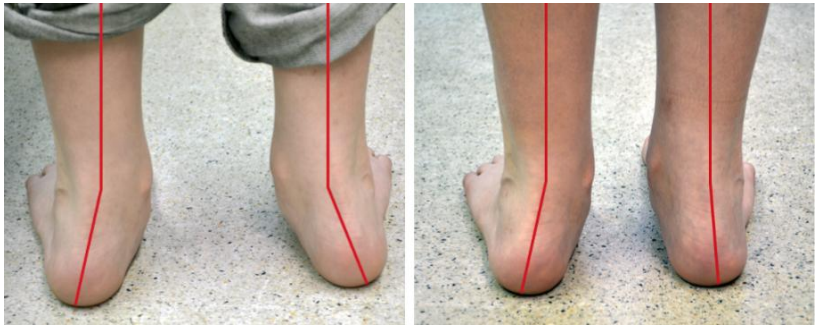
- Flexible flat feet require no treatment.
- Advice regarding choice of shoe wear may be needed (integral medial arch support, shock absorbance soles) and only occasionally is orthotic support indicated.
- The tendency for overtreatment of physiological flat feet by exercises, orthotics and special shoe wear is still observed, resulting in high-cost, ineffective treatment.
- Printed information can be very useful for the family to take home to share with anxious grandparents

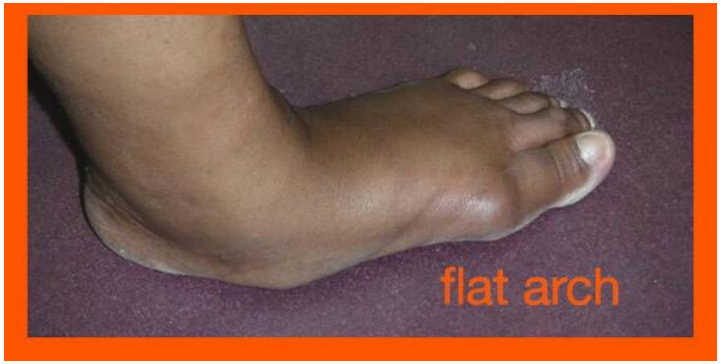
Pathological flat foot

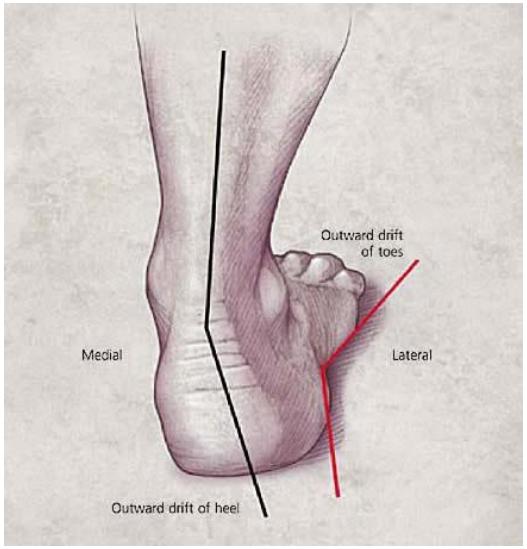


Pathological flat foot

Pathological flat foot shows some degree of stiffness, such as loss of subtalar movement or tightness of the Achilles tendon (less than 10° dorsiflexion)





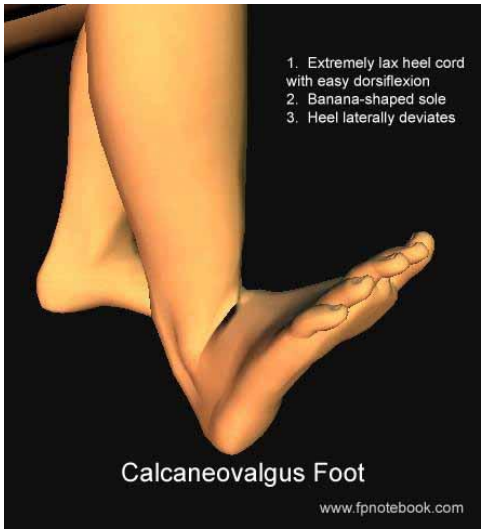


Causes

- Intrauterine crowding (talipes calcaneovalgus)
- Abnormal alignment of the tarsal bones (congenital vertical talus (CVT)
- Tarsal coalition
- A combination of Achilles tendon contracture with hypermobility.

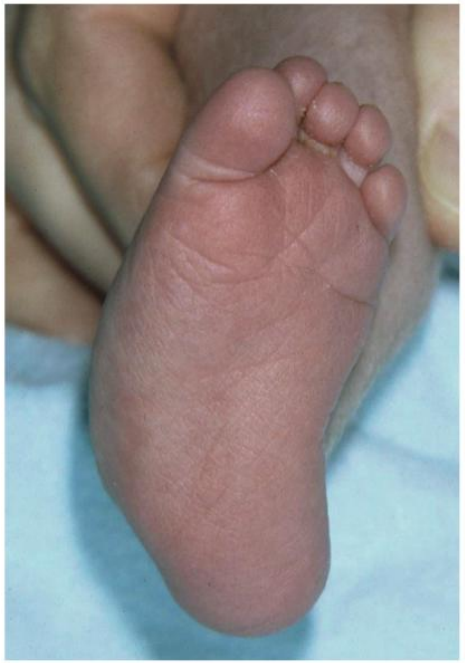
Talipes calcaneovalgus

Talipes calcaneovalgus will resolve spontaneously but demonstration of passive stretches into plantarflexion and inversion,



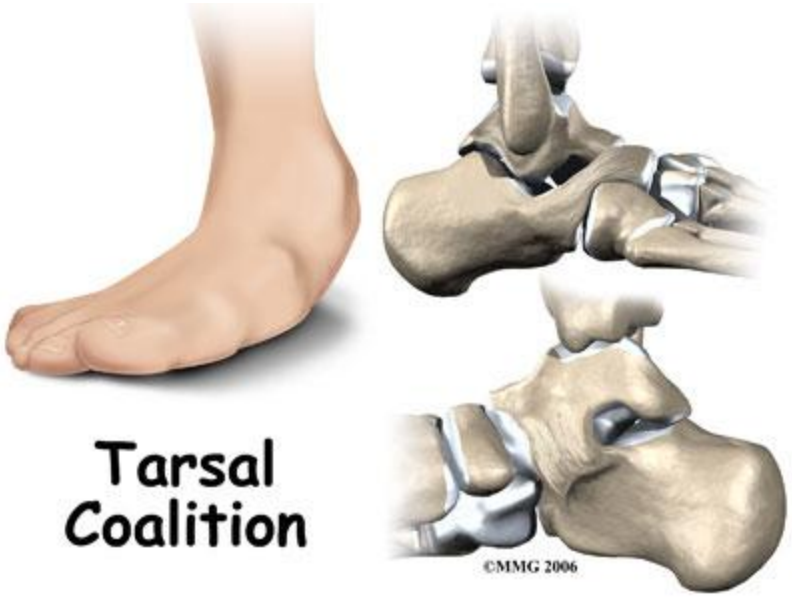
Congenital vertical talus

- CVT is a severe foot deformity in which the head of the talus can be felt in the sole of the foot. Viewed from the side, the foot will have a rocker-bottom appearance with fixed equinus of the hindfoot and calcaneus and valgus of the forefoot



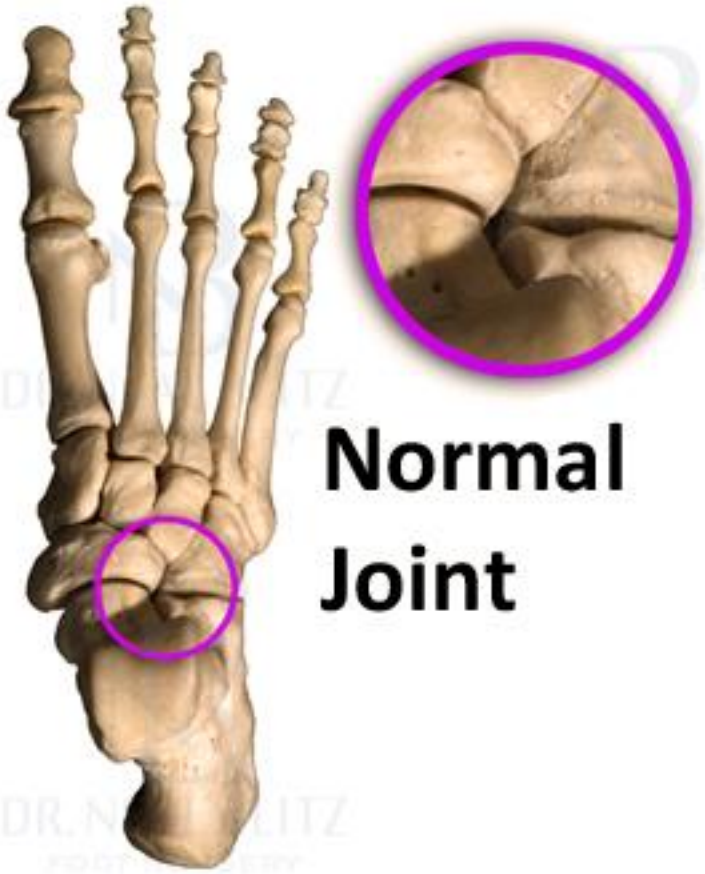
- Surgical management is necessary to realign the talus.
- Physiotherapy may be indicated as CVT is associated with neuromuscular problems and various syndromes as well as neural defects and spinal anomalies.
- Physiotherapy may help a child achieve developmental milestones as well as manage other joint and soft-tissue deformities that would be amenable to serial splintage, passive stretches, positioning
- advice, provision of aids and equipment.

Tarsal coalitions



- Tarsal coalitions, also known as peroneal spastic flat foot,
- can be unilateral or bilateral.
- There may be a family history.
- The commonest sites are between the calcaneus and the navicular or the talus and calcaneus

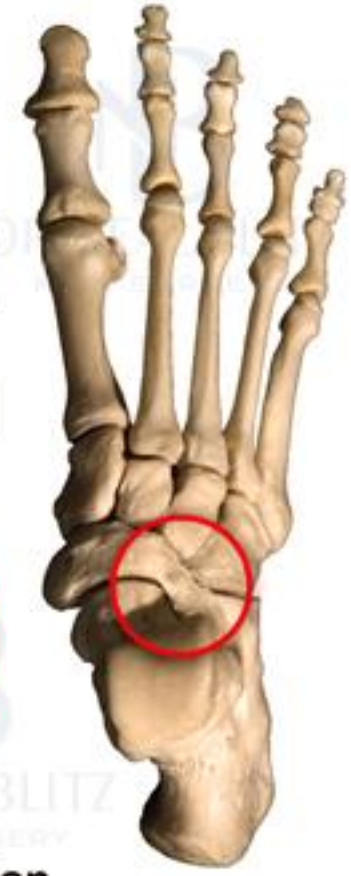
TARSAL COALITION CALCANEONAVICULAR



Normal Joint

Tarsal Coalition

Abnormal bone growth/connection



TARSAL COALITION: MIDDLE FACET TALOCALCANEAL

Normal Joint

Tarsal Coalition

- The usual initial presentation is after a simple twist or sprain of the foot or ankle in a child over the age of 10 years
- An abnormal fibrous band, present from birth, between the bones begins to ossify at around this age, causing stiffness and pain.
- At this stage a child may be referred for physiotherapy, as there may be difficulties in walking and running, as well as pain

Immobilization of the foot and ankle in a plaster cast will relieve symptoms, which commonly relapse when the cast is removed. Surgical resection of the bar can be successful in relieving symptoms.

Questions?