

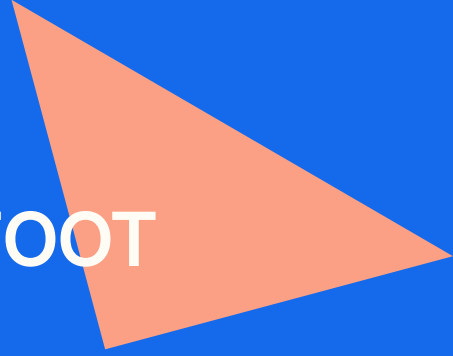
PES PLANUS

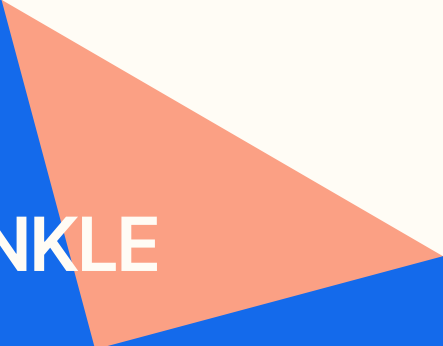
PG. 517 RATTRAY

WHAT IS IT?

PES PLANUS IS A DECREASED
MEDIAL LONGITUDINAL ARCH AND
A PROTRACTED HINDFOOT

**THE TERM PES PLANUS, PRONATED FOOT
AND FLAT FOOT ARE OFTEN USED
INTERCHANGEABLY**

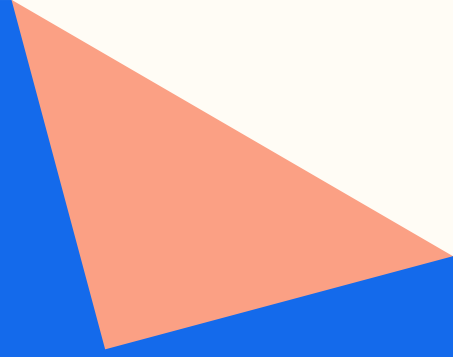




PRONATION:
COMBINED MOVEMENT OF THE FOOT/ANKLE
THAT INCLUDED EVERSION OF THE
CALCANEUS, ABDUCTION OF THE FOREFOOT
AND SOME DORSIFLEXION AT THE SUBTALAR JT

HINDFOOT VALGUS: EVERSION OF THE
CALCANEUS, LEADS TO FOOT PRONATION

**SUPINATION: CONVERSE
MOVEMENT. INVOLVES INVERSION,
ADDUCTION SOME
PLANTARFLEXION AT SUBTALAR JT**

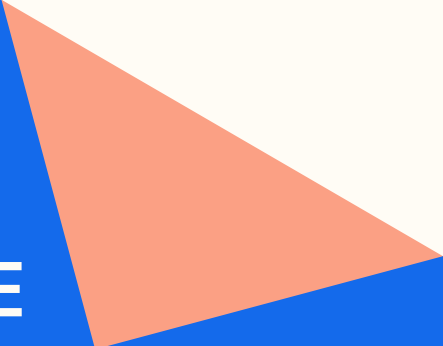




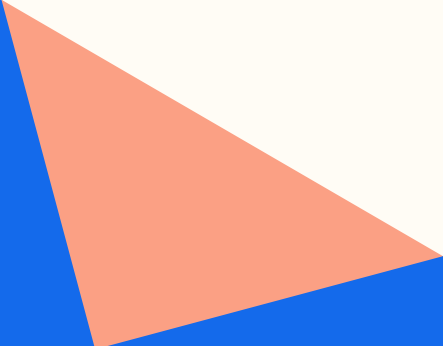
THERE ARE 2 TYPES OF PES PLANUS:

FUNCTIONAL: INDICATES LIG LAXITY OR MM WEAKNESS AS A CONTRIBUTING FACTOR. CAN BE CORRECTED

STRUCTURAL/RIGID: BONY MALFORMATION/CHANGE. CANNOT BE ALTERED BY POSITIONAL CHANGES/VOLUNTARY EFFORT

A large orange triangle is positioned in the top right corner of the slide, pointing towards the center.

ORIGINALLY IT WAS BELIEVED THAT THE ARCHES IN NORMAL, STATIC FOOT, ESPECIALLY THE MEDIAL LONGITUDINAL ARCH, WERE SUPPORTED BY MM. IT HAS BEEN DISPROVED BY ELECTROMYOPGRAPHIC TESTS. A COMBINATION OF BONE LIGS, AND MM SUPPORT THE ARCHES OF THE NORMAL FOOT.

A decorative orange triangle is located in the top right corner of the slide, pointing towards the center.

THERE ARE 3 MAIN ARCHES:

- 1. MEDIAL LONGINTUDINAL ARCH**
- 2. LATERAL ARCH**
- 3. ANTERIOR TRANSVERSE ARCH**

MEDIAL LONGINTUDINAL ARCH

THE BONES THAT FORM THE MED LONGINTUDINAL ARCH ARE THE CALCANEUS, TALUS, NAVICULAR, THREE CUNEIFORMS, AND THREE METATARSAL

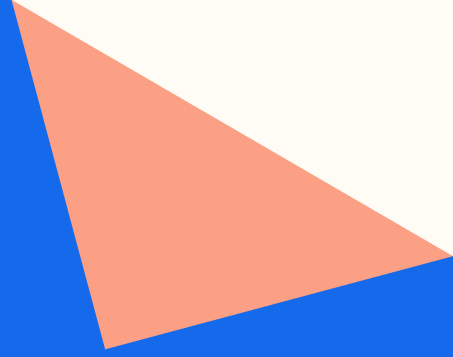
THE MED LONGINTUDINAL ARCH IS NOT A TRUR ARCH, IN AN ARCHITECTURAL SENSE.

THE CONFIGURATION IS NOT FORMED BY THE SHAPE OF THE BONES ALONE.

IN STATIC/WEIGHT BEARING FOOT, THE MED ARCH IS MAINTAINED BY THE LONG AND SHORT PLANTAR LIGS, PLANTAR CALCANEONAVICULAR (SPRING) LIG AND THE PLANTAR APONEUROSIS.

IN THE ACTIVE/DYNAMIC FOOT, TIB POST, TIB ANT, AND TO A LESSER EXTENT, PERONEUS LONGUS PROVIDE A MM SLING TO SUPPORT THE ARCH. THIS PREVENTS IT FROM FLATTENING INTO A PRONATED POSITION.

OTHER MM THAT PROVIDE SUPPORT ARE
FLEX HALLUCIS LONG, FLEX DIGITORUM
LONG, AND INTRINSIC MM OF THE FOOT.

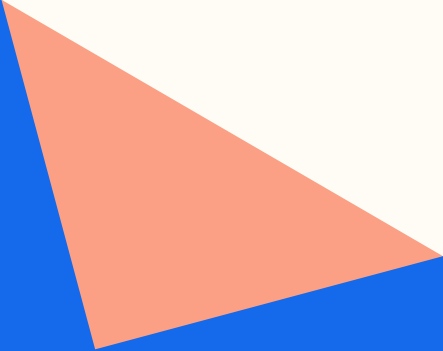


ANTERIOR TRANSVERSE ARCH

COMPOSED OF METATARSAL HEADS ,
ALSO DEPENDS ON MUSCULAR SUPPORT
FROM LUMBRICALS AND INTEROSSEI

LATERAL LONGITUDINAL ARCH

IS A TRUE ARCH. THE CUBOID BONE FORMING THE KEYSTONE BETWEEN THE CALCANEUS AND THE 4TH AND 5TH METATARSALS.



NEWBORN BABIES LACK ALL THESE
ARCHES.

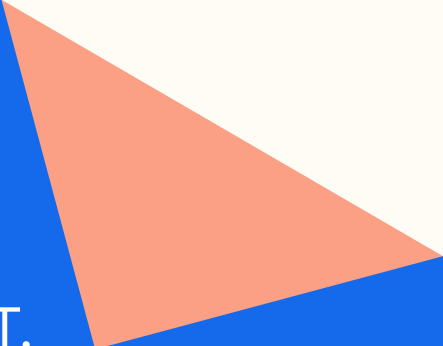
THE MED LONG ARCH STARTS TO
DEVELOP AFTER 2 YRS OF AGE.

NORMAL FOR INFANTS TO HAVE PES
PLANUS

TO ILLUSTRATE THE CONFIGURATION OF THE ARCHES, THE FOOT MAY BE PRESENTED AS A TWISTED OSTEOLIGAMENTOUS PLATE.

IN THE STANDING FOOT, THE METATARSAL HEADS REPRESENTING ONE END OF THE PLATE, ARE POSITIONED HORIZONTALLY; THE CALCANEUS, REPRESENTING THE OTHER END, IS POSITIONED VERTICALLY (PG. 518).

THE MED ARCH RELIES ON THIS TWISTED CONFIGURATION OF THE FOOT.



PRONATION OF THE FOOT OCCURS PRIMARILY AT THE SUBTALAR JT AND SECONDARILY AT THE MIDTARSAL JT.

WHEN THE FOOT PRONATES, THE TWISTED PLATE FLATTENS LONG THE MED ARCH.

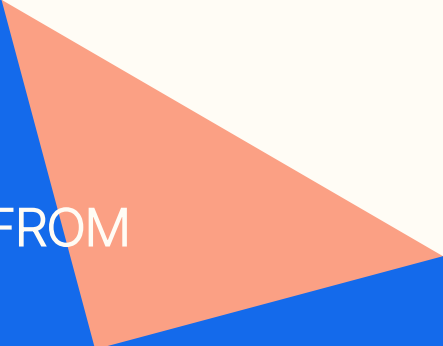
WHEN THE FOOT SUPINATES, THE TWIST ON THE PLATE INCREASES, RAISING THE MED ARCH.

NORMAL GAIT CYCLE

SOME PRONATION IS IMPORTANT DURING THE CONTACT PHASE FOLLOWING HEEL STRIKE.

ALLOWS THE FOOT TO ADAPT TO UNEVEN TERRAIN AND ENABLES THE LOWER LEG TO INT ROT

TOE OFF CAUSES THE PLANTAR APONEUROSIS TO TIGHTEN, SUPINATING OR RAISING THE MED ARCH AND ADDING STABILITY TO THE FOOT.

A large orange triangle is positioned in the top right corner of the slide, pointing towards the center.

IN PES PLANUS, THE TALAR HEAD IS DISPLACED MED/INF FROM NAVICULAR BONE

LIGS/JTS CAPSULES AND FASCIA WHICH SUPPORT AND FORM THE MED LONG ARCH BECOME OVERSTRETCHED.

LACK OF LIG STABILITY IN THE FLATFOOTED PERSON, FORCES THE MM TO PROVIDE MOST OF THE ARCHES' STABILITY BOTH IN STANDING AND WALKING, BECAUSE FOOT PRONATED/UNTWISTED POSTITON.

MM SUPPORTING THE ARCH: DYNAMIC FOOT

TIB ANT AND PERONEAL: PHASIC MM, RESPOND TO STRESS BY FATIGUING

GASTRAC/SOLEU: POSTURAL MM, RESPOND TO STRESS BY ADAPTIVELY SHORTENING

THESE CHARACTERISTICS OF THE MM HELP PERPETUATE PES PLANUS

MM THAT EVERT THE FOOT: PERONEUS LONG/BREVIS/TERTIUS.

THESE MM ARE ALL EVERTORS OF THE FOOT, THE TENDON OF PERONEUS LONG WRAPS AROUND THE LAT SURFACE OF THE CUBOID AND INSERTS ONTO THE MED PLANTAR SURFACE OF THE FIRST CUBOID AND FIRST METATARSAL.

IT INDIRECTLY EVERTS THE FOOT.

WEIGHT BEARING, SUPPORTS THE MED ARCH BY CAUSING HEAD OF 1ST METATARSAL TO PRESS INTO FLOOR.

PERONEUS BREVIS/TERTIUS INSERT LAT ONTO THE BASE OF THE 5TH METATARSAL, EVERTING THE FOOT.

PRONATED FOOT, THE MM, ARE PRONE TO DEVELOP TP'S AND TAUT BANDS. SHORTENING REINFORCES EVERSION, MAINTAINING PES PLANUS. SAME WITH GASTRAC AND SOLEUS.

FUNCTIONAL PES PLANUS

CAN WORSEN IF THE ARCHES NOT ADEQUATELY SUPPORTED.

STUDY: 44 PERSONS COMPLETED 100KM HIKE. THOSE WITH PES PLANUS BEFORE WALK, ARCHES FURTHER DROPPED AT THE END. THOSE WITH NORMAL FEET HAD NO CHANGE.

OTHER FOOT PROBLEMS:

FOREFOOT VARUS: inversion of the foot on the hindfoot at the midtarsal jt. Looks like pes planus, can contribute to tib post tendinitis and Morton's neuroma.

HEEL SPURS: continuous pulling on the attachments of the plantar aponeurosis. MED longitudinal arch flattens, increased stress is placed on aponeurosis.

SPREADING OF ANT TRANSVERSE ARCH: between 1st and 2nd metatarsal heads. Allows hallux valgus to form.

HALLUX VALGUS: valgus orientation of big toe. Accompanying MED deviation of 1st metatarsal bone. Caused/contributed to pes planus. 1st metatarsophalangeal jt capsule becomes hypermobile; callus and inflamed thickened bursa develops over the jt, forms a bunion. Due to poor footwear.

OTHER FOOT PROBLEMS:

PES CAVUS: opposite foot configurations to pes planus. High MED arch due to increased twisting/supination of the foot. Calcaneus is inverted. TIB ANT, TIB POST, and tow FLEX are shortened.

HINDFOOT VARUS: inversion of the calcaneus, seen with supination.

FOREFOOT VALGUS: eversion of the forefoot on the hindfoot at the midtarsal jt. Looks like pes cavus.

METATARSALGIA: general term for foot pn at metatarsal heads. Occurs with either pes planus/cavus.

MORTON'S FOOT STRUCTURE: 2nd metatarsal is longer than the 1st. Allows 1st metatarsal to become hypermobile. Body's weight is abnormally distributed through head of 2nd metatarsal on toe off phase of gait cycle. Results in callus formation and tenderness under 2nd metatarsal head. Places stress on TIB POST, may occur with pes planus.

Other notes:

Pes planus can contribute to other postural dysfunctions because MED displacement of talus leads to internal ROT of the tibia when client standing.

Results in altered knee and hip biomechanics: knee valgus, patellar tracking disorders, ITB contracture piriformis syndrome, hyperlordosis, scoliosis, and osteoarthritis of the hip.

Conversely, dysfunctions can cause pes planus.

Overuse injuries: achille tendinitis, shin splints and stress fractures of the metatarsals and navicular, may also result from pes planus.

The client may not view a foot condition as the source of the problem. You must, as a therapist be aware that pes planus may be a contributing factor to the presenting complaint.

CAUSES OF PES PLANUS

HYPERMOBILITY: in foot due to JT capsule and LIG laxity. May be inherited or due to pathology such as RA.

POOR BIOMECHANICS: subtalar jt and midtarsal jt

SHORTENED MM: gastrap/soleus/achilles tendon, reduces ability of the ankle to dorsiflex. Leads to compensation by midtarsal jt. Foot must untwist into pronation to allow midtarsal jt to unlock. Peroneus longus/brevis/tertius are shortened by pronation. Shortened ITB and INT TIB ROT can cause/result from pes planus.

WEAKNESS: mm that support the arch in dynamic foot, especially TIB POST.

CONGENITAL ABNORMALITIES IN BONES OF FOOT: fixation of the talus and calcaneus by LIGs or osseous union. Longer 2nd metatarsal allows weight bearing to occur through head of the bone, leading to pn and possible transverse arch spread. Hallux valgus may cause/result from pes planus.

CAUSES CONT:

CONGENITAL ABNORMALITIES IN THE BONES OF LEG/THIGH: femoral anteversion or increase in torsion of the femur. Viewed from above: distal end of femur INT ROT. person has increased INT ROT of the leg in stance phase, INT ROTs the subtalar jt pronating the foot. Leads/results from pes planus. INT TIB torsion can contribute to pes planus.

HABITUAL POOR POSTURE: standing with feet wide apart, pronates the hindfoot.

NERVE LESIONS: The common peroneal or POST TIB nn resulting in paralysis or mm weakness.

TRAUMA: in foot/ankle. Landing heavily on the feet after jumping or falling resulting in fractures to the calcaneus or in a third degree sprain of the spring lig. In elderly persons, acquired pes planus is associated with tibialis post tendon rupture.

FOOTWEAR: does not provided MED arch support. Can make pes planus worse. running /hiking activities affected.

SYMPTOM PICTURE:

- ❑ Hypermobility of MED arch present, foot pronated
- ❑ Pes planus can be functional/structural, unilateral/bilateral
- ❑ Existing pes planus: overuse without adequate arch support, worsen condition
- ❑ Pain may not be present. Usually due to fatigue of affected mm and lig. Most frequently noticed in plantar surface, also occur in fatigued TIB ANT/POST. Pn with regular activities/increased stress during activities such as running. Can be located in knee, hip, low back from compensation.
- ❑ Pronation: peroneus long/brevis/tertius, gastrac, soleus are likely short/hypertonic. TPs may be present around peroneal and achilles tendon. Ankle jt and SUP tibiofibular jt may be hypomobile.
- ❑ TIB POST/ANT, long toe FLEX and intrinsic mm of foot lengthened and possibly weak.
- ❑ Other: plantar fasciitis, shin splints, and ITB contracture, may be present.
- ❑ Occupational/recreational factors may perpetuate/worsen pes planus

OBSERVATIONS:

GAIT ASSESSMENT: in normal gait, pronation occurs 15-20% into contact phase. With pes planus, pronation occurs throughout stance phase

POSTURAL ASSESSMENT: Mild pes planus has 4-6 degrees of hindfoot valgus when measured in a standing POST view. MOD pes planus has 6-10 degrees of hindfoot valgus. Severe has 10-15 degrees of hindfoot valgus

Achilles has a valgus orientation

INT TIB torsion is possible

Valgus may occur at the knees

INT ROT may occur at hip

MED arch is flattened and foot pronated

Talar head bulges MED. redness/callus formation where shoe rubs against talar head.

POSTURAL ASSESSMENT CONT:

Valgus orientation of the 1st metatarsal jt may be present





