FLATFOOT

Definition
Flat foot is defined as a condition in which there is a loss of medial longitudinal arch on weight bearing. It can be quantified by means of footprints.

23% in normal population (Harris and Beath) have flatfoot.

Flat foot can be associated:
- Hind foot valgus
- Achilles contracture
- Genu Valgum
- Greater prevalence of flatfeet in shod than in unshod kids in india

Types
I. Flexible or Hypermobile flatfoot with normal Achilles
   65% of Flatfoot and 15% all population
   No clinical concern
   Benign and normal variation
   Look for: Hyperlaxity [Marfans, Downs]
            Accessory navicular

II. Flexible flat foot with tight Achilles
    25% of flatfoot and 7% of normal population
    Associated contracture of achilles and may be symptomatic.
    Normal excursion of subtalar joint

III. Rigid flat foot
     10% of flatfoot [3%]
     Causes: Subtalar arthritis
             Tarsal coalition
             Subtalar infection
             Old fracture
             Vertical talus

IV Neuromuscular
- Cerebral Palsy
- Spina bifida

V Adult onset flatfoot
- Tibialis posterior dysfunction

Assessment
1. Family history
2. Look for abnormal callosity
3. Look for ligament laxity
4. Check the shoe for wear pattern
5. Foot print
6. Hindfoot movement
7. Look for tendo achilles contracture
   The talonavicular joint is locked in inversion
   Dorsiflexion of the foot with knee in extension and flexion.

8. Jack test: Patient weight bearing. On dorsiflexing the great toe, the arch of the foot exaggerates
   in a flexible flatfoot.

9. On standing tip toe: In flexible flatfoot, arch appears indicating that the hindfoot is flexible. If
   there is no change in the heel on standing tip toe, the flatfoot is rigid

10. Test for Tibialis posterior dysfunctional syndrome

11. Neurological assessment

**X RAY**
Weight-bearing radiographs
1. Lateral view: Look for a sag at talonavicular or Navicu
2. Talo-Calcaneal angle
   AP: Talo-Calcaneal angle: 15 to 35º; >35º valgus heel
   Lat: Talo-Calcaneal angle: 25-50º

3. Talo-Metatarsal angle:[Meary]
   0° is normal
   In Cavus foot
   0° to 15° is a mild deformity
   15° to 30° is moderate
   >30° is severe.

In Planovalgus feet, this angle is negative
Illustrations of usefully measured angles. A: AP views
demonstrating TC = talocalcaneal and T-1stMT = talo-first
metatarsal angles. B: Lateral views demonstrating A =
tibiotalar; B = talo-first metatarsal; C = talohorizontal; D =
talocalcaneal; and E = tibiocalcaneal angles
Treatment

1. In most an arch will develop by 5 years. In children, reassure the parents and explain the benign nature.
2. Exercise, shoe inserts and modification are ineffective
3. In symptomatic patient [pain] or severe shoe wear consider orthotic support.
   - Medial arch support and heel cup
3. When heel cord tightness is present
   - Suggested stretching exercises
   - Rarely heel cord lengthening or lengthening of lateral column.
4. Rare bony surgeries for flat foot
   - Calcaneal osteotomy
   - Miller fusion: Navicular – I Cuneiform – I metatarsal
   - Lateral column lengthening

THE LATERAL COLUMN LENGTHENING

A bone graft from the tibia is inserted into the anterior process of the calcaneum.

This procedure preserves the calcaneo-cuboid joint and pushes the navicular bone medially.

The osteotomy is between the anterior and middle facet of the calcaneum

MEDIAL DISPLACEMENT CALCANEAL OSTEOTOMY

Make a lateral oblique incision.

Retract the peronie tendons superiorly

Osteotomise the calcaneus perpendicular to the body between the posterior facet and the tuberosity.

Open the osteotomy site with a lamina spreader

Now displace the medial calcaneal tuberosity medial

6.5 cannulated screw
CONCLUSIONS

1. No long term prospective study regarding natural history.
2. Prognosis is good
3. Longitudinal arch in the child’s foot develops spontaneously during the first 5 years
4. When Achilles contracture: need stretching and sometimes teno achilles lengthening
5. Arch supports has not shown to improve the height of the arch
6. Severe: Soft tissue procedures or combine osteotomies and arthrodesis to restore the arch
8. CT: Rule out any coalition

SKEW FOOT

Rare; Genetic
Hindfoot deformity of flatfoot and forefoot adductus
Etio: Idiopathic/iatrogenic

**X ray:** Skewfoot: An AP radiograph reveals the significant varus deformity of the forefoot creating a negatively valued talo-first metatarsal angle. Delayed ossification of the navicular prevents radiographic documentation of the lateral talonavicular subluxation. The hindfoot valgus is portrayed by the increased talocalcaneal angle

**Treatment**
Symptomatic
Evans Calcaneal lengthening osteotomy
And Medial cuneiform opening wedge osteotomy and lengthening of Achilles

CONGENITAL VERTICAL TALUS

Talus is in plantar flexion with dorsal dislocation of the navicular on the talar head and neck. Vertical position of the talus is seen in X rays in both dorsiflexion as well as in plantarflexion. In severe form may be associated with Calcaneo-cuboid joint involvement.

**Etiology**

1. Defects of CNS: Myelomeningocele
   Diastematomyelia
   Sacral agenesis
   Arthrogryposis
   Cerebral palsy, Polio
2. Iatrogenic: Overcorrection of a clubfoot
3. Idiopathic
4. Genetic: Patau syndrome trisomies of 13-15, 
   Edwards syndrome
   Whistling face and prune belly syndrome

**Pathology**

Bones
   Talus and calcaneus plantarflexed
   Navicular dorsiflexed

Ligaments
   Stretched ligament: Spring ligament, Talo-calcaneo-navicular ligament
   Anterior fibers of Deltoid
   Contracted ligament: Lateral portions of dorsal talonavicular, Interosseous talo-
   calcaneal ligament

Muscles
   Contracted: Achilles, Tibialis Anterior, EHL, Peroneus longus and brevis
   Lengthened: Tibialis Posterior, FHL, FDL

Retinaculum
   Dorsal retinaculum thickens
   Peroneal retinaculum is lax and allows subluxation of the tendon

**Assessment**

1. Persian slipper foot appearance
2. Peg like gait (walks on the talar head)
3. Deformities in rocker bottom foot
   a) Hindfoot : Equinovalgus
   b) Midfoot valgus
   c) Dorsal dislocation of Talo-navicular joint
   d) Forefoot abduction
4. Neurological assessment
5. Hip and spine assessment
X ray

Lateral foot in Dorsiflexion and plantar flexion
Vertical Vs oblique Talus

Calcaneal pitch angle is low

Vertical Talus: An AP radiograph demonstrates an increased talocalcaneal angle due to the equinovalgus angulation of the os calcis. The lateral view depicts the significant hindfoot equinus and vertical position of the talus. Thus, the talohorizontal and tibiotalar angles approach 90° and 180°, respectively. The maximum-dorsiflexion view reveals the rigidly fixed hindfoot equinus.

Oblique talus: Comparison of the maximum-dorsiflexion and plantar flexion views demonstrate the reduction of the midfoot on the hindfoot in plantar flexion which establishes the diagnosis of oblique talus.

MRI is useful as it can outline the cartilaginous analogue of the bones.

MRI of spine when spinal pathology is suspected

Treatment

1. Patient with neurological problem have less favourable functional outcomes and may require talectomy if recurrence of deformity following soft tissue release

2. In majority the procedure is performed between 6-12 months
Principle of surgical treatment
Cincinnati incision
The heel cord is lengthened and Posterior tibial Neurovascular bundle is identified
FHL, FDL and Tibialis Posterior is divided
Posterior capsulotomies
Lateral subtalar capsulotomy and divide contracted Calcaneo-fibular ligament
Capsulotomy of Calcaneo-Cuboid joint
Z lengthening Peronie, EHL and Tibialis anterior
Shorten: FHL, FDL, Tibialis posterior
  3 wires: Talo-Calcaneal; Calcaneo-Cuboid; Talo-Navicular

Differential diagnosis

Metatarsus Adductus: An AP radiograph demonstrates varus deformity of the forefoot relative to
the hindfoot as represented by the negative value of the talo-first metatarsal angle. The
talocalcaneal angle is normal.

Skewfoot: An AP radiograph reveals the significant varus deformity of the forefoot creating a
negatively valued talo-first metatarsal angle. Delayed ossification of the navicular prevents
radiographic documentation of the lateral talonavicular subluxation. The hindfoot valgus is
portrayed by the increased talocalcaneal angle (the upper limits of normal as shown).

Clubfoot: A: On the AP radiograph, the "parallelism" of the talus and calcaneus and negatively
valued talus-first metatarsal angle demonstrate the varus deformities of both the hindfoot and
forefoot, respectively. The lateral view reveals the decreased talocalcaneal angle characteristic of
the hindfoot equinovarus deformity. Moderate stacking of the metatarsals depicts the forefoot
supination.

Tarsal coalition: The 45° internal oblique view may prove useful for diagnosis of calcaneonavicular
coalitions. The lateral view may demonstrate the "anteater nose sign" typically characteristic of
calcaneonavicular coalitions. Note the tubular elongation of the anterior aspect of the calcaneus
towards the mid-navicular region.

Conclusion

Radiographs are a critical tool in evaluation of pediatric foot abnormalities. The resulting angular
measurements can define the boundaries of normal and assist in the diagnosis as well as quantify
the degree of deformity. However, accurate and reproducible radiographic studies are essential for
effective use of these lines and angles. Small flaws in radiographic techniques may significantly alter
these measurements.

Ultimately, diagnosis of congenital foot deformities is accomplished clinically. Radiographic studies
are an effective adjunct used to exclude unexpected deformities or to document the evolution of
deformities. Thus, clinical management should not be determined solely on these radiographic
measurements. Values beyond normal ranges do not imply presence of a pathologic condition or a
need for treatment.