Adolescent flatfoot
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I. FLATFOOT
A. No universally accepted clinical or radiographic definitions of the average height, or the normal range of heights, of the longitudinal arch

B. Flexible flatfoot (FFF) is the "normal contour of a strong and stable foot…of little consequence as a cause of disability" - Harris and Beath: *JBJS* 30A:116, 1948

C. Flatfoot is present in 23% of adults - Harris and Beath: *Army Foot Survey*, 1947
   1. FFF - 64% of total - rarely causes pain or disability
   2. FFF with short tendo-Achilles (FFF-STA) - 27% of total - often causes disability
   3. rigid flatfoot (peroneal spastic flatfoot) - 9% of total - causes disability 20-24% of the time – Leonard: *JBJS* 56B:520, 1974

D. Most babies are flatfooed
   1. the average arch height is lower in the child than in the adult
   2. the height of the longitudinal arch increases spontaneously during the first decade of life in most children
   3. there is a wide range of normal arch heights at all ages
   4. "corrective shoes" and orthotics do not alter the natural history of spontaneous development of the arch

E. Flatfoot is determined by the shapes of the bones and the laxity of the ligaments, not the muscles

II. TREATMENT

A. ASYMPTOMATIC FLEXIBLE FLATFOOT
   1. Education
B. SYMPTOMATIC FLEXIBLE FLATFOOT
1. Confirm the diagnosis
2. Orthoses (FO, UCBL) will frequently relieve symptoms and extend the useful life of shoes

C. SYMPTOMATIC FLEXIBLE FLATFOOT w SHORT TENDO-ACHILLES
1. Heelcord stretching by exercise or serial casting
2. There is little role for orthoses – may increase symptoms
3. Many operative procedures have been proposed during the past century with undefined indications, often good short-term results, and poor long-term results.
   a. Soft tissue plications/procedures
      ▪ fail
   b. Tendon transfers
      ▪ fail
   c. Bone excisions
      ▪ destructive
   d. Arthrodesis of 1, 2, or all 3 joints of the subtalar complex
      ▪ loss of shock absorber of foot
      ▪ DJD at adjacent joints
   e. Arthroereisis of the subtalar joint with bone block
      ▪ fail
   f. Arthroereisis of the subtalar joint with synthetic implant
      ▪ foreign body reaction
      ▪ infection
      ▪ pain
      ▪ incomplete deformity correction when severe
      ▪ damage to articular cartilage of subtalar joint
   g. Limited medial midtarsal fusions (Hoke, Miller, Durham, Giannestrus, others)
      ▪ WRONG JOINT!
      ▪ incomplete deformity correction when severe
      ▪ recurrence of pain and deformity
      ▪ DJD at adjacent joints
   h. Posterior calcaneal wedge osteotomy (Dwyer)
      ▪ does not correct external rotational or translational deformity
   i. Posterior calcaneal displacement osteotomy (Koutsogiannis)
      ▪ “Chiari osteotomy” of the acetabulum pedis
      ▪ compensatory osteotomy to “correct” hindfoot valgus
      ▪ does not correct external rotation deformity in the subtalar complex
      ▪ does not correct malalignment at talonavicular joint
      ▪ non-arthrodesing
   j. Calcaneal lengthening osteotomy (Evans/Mosca)
      ▪ “Salter osteotomy” of the acetabulum pedis
      ▪ corrects all components of even severe valgus deformity of the hindfoot at the site of deformity
      ▪ restores function of the subtalar complex
      ▪ relieves symptoms
• theoretically, protects the ankle and midtarsal joints from early DJD by avoiding arthrodesis
• best intermediate-long term results of any procedure used to correct flatfoot – Phillips: JBJS 65B:15, 1983

4. Arthrodesis of any joint in the foot of a child leads to early degenerative changes at adjacent joints

5. THE FOOT IS NOT A JOINT!
   A flatfoot has 2 deformities in opposite directions – as if the foot was wrung out. And a symptomatic flatfoot has a 3rd deformity – equinus. Each needs to be addressed individually.
   a. Valgus deformity (eversion, pronation) of the hindfoot
   b. Supination deformity of the forefoot in relation to the hindfoot
   c. Equinus deformity of the ankle due to contracture of the Achilles tendon, or the gastrocnemius

6. INDICATION FOR SURGERY: when prolonged attempts at non-operative treatment have failed to relieve the pain and the excessive callus under the head of the plantar flexed talus.

III. CALCANEAL LENGTHENING OSTEOTOMY

A. ADVANTAGES
   1. corrects all components of even severe valgus deformity of the hindfoot at the site of deformity
   2. relieves symptoms
   3. restores function of the subtalar complex
   4. avoids arthrodesis
   5. preserves calcaneal growth

B. INDICATIONS
   1. extreme valgus deformity of the hindfoot with plantar flexion of the talus with
   2. failure of prolonged non-operative treatment to relieve: pain, callus, or ulceration under the head of the talus
   3. age range not known

C. CONTRAINDICATIONS
   1. incompetent plantar fascia
   2. subfibular impingement secondary to lateral translation of the calcaneus – usually seen in overcorrected clubfoot
D. TECHNIQUE (references)


1. Mosca’s modifications from Evans
   a. strict indications for surgery
   b. skin incision
   c. location and direction of the osteotomy
   d. shape of the graft
   e. management of the soft tissues, laterally and medially
   f. use of internal fixation to stabilize calcaneocuboid joint
   g. importance of Achilles or gastrocnemius contracture and need for lengthening
   h. management of the forefoot supination deformity

2. patient is supine with folded towel under ipsilateral buttock

3. modified Ollier incision in Langer skin line

4. protect superficial peroneal and sural nerves

5. elevate soft tissues in sinus tarsi

6. release peroneal tendon sheaths

7. z-lengthen peroneus brevis, NOT peroneus longus

8. divide aponeurosis of abductor digiti minimi

9. avoid injury to capsule of calcaneocuboid jt.

10. place curved Joker elevator/retractors in interval between anterior and middle facets of subtalar jt.

11. oblique osteotomy of calcaneus using osteotome or sagittal saw
   a. from proximal-lateral to distal-medial
   b. start approx 2 cm prox to calcaneocuboid joint (at lowest point of calcaneus proximal to beak)
   c. exit between anterior and middle facets – complete through the medial cortex

12. cut plantar periosteum and long plantar ligament if necessary – NOT plantar fascia

13. Steinmann pins as joy sticks
   a. insert lateral to medial both proximal and distal to the osteotomy

14. retrograde longitudinal Steinmann pin across calcaneocuboid jt. **before osteotomy is distracted/graft inserted** – stop at osteotomy

15. trapezoid-shaped graft
   a. lengthening distraction-wedge osteotomy
b. use the largest graft that will fit, determined by distracting the osteotomy with a laminar spreader
c. usually 10-14 mm laterally and 4 mm medially
d. tricortical or bicortical iliac crest graft
e. allograft or autograft

16. distract osteotomy with Steinmann pin joy sticks
   a. distal pin moves distal/plantar and supinates pes acetabulum and forefoot

17. impact graft with bone tamp

18. advance longitudinal Steinmann pin retrograde through graft and into proximal calcaneal fragment

19. bend pin at dorsal insertion site and cut long for retrieval in clinic

20. repair lengthened peroneus brevis

21. plicate talonavicular jt. capsule and tibialis posterior tendon through medial longitudinal incision

22. lengthen Achilles tendon through posteromedial ankle incision or gastrocnemius through postero-medial mid-calf incision - based on Silverskiold test

23. correct forefoot supination deformity, if present, after hindfoot is corrected
   a. flexible, mild deformity may correct spontaneously due to effective shortening of peroneus longus created by lateral column lengthening
   b. osteotomy of medial cuneiform for rigid deformity
      - plantar-based closing wedge if forefoot is also slightly abducted or neutral – fix with plantar-to-dorsal staple
      - dorsal opening wedge if forefoot is also adducted
      - osteotomy starts half way between the proximal and distal ends of the medial cuneiform and exits at level of middle cuneiform-2nd MT joint

24. postoperative management
   a. non-weightbearing in short leg cast for 8 wks.
   b. cast change with pin removal at 6 wks.
   c. simulated standing AP and lateral radiographs at 6 and 8 weeks
   d. over-the-counter arch support indefinitely

**NOTES:**
REFERENCES:


Williams & Wilkins, 2010:1608-1618.