



Crossover Toe/Lateral Collateral Ligament Reconstruction (Outline)

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Outline (Congress of the Polish Foot & Ankle Society (PFAS), Jastarnia 2-4 October 2008, Poland)

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1. INCIDENCE:

a. Multiplanar second metatarsophalangeal joint instability

- i. Traumatic incident
- ii. Forced hyperdorsiflexion force with axial load
- iii. Extrinsic pressure creating attenuation
- iv. Hallux valgus deformity
- v. High-heeled shoes
- vi. Chronic inflammatory conditions
- vii. Rheumatoid arthritis
- viii. Seronegative spondyloarthropathies

2. ANATOMIC CONSIDERATIONS

a. Length of metatarsals: Three patterns

- i. Index minus type:
 1. First metatarsal noticeably shorter than second MT
 2. $1 < 2 > 3 > 4 > 5$

3. IATROGENIC CONSIDERATIONS

a. Excessive shortening 1st metatarsal

- i. Lapidus procedure or proximal metatarsal osteotomies

4. PATHOGENESIS

a. Stability of the MTP compromised through

- i. Laxity of volar plate
- ii. Rupture of lateral collateral ligament
- iii. Dorsal subluxation, dislocation of MTP joints

5. DIAGNOSIS

a. Obvious malalignment of digit

b. Positive drawer sign (Thompson, Orthop, 1987)

i. Digital Lachman test

1. Stage 0 = no laxity
2. Stage 1 = subluxation
3. Stage 2 = dislocatable but reducible
4. Stage 3 = fixed dislocation

c. Pain at both volar plate and lateral collateral ligaments

6. ALTERNATIVE DIAGNOSES

a. 2nd webspace Morton's neuroma

b. 2nd metatarsalgia

c. May be secondary phenomenon

d. 2nd metatarsal stress fracture

e. Freiberg's infraction

7. CLINICAL STAGING

a. Stage 1: synovitis and mild medial deviation

b. Stage 2: dorsomedial medial deviation (subluxation) at MTP

c. Stage 3: overlapping of the hallux

d. Stage 4: complete dislocation of the 2nd MTP

8. RADIOGRAPHS

a. Second metatarsophalangeal joint

- i. Normal clear space 2mm to 3mm

b. Second metatarsophalangeal joint angle

- i. Normal lateral deviation 12 degrees

c. Hallux valgus angle

d. Length of 2nd metatarsal in relation to 1st metatarsal

- i. Normal within 2mm of adjacent metatarsals
- ii. $> 4\text{mm}$ is a long metatarsal

9. CONSERVATIVE MEASURES

a. Toe Taping

- i. Loop around 2nd toe to stabilize volar plate
- ii. May tape 2nd to 3rd toe as well for lateral collateral ligament symptoms

b. Taping does not correct deformity (Coughlin, FAI, 1993)

- i. 27% success rate

c. Activity Modification

- i. Stiff-soled shoe
- ii. Prevent dorsiflexion stress at 2nd MTP

d. Steroid injections controversial

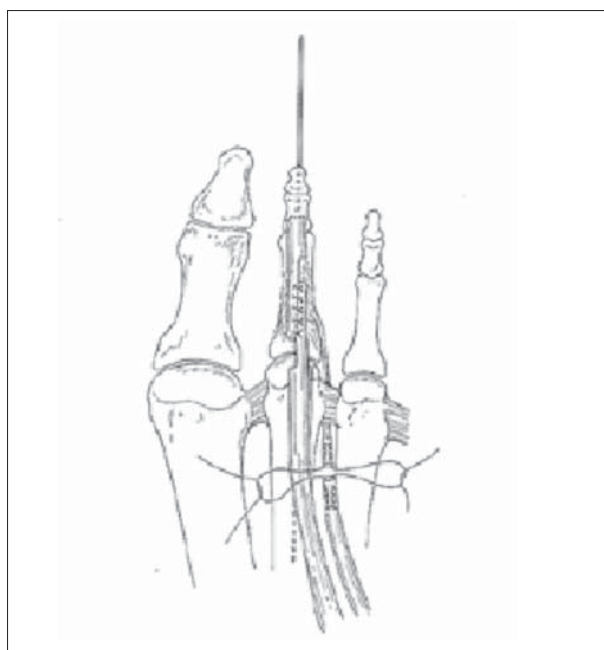
- i. May accelerate deformity from microvascular attenuation
- ii. Trepman (FAI, 1995)
 1. 60% asymptomatic, 33% improved

10. SURGICAL OPTIONS

a. Capsular release

1. Medial and dorsal
2. Plantar extension to release 1st lumbrical
3. Curved elevator to release adhesions of plantar capsule
- ii. Repair redundancy/rupture of the lateral collateral ligament
- iii. Why this isn't enough....
 1. Deland (FAI, 2000)
 - Cadaveric dissection
 - Imbalance of muscle forces about a weakened plantar plate
 - Not addressed through ligament repair
 - Medial pull of flexor tendons persists despite ligament repair

b. Flexor-To-Extensor Tendon Transfer



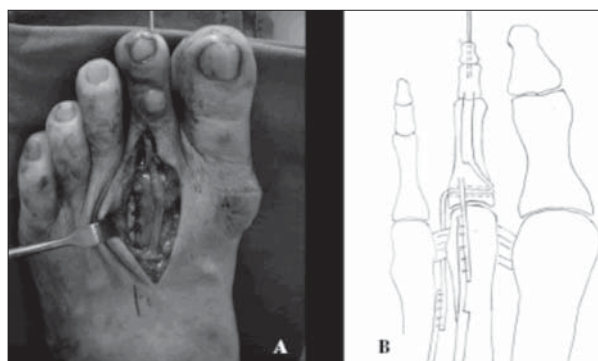
- i. 1cm transverse incision, proximal crease
- ii. Open flexor pulley
- iii. Separate FDL from FDB limbs
- iv. Tenotomy FDL at distal phalangeal insertion
- v. Pass tendon on either side of phalanx
- vi. Suture to extensor expansion with ankle in neutral

vii. Results:

1. Thompson and Deland (FAI, 1993)
 - 62% asymptomatic
 - 54% with joint reduction
 - Most common complaint: Stiffness
 - Pain correlated with stiffness (residual pain in patients with 15° dorsiflexion)
2. Coughlin (FAI, 1987)
 - Recommends asymmetric tensioning lateral arm of FDL
 - Rotary (pronation) of the toe may develop
3. Cracchiolo (1997)
 - Compared transfer to extensor expansion with drill hole proximal phalanx
 - 94% satisfied
 - Drill hole more stable
4. Necrosis of digit
 - Tendon transfer constricts vessels
 - Significant dorsal procedures done simultaneously

c. Extensor Digitorum Brevis Tendon Transfer

- i. Dynamic tendon transfer
 1. Harvest extensor brevis 4cm proximal to MTP joint
 2. Free it up distally to insertion
 3. Weave it from distal to proximal deep to transverse metatarsal ligament
 4. Perform end-to-end anastomosis
- ii. Results
 1. Haddad, Myerson (FAI, October, 1999, Number 12)
 - 71% asymptomatic (26% mild pain)
 - comparison with FDL transfer
 - i. EDB pain level = 1.4
 - ii. FDL pain level = 1.8
 - iii. 86% without recurrence of deformity
 - iv. Motion improved with EDB transfer
 - v. EDB ROM 78° vs. FDL ROM 62°



- Appropriate for Stage 1, Stage 2, and early Stage 3 deformity
- iii. Potential problems have lead others to consider modifications
1. Addressing difficulty in getting tendon transfer to anastomose upon itself
 2. Addressing potential supination of the 2nd toe
 3. Technique (Tun Hing Lui, Kwok Bill Chan, FAI April 2007, Number 4)
 - Extensor digitorum longus (EDL) is identified and split as a standard (long) Z-lengthening
 - Extensor digitorum brevis (EDB) is tenotomized far proximal to transverse metatarsal ligament
 - 2.5mm drill bit used to create tunnel in base of proximal phalanx
 - i. Placed just inferior to longitudinal axis of proximal phalanx
 - ii. Superior placement = supination force
 - iii. Plantar placement = hyperextension force at 2nd MTP joint
- Distal stump of EDL passed from medial-to-lateral through drill hole
 - i. Tendon routed through proximal phalanx
 - EDL is routed plantar to transverse metatarsal ligament
 - i. Provides more tendon to work with
 - 2nd toe is reduced and pinned across the MTP joint
 - EDL is then transferred to EDB in a side-to-side anastomosis
 - i. Stronger repair than end-to-end described by Haddad and Myerson
 - The proximal EDL tendon is then transferred to the EDB distal stump, maintaining extension at the MTP joint.
 - Tun Hing Lui, Kwok Bill Chan, FAI April 2007, Number 4
- iv. Toe Strapping is critical to the success of all procedures
1. Minimum 6 weeks after pin is pulled (normally 2 to 3 months)