Treatment Alternatives for Hallux Rigidus

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Conflict of Interest

I have the following potential COI:
• Consulting/Royalty payments directly related to products discussed – Orthohelix/Tornier and Acumed

What is Normal?

• Hallux MTP function
  – Cam-shaped condylar hinged joint
  – Alignment: 5° varus to 15° valgus
  – ROM:
    • 40°-100° Dorsiflexion
    • 3°-43° Plantar Flexion

Pathogenesis

- **Traumatic**
  - Intra-articular fracture, crush/direct jamming injury
- **Inflammatory**
  - Gout

Pathogenesis

- **Idiopathic:** predisposing factors may cause
  - increased joint stress with swelling, synovitis, degeneration
  - Metatarsus elevatus: > 5 mm may predict hallux rigidus (Boualcha et al 2010)
  - Osteochondral Defect
  - Long 1st ray
  - Pes planus
  - ? Significant hallux valgus interphalangeus

Clinical Presentation

**Physical Examination**

- Spectrum of painful, stiff MTP ROM
  - Dorsiflexion impingement with pain and stiffness
  - Plantarflexion also painful
  - Pain with axial grind
- Shoewear difficult because of dorsal osteophytes
  - Dorsal skin irritation 2/2 spur
Clinical Presentation

**Physical Examination**

- Difficulty with push off during gait
- Stress transfer with 1st ray unloading
  - Avoidance gait

**Radiographic Features**

- **Early**
  - X-rays may be normal initially
  - Only soft-tissue swelling and dorsal osteophytes seen on oblique view only
  - Sharpening of lateral phalanx base
- **Moderate disease**
  - Squaring of Met head
  - Dorsal osteophytes
  - Narrowed dorsal joint space
    (Symmetric or asymmetric)
- **Advanced disease**
  - Minimal joint space
  - Osteophytes at dorsal base of proximal phalanx
  - Joint narrowing
  - Subchondral cysts
  - Dorsal metatarsal osteophytes
Grading System
Coughlin & Shurnas

• Grade 0
  - 40°-60° dorsiflexion or 10%-20% less than opposite side
  - Normal x-rays
  - No pain, only stiffness

• Grade 1
  - 30°-40° dorsiflexion or 20%-50% less ROM than opposite side
  - Dorsal osteophytes
  - Minimal narrowing, peri-articular sclerosis or head flattening
  - Mild or occasional pain and stiffness at extremes of ROM

• Grade 2
  - 10°-30° dorsiflexion or 50%-70% less than opposite side
  - Dorsal, lateral ± medial osteophytes
  - <25% dorsal joint space involved
  - Mild to moderate joint space narrowing
  - Moderate to severe pain near extremes of motion

• Grade 3
  - <10° dorsiflexion or 75%-100% loss of dorsiflexion
  - Substantial joint space narrowing
  - Peri-articular cysts
  - >25% of joint involved
  - Constant pain and substantial stiffness at extremes but not midrange of motion

• Grade 4
  - Same criteria as grade 3, but pain in midrange of motion
Non-Operative Treatment

• Avoidance of offending activities
• NSAIDs
• Shoe modification
  – Rocker sole shoe
  – Steel shank shoe
  – Spring steel/ Carbon graphite plate insole
  – Metatarsal bar
• End-stage joint, before fusion, cortisone injections may buy time

Operative Treatment

Cheilectomy

• Remove 1/3 to 1/2 of dorsal portion of joint
• Plantar and distal cartilage may be intact
• Should have 60°-90° dorsiflexion in OR
• Final ROM will be typically 50% of intra-op
• >90% good to excellent results in grade 1 or 2

Results (Coughlin & Shurnas 2003)

– 9.6 year follow-up, 93 feet (80 patients)
– 96% good-to-excellent results
– Outcomes correlated with stage
– Approximately 20° average improvement in ROM
– Cheilectomy does not alter natural progression of disease
Operative Treatment

Cheilectomy

• Results (Smith et al 2012)
  – 17 patients – stage 1 or 2
  – Significant increases in MTP ROM
  – Objective improvement in gait – improved ankle push-off

Operative Treatment

Moberg Procedure

• Young patient with limited MTP dorsiflexion (especially avid runners)
• Dorsal closing wedge at base of proximal phalanx (Moberg 1979)
• Cheilectomy for those lacking dorsiflexion
• Must have adequate MTP plantarflexion
• Can add Akin (“Mo-Akin/Akinberg”) if HV interphalangeus present

Operative Treatment

Moberg Procedure

• Results (Easley et al 1999)
  – 57 patients (75 feet), minimum 3-year follow-up
  – AOFAS score improved from 45 to 85 points (90%-96% satisfaction)
  – Dorsiflexion improved ~20°
  – Progression of grade in >50% with time
Operative Treatment

Keller Procedure

- Remove proximal aspect (base) of proximal phalanx
- Indicated for household ambulators
- Disadvantages
  - Cock-up deformity
  - Transfer metatarsalgia with stress fractures to lesser metatarsals
  - Dislocation of 2nd MTP joint

Operative Treatment

Keller Procedure

- **Results** (Coutts et al 2012)
  - 104 patients (131 feet)
  - 95% reported symptom improvement
  - 20% disappointed with cosmetic appearance
  - 9.5% transfer metatarsalgia
- **Results** (Schneider et al 2012)
  - 87 patients, 23-year follow-up
  - 94% would have operation again
  - 5% required revision

Operative Treatment

Other Osteotomy Options

- **Valenti Procedure**
  - Preserves plantar plate
- **Watermann Osteotomy**
  - Rotates functional cartilage dorsal
- **Green-Watermann**
  - Modified chevron + dorsal cheilectomy
Operative Treatment

Resurfacing- Allograft ECM Scaffold

- Dermal acellular matrix as spacer/cover over MT head

- Berlet et al 2008
  - 9 consecutive pts with Coughlin grade 3
  - Avg 12.7 mo f/u = AOFAS 87.9 (63.9 pre-op) and pain subscore 34.4 (17.8 pre-op)

Operative Treatment

Anchovy Interposition Arthroplasty

- Goal
  - Pain relief
  - Minimize loss of plantarflexion strength
  - Maintain/restore motion
  - Preserve stability

- Indications
  - Failed cheilectomy
  - Athletes = preserve motion
  - Women = demand ability for high heel wear

- Contra-indications
  - Joint malalignment
  - Hallux valgus/varus
  - ? Metatarsus elevatus

Operative Treatment

Anchovy Interposition Arthroplasty

- Types described
  - Plantaris
  - Gracilis (autograft)
  - Semitendinosus (allograft)

- Medial or dorsal approach

- Debridement/joint decompression
  - Release collaterals, sesamoid adhesions
  - Conical reaming

- Create some distraction but maintain 40-60 degrees of motion

- Anchovy secured with anchor

- Close capsule over graft
Operative Treatment
Anchovy Interposition Arthroplasty

- **Results** (Coughlin 2003)
  - Gracilis (autograft) anchovy interposition
  - 7 feet with f/u
    - Pt satisfaction (3 excellent, 4 good)
    - All able to walk in comfortable shoes w/o impingement
    - Avg 5 mm shortening w/ mild metatarsalgia and transfer lesions
    - Avg recovery = 3 months

Operative Treatment
Prosthetic Joint Arthroplasty

- **Total vs Hemiarthroplasty**
- **Contraindications:**
  - Moderate-severe hallux valgus/varus
  - ? metatarsus elevatus
- Avoid in very active people (e.g., athletes)
  - Early loosening/failure

Operative Treatment
Prosthetic Joint Arthroplasty

- **Results** (Rahman et al 1993)
  - 71% of silicone 1st MTP hemi-implants have evidence of silicone granulomatous disease
- **Results** (Townley and Taranow 1994)
  - >90% good or excellent results with hemi
- **Results** (Ghalambor et al 2002)
  - Metallic wear debris and osteolysis can occur with titanium hemi-implants
- **Results** (Erdil et al 2013)
  - Hemiarthroplasty results comparable to total arthroplasty at short-term follow-up
Operative Treatment
Prosthetic Joint Arthroplasty

- Results (Fuhrmann et al 2003)
  - Overall results of MPJ replacement disappointing at 3-year follow-up
- Results (Dawson-Bowling et al 2012)
  - Reoperation rate of 25% at 8 years with MOJE ceramic TJA; 52% showed loosening
- Results (Morgan et al 2012)
  - 83 patients (108 feet) with total silastic implants, 6.5-year follow-up; prosthesis removal in 3 feet (3%); osteolysis (23%) not correlated with function

Operative Treatment
First MTP Arthrodesis

- Shown to be effective long-term solution – 95% good/excellent results
- Considered “gold standard” for severe DJD
- Remove spurs and diseased cartilage
- Fuse joint together – no motion remains
- Reduces pain and size of the joint

Operative Treatment
First MTP Arthrodesis

- Many methods of cutting and fixing
- 15 dorsiflexion (to ground)
  - True radiographic dorsiflexion varies based upon foot morphology (cavus vs pes planus)
- 5°-10° valgus
  - Must avoid overcrowding of 2nd digit
- Partially determined by shoewear desires
- Bone graft usually unnecessary
- Adequate IP flexion required for success
Some limitation in activities: can’t tolerate squatting, high heels
Changes in gait pattern: decreased step length, earlier heel-off
Possible nonunion, DJD of neighboring joint

Complications of 1st MTP Fusion
Too dorsiflexed  Too plantarflexed

Arthrodesis of 1st MTP Joint
Operative Treatment
First MTP Arthrodesis

- Results (Coughlin and Abdo 1994)
  - 6.7-year follow-up, 34 feet (30 patients)
  - 94% fusion rate
  - 100% good to excellent results
- Results (van Doeselaar et al 2010)
  - 62 patients (27 with hallux rigidus)
  - 95% fusion rate
  - 82% would have procedure again

Treatment of Hallux Rigidus

Conclusions

- Second most common condition affecting Hallux MP joint
- Variety of surgical options available depending on degree of pathology
- Ultimate treatment based upon patient factors (age, activity level, shoewear desires, etc) and understanding of risk of recurrence/durability of treatment