Hallux Limitus/Arthrodesis of the First Metatarsalphalangeal Joint

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The Pathologic First MTPJ

- Rheumatoid
- Gout
- Psoriatic
- Systemic Lupus Erythematosus
- Antiphospholipid Antibody
- Seropositive, Seronegative Arthropathy
- Sickle Cell Disease
- Osteoporosis
- Vasculitis
Arthropathy: Seropositive, Seronegative: Dislocations/Subluxations

Mader R, et al. University of Toronto, Toronto Ontario, Canada

Optimizing treatment with biologics

Diagnostic Pitfalls

Pillinger MH, Rosenthal P, Abeles AM

Hyperuricemia and gout: new insights into pathogenesis and treatment
Hypertrophic Synovium

- Inflamed synovium
  - Soft tissue instability
  - Cartilage destruction

- Treatment
  - Synovectomy
    - Reduces inflammation, pain and joint destruction

- Useful when the joint is symptomatic and relatively pristine.

Structural Deformities

- Digital Contractures
- Anterior Displacement of the Fat Pads
- Retrograde Buckling
- Metatarsal Head Prominence
- Metatarsophalangeal Dislocation
- Hindfoot Dislocation
- Pes Cavus
- Pes Planus
- Hallux Abducto Valgus
- Exostosis
## Prevalence of Surgical Intervention in Rheumatoid Arthritis

- Out of 1064 patients 181 (17%) required surgical intervention within 5yr.
- 264 procedures were performed on these 181 patients.

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Number of patients</th>
<th>% of patients</th>
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</thead>
<tbody>
<tr>
<td>Major joint Replacement</td>
<td>95</td>
<td>36%</td>
</tr>
<tr>
<td>Hip, Knee, other</td>
<td>53, 32, 10</td>
<td>56%, 34%, 10%</td>
</tr>
<tr>
<td>Intermediate Joint Surgery</td>
<td>71</td>
<td>27%</td>
</tr>
<tr>
<td>Wrist/hand, femoral neck, synovectomy of elbow/knee, ankle/STJ/foot</td>
<td>40, 6, 4</td>
<td>56%, 8%, 6%</td>
</tr>
<tr>
<td>Tendon and Minor surgery</td>
<td>98</td>
<td>37%</td>
</tr>
<tr>
<td>Hand/wrist, carpal tunnel, other</td>
<td>31, 21, 20</td>
<td>31%, 21%, 20%</td>
</tr>
<tr>
<td>Total procedures</td>
<td>264</td>
<td>100%</td>
</tr>
</tbody>
</table>

James, D et al. Rheumatology, 43:369-367, 2004

## Time From Baseline Visit to Surgical Intervention

- Median time from baseline visit to surgical intervention was 36.5 months.
- 41 months for intermediate joints (hand and foot)

James, D et al. Rheumatology, 43:369-367, 2004
**Surgery Correction for the First MTPJ**

- Arthroplasty: Total vs Partial
- Interpositional Arthroplasty
- Implant Arthroplasty: Total vs Partial
- Arthrodesis
- Arthrodiastasis

**Indications for First MTPJ Arthrodesis**

- Hallux limitus/rigidus
- Hallux valgus deformity
  - Failed, Severe, Geriatric
- Arthritis
- Hallux Varus
- Joint instability
- Salvage procedure: Resolved Infection
- Post-traumatic conditions
- Failed implants
- Neuromuscular disorders
- AVN
Arthrodesis of the First MTPJ

Considerations

- Position of fusion
- End to End fusion
  - Manual
  - Reaming systems
  - Bone resection
- Bone grafting
  - Auto/Allo
- Bone Transport
- Fixation
  - Screws/plates/wires/staples/Ex Fix
- Perioperative management

4th Annual International External Fixation Symposium
December 11-14, 2008
What does the evidence reveal about first MTPJ Arthrodesis

- Foot Ankle Int. 2005 Sep;26(9):680-90
- RCT; arthrodesis and replacement arthroplasty.
  - 63 patients: ages of 34-77
  - randomly selected to have MTPJ arthrodesis or arthroplasty.
  - 22 patients (38 toes) had arthrodesis and 27 patients (39 toes) had arthroplasty.
  - primary outcome; decrease in pain as measured on a Visual Analogue Scale (VAS).

- Arthrodesis or total replacement arthroplasty for hallux rigidus: a randomized controlled trial. Gibson JN, Thomson CE.

- Department of Foot and Ankle Surgery, Royal Infirmary of Edinburgh, United Kingdom.

**RESULTS:**

- Assessment: 6 months, 1 & 2 years F/U.

- 24 months, pain improved in both groups (p < 0.001), greater improvements after arthrodesis (p = 0.01). All 38 arthrodeses united.

- Arthroplasty group, 6/39 inserted implants removed due to phalangeal component loosening.

- Remaining arthroplasty group; ROM gained was poor, patients tended to bear weight on outer border of foot. Cost ratio was 2:1 in favor of arthrodesis.

- CONCLUSIONS: Arthrodesis better than arthroplasty. Results partially attributable to unacceptably high incidence of loosening of phalangeal components, which resulted in removal of the implants.

- When data from the failures were excluded, arthrodesis was clearly preferred by most patients.
Surgical options for treatment of the arthritic first MTP joint in rheumatoid arthritis
- Arthrodesis
- Excision of the metatarsal head
  - with or without interposition of the soft tissues,
- Excision of the proximal phalanx,
- Joint replacement

Discusses the various types of arthroplasty of the first MTP joint and the reported outcomes in the rheumatoid forefoot.

Rheumatoid forefoot reconstruction: 1st metatarsophalangeal fusion and excision arthroplasty of lesser metatarsal heads. Kadambande S et al
Royal Gwent Hospital, Newport, United Kingdom

Retrospective review of 66 feet (mean follow-up of 3 years) 43 patients with painful severe rheumatoid forefoot deformities.

All treated by arthrodesis of the first metatarsophalangeal (MTP) joint through a dorsomedial incision and excision of the lesser metatarsal heads through a separate plantar approach.
Conclusions: mean post-operative AOFAS 65.94 (range: 32 to 82). Mean post-operative Foot Function Index (FFI) was 0.47 (range: 0.23 to 0.63).

- 85% (57/67 feet) Excellent/good pain relief
- Mean hallux valgus angles improved from 39 degrees to 16 degrees, IM angle from 16 degrees to 8 degrees.
- 5 feet, nonunion of the 1st MTPJ arthrodesis.
  - 5 re-operations for non-union of the 1st MTP joint arthrodesis.
- Success depends upon metatarsal length harmonisation, stabilisation of the 1st MTP joint = even distribution of loading of the forefoot.
- Poor results: failure to secure the stability of the 1st MTP joint.


- 23 symptomatic hallux rigidus cases treated with first MTP joint arthrodesis.
- Prospective gait analysis 8.6 days b/f surgery and 1 year postop.
- 3 statistically significant changes in gait:
  - increases in maximal ankle push-off power
  - Increased single-limb support time on the involved extremity
  - decrease in step width.
- First MTP joint arthrodesis
  - improvement in propulsive power, weightbearing function of the foot, and stability during gait.

- Purpose: Evaluate operative procedures used for treatment of severe hallux valgus by academic foot and ankle surgeons (US)
- METHODS: A patient with severe hallux valgus deformity was developed as a hypothetical case: a 50-year-old woman with a severe deformity (intermetatarsal angle = 20 degrees; hallux valgus angle = 42 degrees). The case was sent to academic foot and ankle surgeons in a survey to determine their preferred operative treatment for this case.

- Response rate=84% (120 of 153)
- 52% (54 of 102) metatarsal osteotomy
  - 24 used a Ludloff
  - 16 a proximal crescentic
  - 8 proximal chevron
  - 2 scarf
  - 2 distal chevron and two other.
- 26% (26 of 102) first (MTP) joint arthrodesis
- 24% (24 of 102) Lapidus procedure
- Secondary procedures
  - Weil osteotomy in 46% (47 of 102)
  - Akin osteotomy in 30% (31 of 102)
### Metatarsophalangeal joint arthrodesis after failed Keller-Brandes procedure

**Vienne P, et al,** Foot Ankle Int. 2006 Nov;27(11):894-901, Forchstrasse 340, Zurich 8008, Switzerland

- 10/99-12/02, Arthrodesis of the MTPJ after a failed Keller-Brandes procedure in 28 feet of 26
- 22 feet, 24 months followup clinical and radiographic assessment.
- Pedobarographic measurements: latest followup in 16 patients (17 feet).
- 16 (72%) were pain-free
- 6 (28%) had mild, occasional pain.
- (AOFAS) forefoot score increased from a preoperative 44 (range 29 to 67) points to 85 (range 73 to 90) points at longest clinical followup (average 34 months, range 23 to 48, \( p < 0.001 \)).

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- Hallux valgus angle was corrected from 24.0 (range 7 to 47) degrees preoperatively to 16.0 (range 0 to 40) degrees postoperatively (\( p < 0.001 \)).
- Two pseudoarthroses
- Biomechanically, MTPJ arthrodesis could not fully restore the function of the hallux but produced a significant improvement, allowing a more physiologic loading pattern under the hallux and the metatarsal heads.
- **CONCLUSIONS:** First MTPJ arthrodesis after a failed Keller-Brandes, technically safe/reliable
- Reduction of pain and gain of function that produced high patient satisfaction.
First metatarsophalangeal joint arthrodesis as a treatment for failed hallux valgus surgery.

Grimes JS, Coughlin MJ. Texas Tech Department of Orthopaedics, Lubbock, TX. Foot Ankle Int. 2006 Nov;27(11):887-93

- 20-year review with 33 feet, average followup was 8 years.
- Visual analog pain score (AOFAS) & Patient satisfaction scale & Radiographs
- Average pain score improved from 7 to 3 points.
- Mean AOFAS score was 73 points at followup.
- Patient satisfaction
  - was excellent 13 feet (39%)
  - good in 11 (33%)
  - fair in eight (24%)
  - poor in one (3%)
- Mean hallux valgus angle was 16 degrees, with an intermetatarsal angle of 8 degrees.
- 3 asymptomatic and 1 symptomatic nonunion.
- 22 feet (67%) had corrective procedures performed on the lesser toes at the time of the first MTP joint arthrodesis.


Goucher NR, Coughlin MJ. Carlton-Harrison Orthopedic Clinic, Ogden, UT

- Prospective study: Determine results of one method using dome-shaped reamers to prepare the joint surfaces and a low-profile dorsal titanium plate for internal fixation.
- 54 feet had first MTPJ arthrodesis 1/04-1/05.
- Preop eval; underlying pathology, pain, function, and radiographs.
- First MTPJ arthrodesis fixed with a dorsal titanium plate with preset valgus and dorsiflexion after the joint surfaces were prepared with matching male and female dome-shaped power reamers.
- 1-year f/u evaluation of pain, function, and radiographic findings, time out of work, how long swelling persisted, and whether the hardware caused symptoms.
49 of 53 f/u = average of 16 months after surgery.

(AOFAS) scores improved significantly ($z = -6.301$, $p > 0.01$)
- 51 points preoperatively (range 24 to 97) to
- 82 points postoperatively (range 47 to 90).

Pain scores = significant improvement ($z = -6.154$, $p > 0.01$) a mean of 6.3 to a mean of less than 1 point on the visual analog pain scale.

Time off work = 3 weeks

Swelling = average of 11 weeks

Results of 35 feet
- 32 patients (66%) excellent
- 16 feet in 16 patients (30%) good
- 2 feet (4%) fair
- 4 nonunions (8%) 3/4 with asymptomatic nonunion

96% satisfaction rate MTP joint arthrodesis with a low-profile contoured dorsal titanium plate and crossed lag screws after joint preparation with dome-shaped reamers is both reliable and reproducible.

Union rate was high (92%), revision rate low (4%).

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**Functional Results and Patient Satisfaction of First Metatarsophalangeal Joint Arthrodesis Utilizing Dual Crossed Screw Fixation**

- Retrospective study of 75 First MTPJ Arthrodesis Procedures & Surgery performed by single surgeon

**Primary endpoints**
- incidence of successful fusion
- patient satisfaction
- function after the procedure.

**Secondary endpoints**
- Operating times
- Comparison to other fusion techniques
- Comparison to other MTPJ procedures
Sixty three patients (75 feet)  
2000-2005  

Inclusion criteria  
- severe painful deformity of the 1st MPJ  
  - osteoarthritis, rheumatoid arthritis, or gouty arthritis  
- Fusion of the 1st MPJ utilizing dual crossed screw fixation  
- Follow-up of at least 3 months  
- Survey follow-up time of at least 6 months.  

Exclusion criteria  
- revisional surgery  
- fixation other than with dual crossed screws  
- inadequate follow-up.

Rand SF-36 questionnaire, the subjective questionnaire from module 1 (1st MPJ and First Ray) of the ACFAS scoring scale  
Additional questions regarding whether they would recommend the procedure to others, and whether they would have the surgery repeated  
SF-36 was used in order to assess the general health of the fusion patients.  
ACFAS scores were to assess more specifically the 1st MPJ Physical Function, Pain, Energy/General Fatigue, and General Health Perceptions.  
Statistical Analysis was performed using both Student t-test (p<0.0001) and Chi square Test (Pr > ChiSq 0.0001).
Post-op management

- Plaster-of-Paris slipper cast for 2-3 weeks.
- Non-weight bearing on the operative foot.
- Postop week 1, week 3, and week 7, with radiographs performed at each visit.
- Week 3 transitioned into a CAM walker for an additional 4-6 weeks.
- Return to a hard sole shoe or sneaker typically occurred at the 7-8 week.
Demographics/Findings

- Sixty-three patients (75 feet)
- 47 female, 16 were male.
- Thirty two left feet were operated on, 43 were right feet.
- Average age 53.4 years.
- The mean for post-operative office follow-up was 31.7 weeks.
- 19 patients had concomitant surgeries ranging from 2nd, 4th, and 5th digit arthroplasties to Tailor's bunionectomy and pan lesser-metatarsal head resections.
- Hallux rigidus (57 patients, 68 feet) 6 patients (7 feet) RA
- 2 nonunions.
-Complications
  - non-unions (2), cellulitis (2), painful hardware requiring removal (4), hallux IP joint pain/arthritis (2), transfer metatarsalgia (3). There were 2 smokers in the group, only one of which went onto a non-union.

Survey Response

- Forty-nine patients responded to the survey (78%).
- SF-36 Scores
  - Moderately active, with little pain.
  - Mean ACFAS score was 51.2 out of 68.
  - 41 reported little to no pain.
  - 37 reported they either mostly liked the appearance of their toe or liked it very much.
  - 35 reported that they could wear any type of shoe most or all of the time.
  - 87.5% stated they would have the surgery repeated
  - 91.7% would recommend the surgery to a family member or friend.
First MTPJ Arthrodesis with 2 Screw Cannulated Fixation

- Non-weightbearing: 2 weeks
- Camwalker: 5 weeks
- Less lower extremity atrophy
- Minimal to no physical therapy
- High patient satisfaction
- Minimal to no orthotic therapy
- Ability to wear a variety of shoes
Summary for First MTPJ Arthrodesis

- Diagnosis
- Technical considerations
- Position
- Perioperative management
- Reproducible