FIRST RAY CHANGES FOLLOWING 1ST MTPJ FUSION

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SURGICAL GOALS FOR THE PAINFUL 1\textsuperscript{ST} MTPJ

- Relieve Pain
- Reduce Deformity
- Lasting Correction
- Restore Normal Ambulatory Function

Which procedure can consistently provide these outcomes?

Nobody really wants 2 or three operations
PROCEDURE OF CHOICE?
ARTHRODESIS VS. ARTHROPLASTY

- Hallux bears weight in 80% of fusions
- First ray length is maintained or increased
- Hallux continues to play an active role in propulsion
- Low likelihood of revision

- Hallux bears weight in 40% of Keller’s arthroplasty
- Propulsion is lost due to destabilization from
  - Intrinsic detachment
  - Loss of length
- High likelihood of revision
- Improved ROM with Joint Replacement ???
BENEFITS OF ARTHRODESIS

- Restores first ray function
  - First ray stability
  - Hallux and first metatarsal continue to bear weight
  - Functionally lengthens short first ray
- Deformity correction
  - Wide range of deformities and patients are candidates
  - HAV, HV, HR, Revision, Instability

- Cures painful arthrosis
- Low revision rate
- High patient acceptance
- Wide range of patient age and activity
- Excellent healing characteristics
CRITICAL REVIEW OF HR TREATMENT
YEE F&A INT. 2008

- Conservative: Grade B (IV)
- Chielectomy Grades I&II: Grade B (IV)
- Osteotomy: Grade C (IV, V)
- Keller (Low Demand Patient): Grade B (II, IV)
- Interposition: Grade I
- Arthrodesis: Grade B (II, IV)
- Silastic Implant: Grade C
- Metallic Implant: NR (Level II study favored Arthrodesis)
- Hemi-Arthroplasty: Grade C
QUESTIONS ABOUT 1\textsuperscript{ST} MTPJ ARTHRODESI

- Is a first metatarsal osteotomy needed in addition to fusion to correct deformity when there is high inter-metatarsal angle (IMA)?

- If an osteotomy is not needed to decrease the IM angle why? What is occurring at the MTPJ and the 1\textsuperscript{st} met-cuneiform joint to allow reduction of the IMA?
Is a first metatarsal osteotomy needed in addition to fusion to correct deformity when there is high inter-metatarsal angle?

Criteria
- Pre and post op IMA WB measurements
- Clearly defined measurement protocol
- Primary procedure (revisions excluded)
- Greater than 20 patients
### 1st MTPJ Fusion Articles with IMA Measurement

Data extracted from 15 studies included in the present systematic review.

<table>
<thead>
<tr>
<th>Investigator</th>
<th>LOE</th>
<th>Cases (n)</th>
<th>Preoperative IMA (°)</th>
<th>Postoperative IMA (°)</th>
<th>Change in IMA (°)</th>
<th>Age (y)</th>
<th>Follow-up (mo)</th>
<th>Gender</th>
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<td>Feilmeier et al, 2013 (5)</td>
<td>4</td>
<td>94</td>
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<td>Sung et al, 2010 (3)</td>
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<td>4.3</td>
<td>57.7</td>
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<td>Besse et al, 2010 (11)</td>
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<td>36</td>
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<td>Cronin et al, 2006 (8)</td>
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<td>16.7</td>
<td>8.7</td>
<td>8</td>
<td>54.2</td>
<td>13.7</td>
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<td>Nicholas et al, 2005 (12)</td>
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<td>10.9</td>
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<td>Dayton et al, 2002 (6)</td>
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<td>67</td>
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</tbody>
</table>

Abbreviations: IMA, intermetatarsal angle; LOE, level of evidence; NR, not reported.
Total cases, 701; mean preoperative IMA, 14.14°; mean postoperative IMA, 9.58°; mean IMA change, 4.56°; mean age, 60.1 years; mean follow-up period, 57.9 months; total stratified by gender, 370 females and 120 males.
WHAT THAT LAST SLIDE THAT YOU CAN’T READ SAYS:

- Studies meeting criteria = 15
  - 1 Level III
  - 14 Level IV
- Total patients = 701
- Pooled mean IMA pre-op = 14.14
- Pooled mean IMA post-op = 9.58
- Mean change in IMA = 4.56
- Mean age = 60.1 years
- Mean F/U = 57.9 months
BREAKING IT DOWN FURTHER:

Studies with mean IMA < 15
267 patients

- Pooled mean IMA pre-op = 12.40
- Pooled mean IMA post-op = 8.70
- Mean change in IMA = 3.70

Studies with mean IMA > 15
434 patients

- Pooled mean IMA pre-op = 15.90
- Pooled mean IMA post-op = 10.48
- Mean change in IMA = 5.42

The greater the IMA, the greater the magnitude of change in IMA post-op
All patients undergoing primary 1st MTPJ Fusion January 2007-June 2012
256 total
Excluded those with pre-op IMA <11
94 patients met criteria
- Pre-op and post-op WB radiographs
JFAS 2013 CASE SERIES OF 94 PATIENTS


- Overall Reduction 5.44
- Pre-op IMA 11-15 (N=52) Reduction 4.21
- Pre-op IMA 16-24 (N=42) Reduction 6.83
If an osteotomy is not needed to decrease the IM angle why?

What is occurring at the MTPJ and the 1\textsuperscript{st} met-cuneiform joint to allow reduction of the IMA?
OUR QUESTION

What is going on here?
WHAT EXPLAINS THIS?

- Our hypothesis:
  - Positional changes of the metatarsal cuneiform joint were imparted by **decreasing the retrograde buckling force** via MTPJ fusion.
  - Is the Hallux the driving force in a bunion?
    - Dayton P, Kauwe M, Holmes C, **Feilmeier M**, McArdle A, Hensley N. Observed Changes In Radiographic Measurements of the First Ray Following Frontal and Transverse Plane Rotation of the Hallux; Does the Hallux Drive the Metatarsal in a Bunion Deformity? In Press, J Foot Ankle Surg. doi: 10.1053/j.jfas.2014.02.003
WHAT EXPLAINS THIS?

- These changes in position are viewed as a **decrease** in IMA and Cuneiform obliquity.
- These changes include **rotational changes** in the first ray.
  - Spontaneous derotation of the first metatarsal with release of the MTPJ
  - Scranton pointed out in 1980 that the metatarsal was in a valgus position.
  - 4 papers in the last 8 months regarding rotational correction of valgus component of the metatarsal.
POTENTIAL Disadvantages

• Shoe limitations
  • 1-1.5 cm heel height limitation
    • “I haven’t been able to wear high heeled shoes for years”

• Tip toe walking
• Kneeling
• Potential HIPJ arthrosis
POSITIONING

- Slight Abduction / Neutral Rotation
  - Parallel to second toe
  - Don’t make it too straight

- Just off the weight bearing surface
  - 10-15 degrees may be too much
  - Too low
    - HIPJ Arthrosis
    - Lateral weight transfer
  - Too high
    - Poor cosmetic appearance
    - Poor weight bearing
    - Hallux HT
    - First Metatarsal pain
    - HIPJ Arthrosis
CURRENT LITERATURE ON FIRST MTPJ “JOINT PRESERVATION”

- Level IV
- Many, many, many level V recommendations
- SHORT follow up
- Not strong enough to make evidence based treatment decisions
SHORT, ELEVATED OR UNSTABLE FIRST RAY LEADS TO LATERAL WEIGHT TRANSFER

1ST MTPJ FUSION IMPROVES LENGTH AND PURCHASE
SO, NOW THAT WE KNOW THAT A FIRST MTPJ FUSION CAN ALSO CORRECT THE IMA……

CAN A PATIENT WALK NORMALLY WITH A 1\textsuperscript{ST} MTPJ FUSION?...

WHAT IS THE HEALING RATE OF A FIRST MTPJ FUSION?...

Stay tuned….More answers to come next year!
THANK YOU

- Questions?