Joint Sparing Treatment Options for the 1\textsuperscript{st} MTP: FOCAL CARTILAGE DEFECTS vs GLOBAL ARTHRITIS

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AOFAS PRE COURSE
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Hallux Rigidus

I. Staging Hallux Rigidus
   - Available grading systems are really for arthritis and not focal cartilage deficiency
   - Hattrup and Johnson 1988
     - Grade I, II and III based on radiographic parameters of arthritis
   - Coughlin and Shurnas 2003
     - Grade I, II, III and IV based on 3 factors: range of motion, point of pain and x-ray appearance
     - Coughlin scale provides a more functional classification and is preferred by most

<table>
<thead>
<tr>
<th>GRADE</th>
<th>MOTION LOSS</th>
<th>PAIN</th>
<th>XRAYS</th>
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<tbody>
<tr>
<td>I</td>
<td>25 – 50%</td>
<td>Mild at extremes</td>
<td>Dorsal spurs, min joint narrowing</td>
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<tr>
<td>II</td>
<td>50 – 75%</td>
<td>Mod; Increased at extremes</td>
<td>Spurs surrounding joint</td>
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<tr>
<td>III</td>
<td>75 – 100%</td>
<td>Nearly constant; min mid motion pain</td>
<td>Narrowing; cystic degeneration</td>
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<tr>
<td>IV</td>
<td>100%</td>
<td>Constant; all motion pain</td>
<td>Joint absent</td>
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II. Surgical Treatment – Based on Grade of Arthritis

\textbf{GRADE I AND II HALLUX RIGIDUS:}

Cheilectomy:
- derives from the Greek cheilos meaning “lip”
- goal of surgery is to excise dorsal spur thereby improving motion
- effective in mild to moderate hallux rigidus
- technique can remove as much as 30\% of dorsal metatarsal head
- occasionally combined with a dorsiflexion osteotomy of the proximal phalanx (Moberg osteotomy) to maximize dorsiflexion motion
**GRADE IV HALLUX RIGIDUS:**

Arthrodesis:
- indicated for severe degenerative change at MTP
- reliable procedure for pain relief
- successful arthrodesis depends on achieving solid fusion in a physiologic position
  - position goals:
    - proximal phalanx 10 – 15 degrees dorsiflexed off weightbearing aspect of the foot
    - 15 degrees of valgus

**GRADE III HALLUX RIGIDUS:**
- this is where most of the controversy is
- joint sparing options include:
  1. Decompression Osteotomy + Cheilectomy
  2. Marrow Stimulation and Cartilage Grafting for focal cartilage lesions
  3. Interposition Arthroplasty

1. **Decompression Osteotomy + Cheilectomy**
   O’Malley et al (JBJS 95(7), 2013):
   - 81 patients with Hattrup and Johnson Grade III hallux rigidus
   - all patients had cheilectomy + closing wedge proximal phalanx osteotomy (moberg)
   - sig improvement in motion by 27°
   - sig improvement of AOFAS scores
   - 85.2% satisfaction at 4.3 years average follow up

2. **Marrow Stimulation (microfracture) and Cartilage Grafting**
   - can we apply lessons learned from other joints and focal cartilage deficiency
   - subchondral drilling is a marrow stimulation technique that can lead to the formation of fibrocartilage
   Granata et al (AOFAS 2010):
   - 11 patients with average follow up of 3.1 years
   - 82% had traumatic event leading to 1st MTP pain and focal cartilage defect (OCD)
   - average lesion size 12.4 mm²
   - 36% failure rate with re-operation, highest failure rate in males > 40 years of age
   - stimulated a look for a better alternative

Cartilage Grafting
- particulated juvenile cartilage for documented focal contained cartilage lesions of the 1st MTP
- cheilectomy as indicated by restriction of range of motion
- bone grafting of cystic defects

3. **Osteochondral Grafting**
   Kim et al AJSM 40(8), 2012:
   - retrospective comparison of drilling of 1st met head drilling and osteochondral transfer
   - 24 patients: 10 OATS and 14 subchondral drilling
   - sig difference in outcomes based on size of the lesion and presence of cyst
   - > 50 mm² and presence of cyst were indicators of poor outcomes with subchondral drilling
4. Interposition 1st MTP Arthroplasty:
- combination of cheilectomy with interposition of soft tissue between arthritic articulating surfaces
- several techniques in published literature
- 1. EDL/Capsular Technique
- 2. Gracilis Tendon/Bundle Technique
   - Modeled after success with CMC arthritis in the hand
- 3. Allograft Interposition Technique
   - Berlet GC, Hyer CF, Lee TH, Philbin TM. Interpositional Arthroplasty of the 1st MTP Joint using a Regenerative Tissue Matrix for the treatment of advance Hallux Rigidus Foot and Ankle Int 2008 January

Outcomes:
- All interposition techniques have similar outcomes with published studies
- Goal is pain improvement, motion improvement and to buy time until fusion. It should not be implied that this represents a definitive solution for arthritis

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<tr>
<td>Total Score (Max Score = 100 pts)</td>
<td>Mean Preoperative Score + SD</td>
<td>Mean Most Recent Follow-up Score + SD</td>
<td>N/A</td>
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<tr>
<td>(range: 44-77)</td>
<td>63.9 ± 10.2</td>
<td>37.9 ± 9.3</td>
<td>N/A</td>
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<tr>
<td>Pain (No Pain Score = 40 pts)</td>
<td>17.8 ± 6.7 (range: 0-20) (Moderate Pain)</td>
<td>34.4 ± 9.3 (range: 30-40)</td>
<td>N/A</td>
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<tr>
<td>Alignment (Max Score = 15 pts)</td>
<td>15 ± 0.0 (range: 15-15) (Good Alignment)</td>
<td>15 ± 0.0 (range: 15-15) (Good Alignment)</td>
<td>N/A</td>
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<tr>
<td>Function (Max Score = 45 pts)</td>
<td>31.1 ± 6.0 (range: 19-40)</td>
<td>30.4 ± 5.5 (range: 27-45)</td>
<td>N/A</td>
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Evidence Based Analysis:
McNeil, Baumhauer, Glazebrook FAI 34(1), 2013:
- Fair evidence (grade B) in support of arthrodesis
- Poor evidence (grade C) in support of cheilectomy, osteotomy, implant arthroplasty and interpositional arthroplasty
Conclusions: If joint sparing is the surgical goal
- Cheilectomy is predictable for grades I and II hallux rigidus
  - Longest term data suggests 7 – 10 years of good function
- No great options for joint sparing in Grade IV HR
- Grade III HR Options:
  - Cheilectomy + moberg = good outcome at 4 years
  - Interposition arthroplasty = good outcomes at 5 years
  - Cartilage grafting for focal cartilage defects = evolving data that suggests better outcomes than marrow stimulation

References:
3. Johnson KA and Saltzman CL: Complications of resection arthroplasty (Keller) and replacement arthroplasty (silicone) procedures. Contemp Orthop. 1991 Aug;23(2):139-47
11. Kim YS, Park EH, Lee HJ, Koh YG, Lee JW: Clinical comparison of the osteochondral autograft transfer system and subchondral drilling in osteochondral defects of the first metatarsal head. AJSM 40(8), 2012