Distraction Osteogenesis for Brachymetatarsia; Clinical Results and Implications on the Metatarsophalangeal Joint

Haleem AM. MD, Belagadi A. BS, Borst E. BS, Fragomen AT. MD and Rozbruch SR. MD

Limb Lengthening and Complex Reconstruction Service, Department of Orthopaedic Surgery, Hospital for Special Surgery, Weill Medical College Cornell University, New York, NY, USA
Disclosure

The authors *DO NOT* have a financial relationship with any commercial interest.
Introduction

- Brachymetatarsia (congenital shortening of the metatarsal [MT]) results in deformity, psychological dysphoria and potential transfer metatarsalgia.

- Surgical management requires lengthening to restore the parabolic arch and the length of the MT, to normalize load transfer and improve appearance.

- Distraction osteogenesis (DO) using external fixation has revolutionized the management of brachymetatarsia, yet not without complications (30%-100% incidence)

- Most common complication involves the metatarsophalangeal (MTP) joint.
Aim of Study

- To report on clinical outcomes of DO for brachymetatarsia
- Report on complications particularly related to the MTP joint
- Does the method for stabilizing the MTP joint affect the outcome?
Materials and Methods

- Retrospective review of 44 MTs in 27 patients (2M : 25F), mean age 37 + 14 years who had undergone DO

- MTP stabilization;
  - 43%: fixed with K-wire pinning across MTP joint
  - 32%: pinning of phalanges short of MTP and attaching the K-wire to the external fixator
  - 7%: pinning of phalanges and distraction arthroplasty of the MTP
  - 2%: no stabilization
  - 16%: other methods.

- Time to follow up: 14.7 months.
Materials and Methods

- Clinical outcomes analyzed by administrating a non-validated 9 item questionnaire at the latest follow up visit (part of standard clinical follow up at our institution).

- Complications, particularly pertaining to the MTP joint were recorded from chart review and postoperative radiographs at the same time points.
Results

- Preoperatively, MT shortening = 13 mm (29%) in relation to the normal MT length.

- Postoperatively, MT length increased from 46 mm → 59 mm with an increase of 13 mm ($p < .0001$).

- Time to healing was 3.8 months with a mean healing index of 3.3 month/cm.

- Parabola was restored in 75% cases.
Results

- No MT nonunions or refractures.

- Regarding complications of the MTP joint:
  - No significant differences in the rate of complications by MTP fixation method.
  - 74% patients: MTP stiffness
  - 32%: MTP subluxation
  - 8%: MTP dislocation

- MTP requiring additional surgery in 6/44 cases → resolution of symptoms

<table>
<thead>
<tr>
<th>Patient</th>
<th>Obstacle</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4th MTP Flexion contracture + 4th Hammertoe</td>
<td>MTP arthrotomy &amp; capsular release, flexor tenotomy. + PIP resection arthroplasty &amp; smart toe implant.</td>
</tr>
<tr>
<td>3</td>
<td>1st MTP Extension contracture</td>
<td>1st MTP arthrotomy &amp; Capsular release + extensor tenolysis &amp; plantar plate release + MUGA</td>
</tr>
<tr>
<td>4</td>
<td>4th MTP Stiffness + arthritis</td>
<td>4th MTP Distraction arthroplasty + ICBMA injection</td>
</tr>
<tr>
<td>5</td>
<td>4th MTP Stiffness + flexion and abduction contracture (cross-over toe)</td>
<td>4th MTP arthrotomy + capsular release + lateral collateral ligament release + pinning</td>
</tr>
<tr>
<td>6</td>
<td>3rd MTP Extension contracture</td>
<td>3rd MTP arthrotomy &amp; Capsular release + extensor tenotomy</td>
</tr>
</tbody>
</table>
Results - patient reported outcomes

- Significant difference in the proportion of patients who felt comfortable wearing open toe shoes in public \( (p<.0001) \) and standard shoes \( (p< 0.022) \) after surgery compared to before surgery.

- Toe stiffness after surgery was reported by 40% of patients.

- Improved or same function was reported by 85% of patients.

- Satisfaction with surgery and claim that they would do it again was reported by 95% of patients.
Conclusion

- DO is an effective treatment option for brachymetatarsia, with high patient satisfaction rates despite problems.

- The most commonly reported complication was MTP stiffness, which concurs with what was previously reported in the literature.

- MTP dislocation was successfully managed with further surgery.

- No significant difference in the rate of MTP-specific complications by MTP fixation method, likely due to the small sample size per method of fixation.

- Larger patient numbers with longer follow up periods are still required for further validation of the optimum method of MTP stabilization.