Shortened First Metatarsal Bone and Newly Developed Second Metatarsalgia after Parallel-Shaped Modified Scarf Osteotomy for Hallux Valgus Deformity

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- Our disclosures are in the Final AOFAS Mobile App.
- We have no potential conflicts with this presentation.
Introduction

Weil (1991)
Scarf Osteotomy:
✓ Inherent stability
✓ Versatility
✓ Early mobilization

Park (2012)
✓ Parallel-shaped modified scarf osteotomy (PSMSO)
✓ Centrally positioned osteotomy line, parallel to 1\textsuperscript{st} metatarsal
✓ 43 patients, mean f/u 14 months
✓ HVA, IMA: good correction
✓ AOFAS score 63.5 → 88.5
✓ No stress fracture or troughing
Introduction

However, 2nd metatarsalgia has been developed. Why??
we measured the shortening of first metatarsal length and investigated the relation of first metatarsal length and second transfer metatarsalgia after PSMSO for hallux valgus deformity
Materials & Methods

Mar, 2009 - Aug, 2015

168 cases → excluded 45 cases d/t other foot pathologies, previous 2nd metatarsalgia

123 cases (88 patients)

- Group A (2nd metatarsalgia c plantar callosity (+)) : 11 cases (8.9%)
- Group B (2nd metatarsalgia (-)) : 112 cases

Male / Female: 11 / 77

Mean age: 44.2 years (19 – 78 years)

Follow-up: 20.6±7.8 (12-66) months
Materials & Methods

Clinical Evaluation
- VAS, AOFAS (Hallux MTP-IP) score
- 2nd metatarsalgia c plantar callosities

Radiologic Evaluation
- HVA, IMA, DMAA,
- Metatarsal length on standing radiograph

- Modified Davies and Saxby’s method
  \[
  \left[ (B_{\text{post-operative}} \times \left( \frac{A_{\text{post-operative}}}{A_{\text{pre-operative}}} \right) ) - B_{\text{pre-operative}} \right]
  \]
  : the first metatarsal length, Considering magnification

- Maestro’s method
  : the protrusion of second metatarsal relative to first metatarsal
Results

Table 1. Baseline Characteristics: Before and After Propensity Score Matching Method.

<table>
<thead>
<tr>
<th>Group</th>
<th>A</th>
<th>B</th>
<th>p-value</th>
<th>A'</th>
<th>B'</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Propensity Score Matching</td>
<td>Before</td>
<td>After</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2nd Transfer Metatarsalgia</td>
<td>(+)</td>
<td>(-)</td>
<td>p-value</td>
<td>(+)</td>
<td>(-)</td>
<td>p-value</td>
</tr>
<tr>
<td>No. of feet</td>
<td>11</td>
<td>112</td>
<td></td>
<td>9</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td>Age (yr)</td>
<td>45.5±16.0</td>
<td>43.8±16.6</td>
<td>0.443</td>
<td>43.2±16.9</td>
<td>40.8±15.8</td>
<td>0.427</td>
</tr>
<tr>
<td>HVA preop</td>
<td>24.7±5.5</td>
<td>29.1±9.0</td>
<td>0.107</td>
<td>25.8±5.5</td>
<td>24.8±5.6</td>
<td>0.660</td>
</tr>
<tr>
<td>IMA preop</td>
<td>11.4±2.3</td>
<td>14.1±3.4</td>
<td>0.005</td>
<td>11.9±2.2</td>
<td>12.0±2.1</td>
<td>0.914</td>
</tr>
<tr>
<td>DMAA preop</td>
<td>21.9±6.5</td>
<td>27.9±11.1</td>
<td>0.073</td>
<td>22.8±6.9</td>
<td>22.8±8.0</td>
<td>0.993</td>
</tr>
<tr>
<td>Relative 1st MT length preop</td>
<td>86.9±4.3</td>
<td>87.4±3.0</td>
<td>0.167</td>
<td>86.7±4.8</td>
<td>86.7±2.5</td>
<td>0.218</td>
</tr>
<tr>
<td>F/U (mo)</td>
<td>25.3±8.9</td>
<td>20.5±7.5</td>
<td>0.021</td>
<td>24.6±9.8</td>
<td>21.0±6.7</td>
<td>0.379</td>
</tr>
</tbody>
</table>

After propensity score matching considered baseline characteristics, 9 cases with second transfer metatarsalgia were compared to 31 cases without it.
The group with transfer metatarsalgia (A’) showed significant shortening in first metatarsal length and lengthening of second metatarsal protrusion relative to first metatarsal compared to those without the transfer lesion.
Okuda et al. FAI (2001)
→ Suggest combining with 2nd metatarsal shortening osteotomy for hallux valgus with painful plantar callosity (projection of the 2nd metatarsal >12mm)

Lee et al. FAI (2009)
→ Painful plantar callosities can be improved by hallux valgus correction alone without lesser metatarsal osteotomy

Smith et al. FAI (2003)
→ metatarsal shortening with the production of a transfer lesion beneath the 2nd metatarsal head

From our study, if
1st MT shortening ➔ average - 4.8 mm
2nd MT relative lengthening ➔ average +4.2 mm
Transfer metatarsalgia is one of numerous possible complications after scarf osteotomy. To avoid complications, we suggest that shortening of **first metatarsal bone length** should be minimized within -2 mm and **second metatarsal protrusion relative to first metatarsal** kept within +1.9 mm with considering the **metatarsal parabola**.

If the shortening of first metatarsal was done **over -4.8 mm**, the additional procedure for **second metatarsal** may be considered.
References


