Modified Mitchell Osteotomy Alone Did Not Have Higher Rate Of Residual Metatarsalgia Than Combined First And Lesser Metatarsal Osteotomy

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Introduction

• Transfer metatarsalgia (TM) is a common forefoot disorder secondary to hallux valgus (HV) because decreased loading on first metatarsal head leads to laterally shift weight to lesser toes.

• The best treatment for symptomatic TM combined with HV remains controversy.

• Due to the different advices for treating HV with TM, the main purpose of the study was to compare clinical outcomes in the patients with HV and TM who received combined osteotomy, with those who underwent corrective osteotomy for HV only.

• Besides, we evaluated several parameters to find the predictive factors of residual metatarsalgia after surgery, which previous studies didn’t mention.
Methods

• We retrospectively reviewed the medical records and radiographs of patients who underwent osteotomy for HV correction between January 2000 and December 2010.

• Inclusion criteria were the patients who scheduled to undergo HV correction combined with lesser toe metatarsalgia.

• Hallux rigidus, rheumatoid arthritis, gouty arthritis, a previous surgery on the affected toe or psychologic diseases were excluded.

• All the patients underwent HV correction with Modified Mitchell osteotomy.

• Some of these patients received operative correction for TM simultaneously. We used a sliding oblique metatarsal osteotomy to treat the metatarsalgia for patients who received a combined lesser metatarsal surgery.

• In all cases, the surgeries were performed by two experienced surgeons.
• **The clinical evaluations** including the American Orthopaedic Foot and Ankle Society (AOFAS) score and residual metatarsalgia were assessed at each followup.

• **Series radiographic examinations** including antero-posterior and lateral weightbearing views were assessed to determine hallux valgus angle (HVA), 1st-2nd intermetatarsal angle (IMA), metatarsal shortening (MS), and plantar shifting of metatarsal head (PS).

• **HVA** is defined as the angle between the longitudinal axis of first metatarsal and the proximal phalanx.

• **1st-2nd IMA** was measured as the angle formed by the intersection of the axis of first and second metatarsal.

• The length of metatarsal was obtained from the distance between the midpoint of proximal and distal articular surface and the change of metatarsal length before and after osteotomy was recorded, as **MS**.

• The **PS** was measured on lateral radiograph and defined as difference in the distance between the dorsal cortex of metatarsal shaft and plantar displaced metatarsal head related to the ground at osteotomy site.
Fig. 1
∠A = hallux valgus angle (HVA) (degree)
∠B = 1st-2nd intermetatarsal angle (IMA) (degree)

Fig. 2
∠A’ = post-operative hallux valgus angle (HVA) (degree)
∠B’ = post-operative 1st-2nd intermetatarsal angle (IMA) (degree)

Fig. 3
C – C’ = plantar shifting of metatarsal head (PS) (mm)

Fig. 4
D – D’ = metatarsal shortening (MS) (mm)
Results

- Sixty-five patients (83 feet) were enrolled into our study.
- All patients had at least 12-month followup (mean, 3.17 years; range, 1 to 9.75).
- Seventy-seven feet (93%) were female, and the mean age was 46.99 years old (range, 18 to 71).
- Thirty feet receiving a combined sliding oblique metatarsal osteotomy (-SOMO) to treat symptomatic metatarsalgia were grouped as combined surgery group (CS group), and the others were grouped as control group (CN group).
- There was no significant difference between groups (table 1).

<table>
<thead>
<tr>
<th></th>
<th>CS group (n=30)</th>
<th>CN group (n=53)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female (%)</td>
<td>27 (90%)</td>
<td>50 (94%)</td>
<td>0.46</td>
</tr>
<tr>
<td>Age (years old)</td>
<td>49.97</td>
<td>45.85</td>
<td>0.23</td>
</tr>
<tr>
<td>Pre-op AOFAS score</td>
<td>61.00</td>
<td>58.07</td>
<td>0.41</td>
</tr>
<tr>
<td>Pre-op HVA (°)</td>
<td>29.61</td>
<td>28.08</td>
<td>0.34</td>
</tr>
<tr>
<td>Pre-op IMA (°)</td>
<td>13.64</td>
<td>12.86</td>
<td>0.35</td>
</tr>
</tbody>
</table>

CS: combined surgery; CN: control group; HVA: hallux valgus angle; IMA: intermetatarsal angle; Pre-op: pre-operative
No complication, such as infection or nonunion, was found in both group.

No significant difference was noted in AOFAS score.

In the radiographic assessments, there was also no significant difference in HVA, IMA, MS and PS.

The overall rate of persistent symptomatic metatarsalgia was 19.28%.

There was no significant difference in the rate of persistent symptoms between groups (p=0.9) (table 2).

Table 2. - The results of post-operative assessments

<table>
<thead>
<tr>
<th></th>
<th>CS group (n=30)</th>
<th>CN group (n=53)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-op AOFAS score</td>
<td>80.76</td>
<td>83.39</td>
<td>0.35</td>
</tr>
<tr>
<td>Post-op HVA (°)</td>
<td>10.44</td>
<td>11.00</td>
<td>0.71</td>
</tr>
<tr>
<td>Post-op IMA (°)</td>
<td>6.33</td>
<td>6.63</td>
<td>0.65</td>
</tr>
<tr>
<td>MS (mm)</td>
<td>4.23</td>
<td>4.38</td>
<td>0.83</td>
</tr>
<tr>
<td>PS (mm)</td>
<td>1.73</td>
<td>1.70</td>
<td>0.9</td>
</tr>
<tr>
<td>Residual TM (%)</td>
<td>6 (20%)</td>
<td>10 (18.87%)</td>
<td>0.9</td>
</tr>
</tbody>
</table>

CS: combined surgery; CN: control group; HVA: hallux valgus angle; IMA: 1-2 intermetatarsal angle; MS: metatarsal shortening; PS: plantar shifting of metatarsal head; Post-op: post-operative; TM: transfer metatarsalgia
Logistic regression analysis indicated that the predictors of residual metatarsalgia in HV patients were the preoperative HVA more than 30 degrees ($P = 0.0084$) (table 3).

Age, preoperative IMA, postoperative HVA, IMA, MS and PS showed no significant correlation with persistent metatarsalgia.

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>P value</th>
<th>OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>0.265</td>
<td></td>
</tr>
<tr>
<td>Pre-op IMA</td>
<td>0.594</td>
<td></td>
</tr>
<tr>
<td>Post-op HVA</td>
<td>0.095</td>
<td></td>
</tr>
<tr>
<td>Post-op IMA</td>
<td>0.567</td>
<td></td>
</tr>
<tr>
<td>MS</td>
<td>0.299</td>
<td></td>
</tr>
<tr>
<td>PS</td>
<td>0.553</td>
<td></td>
</tr>
<tr>
<td>Pre-op HVA &gt; 30 degrees</td>
<td>0.0084*</td>
<td>14.65 (1.8-403.8)</td>
</tr>
</tbody>
</table>

CI: confidence interval; HVA: hallux valgus angle; IMA: 1-2 intermetatarsal angle; MS: metatarsal shortening; OR: Odds ratio; Pre-op: pre-operative; PS: plantar shifting of metatarsal head; TM: transfer metatarsalgia

*: statistical significant difference, $p<0.05$
Discussion

• The most important finding of the present study was that there was **no significant difference in the incidence of residual metatarsalgia** between combined corrective osteotomy and Mitchell osteotomy alone for patients with HV and TM. The conclusion was consistent with part of previous related studies.

• The recovery rate was 80% in the CS group and 81% in the CN group. The **recovery rate** in the present study was **similar to previous studies**, even better than some of them.

• The difference between CS and CN groups was not statistically significant (P=0.9). It implied that combined lesser metatarsal osteotomy didn’t influence the incidence of residual metatarsalgia after HV corrective osteotomy. In other words, modified Mitchell osteotomy alone didn’t have higher rate of residual metatarsalgia than combined surgery.
• No previous article focused on the predictive factors of residual metatarsalgia after HV correction alone or with combined lesser metatarsal surgery.

• We evaluated several parameters to try to find the predictor of residual metatarsalgia after surgery. Between the feet with and without residual metatarsalgia, there was no significant difference in most parameters except preoperative HVA.

• Therefore, we used logistic regression analysis for further evaluation. We found that the patients with more than 30 degrees preoperative HVA had higher risk of persisted transfer metatarsalgia after surgery (OR=14.65).
References