The Role of the Abnormal Metatarsal Parabola in the Development of Plantar Plate Tears

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My disclosure is in the Final AOFAS Program Book.
I have no potential conflicts with this presentation.
INTRODUCTION

- Plantar plate tears are more commonly being identified as contributing cause of forefoot deformity.

- The metatarsal parabola and the length of the 2\textsuperscript{nd} metatarsal have been implicated in the development of this pathology\textsuperscript{1-4,6,8}.

- The \textbf{purpose of this study} is to compare the metatarsal parabola in the symptomatic and asymptomatic foot in patients with unilateral plantar plate pathology confirmed on intra-operative examination.
METHODS

- Inclusion criteria:
  - 66 consecutive patients with unilateral plantar plate tears confirmed on intra-operative examination.
  - Complete medical records.
  - Bilateral weight bearing radiographs available for review.

- Metatarsal parabola evaluation
  - Hardy & Clapham’s method\(^5\)
  - 2\(^{nd}\) metatarsal protrusion distance\(^2,6\)
  - Maestro’s method\(^7\)

- The parabolas of the symptomatic and asymptomatic feet were compared.
RESULTS

- 66 plantar plate tears identified
- Average age: 52.7 ± 11.1 (20 – 76) years
  - 8 men
  - 58 women
- Hardy & Clapham’s method – not significantly different
- 2nd metatarsal protrusion distance – significantly longer on the symptomatic foot (4.4 mm ± 1.3 vs 3.7 ± 1.9 mm, p<0.01)
- Maestro’s method – not significantly different
## RESULTS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symptomatic Foot</th>
<th>Asymptomatic Foot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardy &amp; Clapham</td>
<td>-1.1 ± 3.2 mm (range -10 – 10)</td>
<td>- 1.3 ± 2.8 mm (range -9 – 5)</td>
</tr>
<tr>
<td>2\textsuperscript{nd} metatarsal protrusion distance</td>
<td>4.4 ± 1.3 mm (range 2 – 7)</td>
<td>3.7 ± 1.9 mm (range of -4-7)</td>
</tr>
<tr>
<td>Maestro – 1\textsuperscript{st} Metatarsal</td>
<td>9.6 ± 2.5 mm (range 5 – 15)</td>
<td>9.2 ± 3.3 mm (range -7 – 15)</td>
</tr>
<tr>
<td>Maestro – 2\textsuperscript{nd} Metatarsal</td>
<td>13.6 ± 3.4 mm (range 6 – 21)</td>
<td>13.3 ± 3.3 mm (range 6 – 22)</td>
</tr>
<tr>
<td>Maestro – 3\textsuperscript{rd} Metatarsal</td>
<td>9.5 ± 3.9 mm (range 3 – 20)</td>
<td>9.5 ± 3.9 mm (range 3 – 20)</td>
</tr>
</tbody>
</table>
DISCUSSION

- Hardy & Clapham’s method –
  - Small measurements failed to detect significant differences in 2\textsuperscript{nd} metatarsal length

- Maestro’s Method –
  - Fibular sesamoid position is key in this measurement
  - Concurrent first ray pathology may influence this measurement as the metatarsal moves over the sesamoid complex.
2nd metatarsal protrusion distance –

Subtle differences (0.7 mm on average) between symptomatic and asymptomatic feet suggest that this may be an underlying osseous deformity in plantar plate pathology.
CONCLUSION

- Subtle changes in the metatarsal parabola likely contribute to the development of plantar plate pathology.

- Correcting only the soft tissue defect may be insufficient to maintain long term correction of this problem.

- Osseous realignment and restoration of the osseous/soft tissue balance to the joint is necessary for high rates of success with surgical correction of plantar plate tears.


