Effect of second toe-to-hand transfer on the plantar pressure distribution of the donor foot

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My disclosure is in the Final AOFAS Mobile App. I have no potential conflicts with this presentation.
Background and objective

With the development of microsurgery, toe-to-hand transfer has been widely used to reconstruct the fingers of an injured hand. This technique could significantly improve the function of the injured hand. But the reports about the influence of such operation on the function of donor foot are rare.

The purpose of the current study was to determine the effect of removal of the second toe at different levels on the plantar pressure distribution of the donor foot.
Methods

• Twelve normal fresh-frozen cadaveric foot specimens were subjected to an axial load of 600 N. An F-scan plantar pressure analysis system was used to measure the forefoot plantar pressure. The testing was performed under the conditions of intact second toe, second toe removal with the second metatarsal head reserved, and second toe removal in combination with the distal one-third of the second metatarsal, respectively.
Methods

Loading machine and the specimen was placed with the ankle in neutral position
Methods

Removal of the second toe with the second metatarsal head reserved.
Removal of the second toe and distal one-third of the second metatarsal.
Results

foot plantar pressure:
region 1, hallux;
region 2, first metatarsal head;
region 3, second metatarsal head;
region 4, third to fourth metatarsal head;
region 5, fifth metatarsal head
# Results

<table>
<thead>
<tr>
<th>Region</th>
<th>Intact ((n = 12))</th>
<th>Second toe removal ((n = 12))</th>
<th>Part second metatarsal removal ((n = 12))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hallux</td>
<td>14.66 ± 3.11 (\ast)</td>
<td>17.25 ± 3.25 (\ast)</td>
<td>22.70 ± 3.03 (\ast)</td>
</tr>
<tr>
<td>MT1</td>
<td>35.04 ± 4.42 (\ast)</td>
<td>39.19 ± 4.24 (\ast)</td>
<td>68.26 ± 6.26 (\ast)</td>
</tr>
<tr>
<td>MT2</td>
<td>66.17 ± 6.05 (\ast)</td>
<td>70.25 ± 6.48 (\ast)</td>
<td>/ (\ast)</td>
</tr>
<tr>
<td>MT3-4</td>
<td>52.68 ± 5.07 (\ast)</td>
<td>56.90 ± 5.13 (\ast)</td>
<td>106.44 ± 7.19 (\ast)</td>
</tr>
<tr>
<td>MT5</td>
<td>22.02 ± 3.50 (\ast)</td>
<td>24.95 ± 3.08 (\ast)</td>
<td>35.95 ± 4.07 (\ast)</td>
</tr>
</tbody>
</table>
Discussion

- the second metatarsal plays the major role in resisting bending and shearing forces, which are mainly transferred through the second metatarsal during walking.
- after the second toe was removed with the second metatarsal head reserved, the peak pressure of each plantar region of the forefoot did not significantly increased. This indicates that second toe removal with the second metatarsal head reserved might have little impact on the weight bearing function of the foot in the short term.
Discussion

- After the second toe was removed in combination with the distal one-third of the second metatarsal, the plantar pressure of the second metatarsal head disappeared. And the plantar pressure of other four plantar regions increased significantly.
In conclusion, an intact second metatarsal took an important part in the normal distribution of plantar pressure. Removal of the second toe with the second metatarsal head reserved had little influence on the plantar pressure distribution of the donor foot. Removal of the second toe and distal one-third of the second metatarsal resulted in abnormal plantar pressure distribution. In the second toe-to-hand transfer, the second metatarsal head should be reserved as much as possible to reduce the complications of the donor foot.