Three-dimensional analysis of the talocrural joint axis: relation to the talar articular surface

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Conflict of interest statement

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We have a potential conflict with this presentation due to:

• One or more of the authors are paid consultants or got financial support direct or to their institution by the following companies:
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• One or more of the authors are board members, of the following institutions:
  German Foot and Ankle Society

• The CT-Datasets were bought and provided by Implantcast (Buxtehude, Germany)
Introduction

• Ankle arthritis has an increasing incidence
• Preferred treatment options are arthrodesis and total ankle replacement (TAR)
• Revision rate after TAR up to 20%
• Different theories about the talocrural joint axis
Introduction

The aim of the present study was to evaluate a new method of determining the geometric axis of the talocrural joint.
Material and methods

Study design

- 96 CT-scans of full cadaver caucasian legs
- Donor Age averaged 81 (range: 44 years-104 years) years
- 47 female/49 male donors
- No obvious foot and ankle deformities
Material and methods
Coordinate system

• Coordinate system followed recommendations of International Society of Biomechanics (ISB) (Wu, J Biomech, 2002)
Material and methods

3D-models

- 3D-models were generated via Mimics® and 3-matic® (Materialise®, Leuven, Belgium)
Material and methods
Geometric axis of the talocrural joint

• The axis of the best fitting cone of the talar joint surface was deemed to be the geometric axis of the talocrural joint.
Material and methods
Illustration of the geometric joint axis

• the **geometric axis** is illustrated compared to:
  – tibial axis
  – defined **frontal, sagittal** and **axial plane**
Results

<table>
<thead>
<tr>
<th>Geometric rotational axis vs. tibial axis</th>
<th>Mean</th>
<th>SD</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>in frontal plane (deg)</td>
<td>84.9</td>
<td>8.5</td>
<td>83.1-86.6</td>
</tr>
<tr>
<td>in sagittal plane (deg)</td>
<td>93.1</td>
<td>42.3</td>
<td>84.5-101.8</td>
</tr>
<tr>
<td>in axial plane (deg)</td>
<td>169.0</td>
<td>6.7</td>
<td>167.6-170.4</td>
</tr>
<tr>
<td>vs. frontal plane (deg)</td>
<td>9.9</td>
<td>6.9</td>
<td>8.4-11.4</td>
</tr>
<tr>
<td>vs. sagittal plane (deg)</td>
<td>103.2</td>
<td>10.8</td>
<td>100.9-105.5</td>
</tr>
<tr>
<td>vs. axial plane (deg)</td>
<td>8.2</td>
<td>8.5</td>
<td>6.4-10.0</td>
</tr>
</tbody>
</table>

- High interindividual deviation especially in sagittal plane
Conclusion

• **New reproducible single-axis model** of the talocrural joint
• **High interindividual variations**
• **Patient-specific TAR** implantation techniques could be considered
Literature

