Radiographic Outcomes of Preoperative CT Scan-Derived Patient-Specific Total Ankle Arthroplasty

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Disclosures:

Andrew R. Hsu, MD: None

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Bruce E. Cohen, MD: Amniox, Arthrex, Inc., DJ Orthopaedics, Wright Medical Technology, Inc.

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All disclosures are listed in the Final AOFAS Mobile App.
Is pre-op CT scan-derived instrumentation for total ankle arthroplasty (TAA) accurate and reliable in a clinical setting?
Level IV Study: 42 TAAs with patient-specific surgical plans and intraoperative guides

- 2012-2014: All CT scan-derived plans and guides reviewed (PROPHECY, Wright Medical Technology, Inc.)
- 29 intramedullary referencing TAAs (INBONE II, Wright)
- 13 low-profile tibia and talar resurfacing TAAs (Infinity, Wright)

- Min 3 month f/u with weight-bearing x-rays

- Coronal and sagittal alignments compared between:
  - Weight-bearing pre-op x-rays
  - CT scan-derived surgical plans
  - Weight-bearing post-op x-rays

- Predicted implant sizes compared to actual final sizes used
*Infinity 12 min faster than INBONE II (p < .05)

No baseline differences in demographics between groups

Ave f/u = 9 months

<table>
<thead>
<tr>
<th>Surgical Data</th>
<th>INBONE (n = 29)</th>
<th>Infinity (n = 13)</th>
<th>Overall (n = 42)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ave age (years)</td>
<td>65 ± 9</td>
<td>59 ± 9</td>
<td>63 ± 9</td>
</tr>
<tr>
<td>Ave BMI</td>
<td>29.5 ± 5.2</td>
<td>30.5 ± 7.5</td>
<td>29.8 ± 5.9</td>
</tr>
<tr>
<td>Ave surgical time (min)</td>
<td>104 ± 11</td>
<td>92 ± 4*</td>
<td>100 ± 11</td>
</tr>
</tbody>
</table>
*Final alignments within ± 3° of predicted plan

No baseline differences in deformity between groups

Var = varus
PF = plantarflexion

<table>
<thead>
<tr>
<th>Radiographic Outcomes</th>
<th>INBONE (n = 29)</th>
<th>Infinity (n = 13)</th>
<th>Overall (n = 42)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ave pre-op coronal alignment</td>
<td>7.1° (var) ± 7.1°</td>
<td>0.8° (var) ± 4.7°</td>
<td>1.9° (var) ± 6.4°</td>
</tr>
<tr>
<td>Ave pre-op sagittal alignment</td>
<td>0.8° (PF) ± 0.8°</td>
<td>0.0° (PF) ± 0.0°</td>
<td>0.0° (PF) ± 0.7°</td>
</tr>
<tr>
<td>Predicted plan coronal alignment</td>
<td>2.0° (var) ± 2.0°</td>
<td>0.4° (var) ± 1.6°</td>
<td>0.1° (var) ± 1.8°</td>
</tr>
<tr>
<td>Predicted plan sagittal alignment</td>
<td>1.5° (PF) ± 1.5°</td>
<td>0.1° (PF) ± 2.0°</td>
<td>0.4° (PF) ± 1.7°</td>
</tr>
<tr>
<td>Ave post-op coronal alignment</td>
<td>0.9° (var) ± 0.9°</td>
<td>0.2° (var) ± 1.0°</td>
<td>0.1° (var) ± 0.9°</td>
</tr>
<tr>
<td>Ave post-op sagittal alignment</td>
<td>0.4° (PF) ± 0.4°</td>
<td>-0.2° (PF) ± 0.6°</td>
<td>0.0° (PF) ± 0.4°</td>
</tr>
</tbody>
</table>
*Plans predicted all implants within 1 size

<table>
<thead>
<tr>
<th>Implant Size</th>
<th>INBONE (n = 29)</th>
<th>Infinity (n = 13)</th>
<th>Overall (n = 42)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correct tibia implant size predicted</td>
<td>100%</td>
<td>92%</td>
<td>98%</td>
</tr>
<tr>
<td>Correct talus implant size predicted</td>
<td>76%</td>
<td>46%</td>
<td>67%</td>
</tr>
<tr>
<td>Plan within 1 size of final implant used</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

*When exact size prediction was wrong, final size used was 1 smaller than predicted. Likely due to increased gutter debridement with talar downsizing.
Summary:

- CT scan-derived patient-specific surgical plans and guides provide accurate and reproducible TAA implant alignment.

- Exact implant sizing was better for tibial components than talar, likely due to our preference for increased gutter debridement with talar downsizing.

- Final coronal and sagittal alignments were all within $\pm 3^\circ$ of predicted plans similar to modern TKA navigation systems.

- **Limitations**: retrospective, small cohorts, ave f/u 9 months, no clinical or functional outcomes.

- Future studies with other TAA systems needed to evaluate the short- and long-term clinical effects of patient-specific TAA.
References:


