Effect of Optimizing Bone-Implant Contact on Hip Offset and Anteversion with Three Contemporary Uncemented Short Metaphyseal-Engaging Implants.

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Disclosure

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FDA status: All Devices Cleared
The goal of THA is to achieve long-term fixation and optimize hip kinematics by restoring offset and anteversion.

Implant position and design play a major role in the extent of femoral contact and the resulting offset and anteversion.

Hip instability and dislocation, both affected by implant offset and anteversion, continue to be a concern.
Objective

To analyze the resulting offset and anteverision of three short metaphyseal- engaging femoral implants after virtual placement with optimum bone-implant contact.
Methods and Materials

- 3 Proximally engaging stems
  - Tri-Lock (DePuy Orthopaedics, Warsaw, IN)
    - Tapered straight stem
  - ABG II (Stryker, Mahwah, NJ)
    - Anatomical
  - ARC (Omnilife Science, East Taunton, MA)
    - Femoral neck preserving

- Computer assisted CT-templating program - ORTHODOC (ISS Inc, Davis, CA)
  - CT’s of 30 patients were each templated with all three stems
    - 15 right femurs
    - 15 left femurs
  Total of 90 templates
Virtual Templating

Tri-Lock

ABG II

ARC
Measuring Offset

Native Femoral Head Center

Post-Template Implant Head Center
Measuring Femoral Neck and Implant Anteversion

- Stem neck Axis
- Intercondylar Axis
- Anatomical Anteversion
- Femoral Neck Axis
## Results - Offset

<table>
<thead>
<tr>
<th>Stem</th>
<th>Offset ± 2mm</th>
<th>Offset ± 3mm</th>
<th>Offset ± 5mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tri-Lock</td>
<td>53.3% (16/30)</td>
<td>73.3% (22/30)</td>
<td>96.7% (29/30)</td>
</tr>
<tr>
<td>ABG II</td>
<td>10% (3/30)</td>
<td>26.7% (8/30)</td>
<td>70% (21/30)</td>
</tr>
<tr>
<td>ARC</td>
<td>40% (12/30)</td>
<td>63.3% (19/30)</td>
<td>83.3% (25/30)</td>
</tr>
</tbody>
</table>

**Virtually Templated Implants Compared to Native Femoral Offset (+/- 2mm)**

![Graph showing implants comparison](image1)

**Virtually Templated Implants Compared to Native Femoral Offset (+/- 5mm)**

![Graph showing implants comparison](image2)
## Results - Tri-Lock Anteversion

### Variation in Native and Implant Anteversion

<table>
<thead>
<tr>
<th>Degrees of Anteversion (°)</th>
<th>Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30</td>
<td></td>
</tr>
</tbody>
</table>

### Stem Anteversion
- 25.6° (10.5°-49.7°)

### Patient Native Anteversion
- 16.8° (-4.4°-41.2°)

### Difference
- 8.8 (-2.6-19.6°)
Results - ABG II Anteversion

<table>
<thead>
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<td>Degrees of Anteversion</td>
<td>35.8° (16.4°-61.5°)</td>
<td>16.8° (-4.4°-41.2°)</td>
<td>19.01° (11.6° - 31.3°)</td>
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</table>
Results - ARC Anteversion

Variation in Native and Implant Anteversion

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<tbody>
<tr>
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</tr>
<tr>
<td>40</td>
</tr>
<tr>
<td>30</td>
</tr>
<tr>
<td>20</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>0</td>
</tr>
</tbody>
</table>

Cases

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<th>Difference</th>
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<td>20.4° (3.2°-43.3°)</td>
<td>16.8° (-4.4°-41.2°)</td>
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## Results - Anteversion

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### Variation in Native and Implant Anteversion

![Variation in Native and Implant Anteversion](image)
Conclusions

- Tri-Lock: Most reliable at restoring native offset within 5mm and less reliable (average <10° difference) at restoring native anteversion.

- ABG II: Good reliability at restoring native offset within 5mm but least reliable at restoring native anteversion (Avg 19.01°).

- ARC: Good reliability at restoring offset within 5mm and most reliable at restoring anteversion (3.6°).
Clinical Relevance

- Stems that establish incomplete metaphyseal implant-bone contact (Tri-Lock) allow for intramedullary adjustment of positioning which may allow restoration of anteversion and offset.

- Stems with more extensive circumferential metaphyseal implant-bone contact (ABGII) may have limited ability to restore anteversion and offset.

- Stems that achieve contact at the femoral neck follow the native anatomy (ARC).
Clinical Relevance

Stem designs must aim to incorporate the features necessary to guarantee initial stable and durable long-term fixation while restoration anteversion and offset.
Thank You!

Chicago, IL, USA

Canaima National Park, Venezuela