Patient-Specific Instrumentation Leads to Accurate Acetabular Component Placement in Total Hip Arthroplasty

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Introduction
- Accurate placement of the acetabular component in total hip arthroplasty is important in maximising the performance of the bearing, reducing the incidence of instability and minimising the likelihood of edge-loading.
- However, postoperative analyses show that more than half of cups can be malorientated.
- The aim of this study was to assess the accuracy of a novel patient-specific instrument system, Corin Optimized Positioning System (OPS™), to optimise the placement of the acetabular component.

Operative Technique
- Patient-specific guide placed into the acetabulum.
- Handle connected to the guide projected a laser beam that defined the planned cup orientation.
- A second laser fixed to the pelvis was adjusted so that its projection was coincident with the guide laser.
- After reaming, a laser attached to the end of the cup introducer was used to guide final component placement, so that it was coincident with the pelvic laser.
- Final orientation was confirmed by verifying the amount of native bone around the rim of the cup matched the etched markings on the acetabular model.

Post-Operative Analysis
- Post-operative CT scan
- Two observers performed the post-operative measurements and each was blinded to the other’s results.

Pre-Operative Planning
- 100 hips received Corin OPS™ preoperative analysis
- The dynamic force in the hip to be replaced was calculated during functional activities and the associated bearing contact patch was analysed as it traced across the articulating surface
- The surgeon chose the optimal orientation to best centralise the joint load
- A patient-specific guide was designed and manufactured to deliver the planned orientation

Results
Table 1. Accuracy of acetabular component placement

<table>
<thead>
<tr>
<th></th>
<th>Inclination</th>
<th>Anteversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Deviation from Plan (Range)</td>
<td>-1.6° (-11.1° to 13.6°)</td>
<td>-1.0° (-12.4° to 12.9°)</td>
</tr>
<tr>
<td>Mean Absolute Deviation from Plan (Range)</td>
<td>1.9° (0.0° to 15.6°)</td>
<td>3.6° (0.0° to 12.9°)</td>
</tr>
<tr>
<td>% within ± 5°</td>
<td>71%</td>
<td>77%</td>
</tr>
<tr>
<td>% within ± 10°</td>
<td>96%</td>
<td>94%</td>
</tr>
<tr>
<td>% within ± 5° (both incl and ante)</td>
<td>54%</td>
<td></td>
</tr>
<tr>
<td>% within ± 10° (both incl and ante)</td>
<td>91%</td>
<td></td>
</tr>
</tbody>
</table>

Conclusions
- Accurate placement of a personalised acetabular component orientation can be achieved utilising patient specific instrumentation.
- The reported technique is comparable to navigated results and superior to conventional free hand techniques.
- The potential clinical benefit of this technology is a reduction in both edge-loading-related wear and malorientation-related instability.

Disclosure: One or more of the authors are paid consultants to Corin Group. One of the authors is a shareholder of Corin Group.