84% of Cups are Placed Inside MGH Restricted Zone for MAKOplasty® THA Versus 47% for Manual THA

A Multicentric Evaluation of Acetabular Cup Positioning in Robotic Assisted THA

Study Summary

- 77 MAKOplasty THA cases from four surgeons were evaluated for acetabular cup positioning inside the MGH Restricted Zone (30°-45° inclination and 5°-25° version).
- Findings were compared to cup alignment results reported in Callanan et al’s John Charnley award-winning paper.²
- Post-op AP pelvic x-rays were evaluated using Martell Hip analysis software (2-D) and RIO® 3-D data.
- Based on RIO data (3-D), 96% of robotic arm assisted THA cases were inside the MGH Restricted Zone.
- The investigators attribute the difference between the RIO data and Martell readings (96% vs. 84%) to the fact that the Martell software:
  - Makes 3-D measurements using 2-D x-rays
  - Does not take pelvic tilt into account when measuring

Study Conclusion: Robotic arm assistance improves acetabular cup positioning
Why Cup Position Matters

Optimal Cup Positioning Increases Survivorship
A reduction in revision rate associated with proper positioning of the acetabular component has been reported by several authors.3,4

Proper Hip Center Placement Reduces Risk of Loosening
Yoder et al. reported an increased rate of femoral loosening when the center of rotation was superior and lateral versus the preferred medial and inferior cup placement, based on a review of long-term follow-up studies (average 9.1 years after surgery)5

Polyethylene Wear is Reduced with Accurate Cup Placement
Kennedy et al. found increased head migration and polyethylene wear in patients whose cups were positioned at an average of 61.9° of inclination versus patients with an average inclination angle of 49.7°. Wan et al. reviewed 139 primary THAs, and found increased wear rates for patients with cup inclination greater than 45°.6

Cup Malposition Leads to Increased Rate of Dislocation
Lewinnek et al. reviewed a series of 300 total hip replacements and found a reduced risk of dislocation for those acetabular components placed with anteversion of 15°±10° and lateral opening of 40°±10°.7 Computer simulation, finite element analysis (FEA) and various other clinical reviews have all confirmed that proper cup placement leads to reduced risk of dislocation.7,8-13

Improper Cup Positioning Causes Impingement
FEA and computer simulations have been used to replicate prosthetic impingement and have found that a cup position with 45° of abduction and 15° to 30° of anteversion (depending on approach) optimizes range of motion5,10

Who is Most Likely to Malposition?
Callanan et al. reviewed radiographs from over 1,823 hips that received THA between 2004 and 2008 at their institution. They found certain factors correlated to cup malposition, including minimally invasive surgical approach, surgeon inexperience, low volume of procedures, and obesity2.

References

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