

Accuracy of cup positioning and achieving desired hip length and offset following robotic THA

Seth A. Jerabek, MD, Kaitlin M. Carroll, BS, Joseph D. Maratt, MD, David J. Mayman, MD, Douglas E. Padgett, MD
 Adult Reconstruction & Joint Replacement, Department of Orthopaedic Surgery, Hospital for Special Surgery, New York, NY

Publication

Int J Med Robotics Comput Assis Surg. 2018; 1-8.

Introduction

- In total hip arthroplasty (THA), poor acetabular cup position can lead to instability, impingement, accelerated wear, and suboptimal hip mechanics.
- Similarly, leg length discrepancy after THA can contribute to poor hip function and patient dissatisfaction.
- Robotic THA has the potential to accurately place the cup, restore the center of rotation, and achieve the planned post-operative hip length and offset
- This study aims to determine the accuracy of the cup inclination, cup version, hip length and offset.

Material and methods

- Five surgeons performed THAs on 21 cadaveric hips using press-fit implant systems using one of three approaches (Table 1)
- A pre-operative CT of each hip was taken with 1mm slices of the full pelvis and proximal femur (to approximately 200mm below the lesser trochanter) and 5mm slices through the knee.
- Using the CT-based pre-op planning software, the surgeon then reviewed the cup and stem with options for stem type (standard or high-offset), head diameter, head length, and liner type (neutral or offset).
- At final reduction, the MAKO hip software displayed the final cup position, hip length and offset changes relative to both the pre-op native hip and contralateral hip.

Table 1. Methods

Surgeons=5	N=21
Approach	7 Posterior Lateral, 3 Anterior Lateral, 11 Direct Anterior
Pelvic Tracking	7 In-Wound, 14 Iliac Crest
Femoral Workflow	9 Express, 12 Enhanced

Methods

- Throughout the procedure implant positional values were recorded.
- At implantation, the MAKO hip software displayed the cup position, hip length, and offset changes relative to both the pre-op native hip and contralateral hip.
- Post-operative x-rays were performed, but accuracy measurements were measured on the CT scans.
- Post-operative CT scans were segmented into 3D models of the operative side pelvis, operative femur, contralateral femur, stem, and cup.
- Post-operative CT measurements were taken of the final cup position, hip length, and offset changes relative to both the pre-op native hip and contralateral hip.
- All of the post-op parameters were then compared with corresponding intra-operatively displayed and/or pre-operative planned values to determine the accuracy of the MAKO system.
- Absolute errors were calculated for each parameter.

Results

- Twenty-one robotic cadaver THAs were analyzed for cup position, hip length, and offset.
- Cup position vs. planned
 - M/L: 1.4 ± 1.1 mm
 - A/P: 1.3 ± 1.1 mm
 - S/I: 1.4 ± 1.2 mm.
- Cup orientation vs. intra-op plane:
 - Inclination: $2.7 \pm 2.2^\circ$
 - Version: $2.2 \pm 1.4^\circ$.
- Reduction results:
 - Hip length: 1.6 ± 1.2 mm
 - Combined offset: 1.3 ± 0.8 mm



Fig. 1
MAKO preoperative simulated surgical plan (left)

Fig. 2
AP Pelvis x-rays: preoperative radiograph (middle) and postoperative (right)

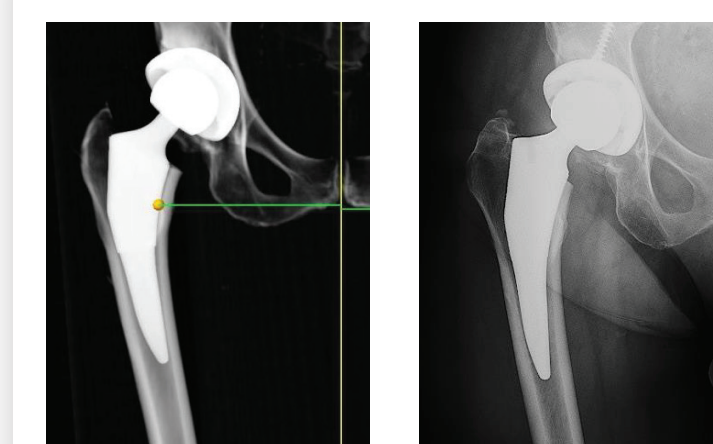


Fig. 3
Comparison of simulated pre-operative x-ray and post-operative x-ray

Conclusions

- Robotic THA provides excellent accuracy and precision with regard to planned cup position, hip length, and offset.

Reference:
 Perets I, Walsh JP, Close MR, Mu B, Yuen L, Domb BG. Robotic-arm assisted total hip arthroplasty: clinical outcomes and complication rate. Int J Med Robotics Comput Assis Surg. 2018; 1-8.

A surgeon must always rely on his or her own professional clinical judgment when deciding whether to use a particular product when treating a particular patient. Stryker does not dispense medical advice and recommends that surgeons be trained in the use of any particular product before using it in surgery.

The information presented is intended to demonstrate the breadth of Stryker's product offerings. A surgeon must always refer to the package insert, product label and/or instructions for use before using any of Stryker's products. The products depicted are CE marked according to the Medical Device Directive 93/42/EEC. Products may not be available in all markets because product availability is subject to the regulatory and/or medical practices in individual markets. Please contact your sales representative if you have questions about the availability of products in your area. Stryker Corporation or its divisions or other corporate affiliated entities own, use or have applied for the following trademarks or service marks: Stryker. All other trademarks are trademarks of their respective owners or holders.

This poster is not sponsored by or affiliated with the AAHKS.

MR07HA-POS-12_18065 © 2018 Stryker