Editorial



# Robotic-arm assisted total hip arthroplasty

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Despite the overall successful track record of total hip arthroplasty (THA), there is still the potential for complications related to component malpositioning, such as leg length discrepancy, dislocations and early implant failures (1). A robotic-arm or any other tool that can help increase surgical reliability through enhanced planning, accuracy and precision of component placement may therefore be of added value.

Qin and colleagues nicely highlight the use of a robotic-arm for THA. This operative technology has been recently introduced in China, and the authors describe their early adoption. Specifically, they discuss some of the potential advantages, such as increased accuracy in cup positioning and improved patient satisfaction, as well as the operative techniques, which included further details of enhanced planning, and the role of team members. The authors also demonstrate an operative case.

Robotic-arm assisted surgery was introduced in the United States many years ago, and has been associated with a number of potential advantages (2,3). Illgen *et al.* (4) compared robotic-arm assisted *vs.* manual THAs and found the rate of acetabular component placement within Lewinnek safe zones to be the highest in the robotic-arm assisted cohort *vs.* the manual THAs (77% *vs.* 30%; P<0.001). The group also found a 0% dislocation rate in the robotic-arm cohort, compared to a 5% in the manual THA cohort. Similarly, Elmallah *et al.* (5) evaluated 224 robotic-arm assisted THAs and found 99% of patients to have components within the pre-designated safe zone. Kamara *et al.* (6) found greater improvements in the precision of component positioning with adoption of the robotic-arm compared to adoption of fluoroscopic guidance.

Furthermore, Bukowski *et al.* (7) compared 100 robotic-arm *vs.* 100 manual THAs and found significantly lower estimated blood loss (374 *vs.* 423 mL, P=0.035) in the robotic-arm cohort, as well as significantly greater mean modified Harris Hip Scores (92 *vs.* 86 points, P=0.002), and mean UCLA activity scores (6.3 *vs.* 5.8 points, P=0.033) for robotic-arm assisted THA patients. Perets *et al.* (8) analyzed 181 robotic-arm assisted patients, and found these patients to have favorable short-term outcomes.

The robotic-arm has also been found to be advantageous for total knee arthroplasty (TKA). Specifically, the robotic-arm technique has been associated with enhanced component position accuracy and precision (9), ability to correct coronal deformities, even in severe cases (10), and protect surrounding soft-tissue (11,12).

In our clinical practice, we have utilized the robotic-arm extensively for hip and knee replacement, and agree with the technical tips and observations of Qin and colleagues, such as the importance of proper probing technique for osteoporotic bone during bone registration. We also agree that although the robotic-arm is a useful tool, the surgeon should maintain ultimate responsibility and control as he/she would during a manually performed THA.

Overall, as Qin and colleagues report, robotic-arm assistance for THA offers the potential for more reliable surgeries and outcomes. Current evidence demonstrates that this technology allows components to be placed more accurately and precisely at the surgeon's target. This can reduce post-operative complications, ultimately resulting in better patient function and greater patient satisfaction (7). Currently published studies report the results of surgeons who were early adopters of this new technology. We

look forward to further studies documenting the effect of robotic-arm assisted surgery on patient-centered outcomes in the hands of a larger and more diverse group of surgeons.

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## Footnote

*Conflicts of Interest:* MS Hepinstall: AAOS, Corin USA, KCI, Stryker; MA Mont: AAOS, Cymedica, DJ Orthopaedics, Johnson & Johnson, Journal of Arthroplasty, Journal of Knee Surgery, Microport, National Institutes of Health (NIAMS & NICHD), Ongoing Care Solutions, Orthopedics, Orthosensor, Pacira, Peerwell, Performance Dynamics Inc., Sage, Stryker: IP royalties, Surgical Technologies International, Kolon TissueGene. The other authors have no conflicts of interest to declare.

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