THA Functional Outcomes Are Independent of Acetabular Component Orientation When a Polyethylene Liner is Employed

Jacob Bobman, Jonathan Danoff, MD, Oladapo Babatunde, MD, Katie Peyser, Calvin Zhu, Jeffrey Geller, MD, William Macaulay, MD.
Center for Hip & Knee Replacement, Columbia University Medical Center, New York, NY, USA.

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Introduction: Long-term functional outcomes for patients undergoing total hip arthroplasty (THA) can be maximized by optimally positioning the acetabular component. Malalignment of the cup may increase hip instability. Lewinnek et al described the safe zone (LSZ) for cup placement as 30-50° abduction and 5-25° anteversion and Callanan et al revised the safe zone (CSZ) to 30-45° abduction and 5-25° anteversion. This study investigated the effect of acetabular component orientation on subjective functional outcomes. We hypothesized that a poorly aligned acetabular component will result in poor patient-scored functional outcomes.

Methods: After IRB approval, we prospectively followed a consecutive cohort of 500 primary THA cases (449 patients). Average follow up was 4.74 years. Two fellowship trained orthopaedic surgeons performed all procedures at a single institution. All articulations utilized a metal-on-polyethylene bearing couple. A posterior approach was used in 486 (97.2%) cases and an anterolateral approach in 14 (2.8%) cases. Component position was retrospectively measured using a validated computer-assisted method on routine pelvis radiographs by two independent blinded reviewers. Hips were categorized as being inside the LSZ or CSZ, or outside either zone. At the preoperative visit and each postoperative visit patients completed the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) questionnaire and Short Form 12 Health Survey (SF-12). Outcomes were compared to baseline measurements and correlated to component alignment.

Results: Average cup abduction was 43.1°±7.5° and anteversion was 13.3°±7.5°. 316 (63.2%) cups were within the LSZ and 233 (46.6%) were within the CSZ. 83 (16.6%) cups were located in the 45-50° abduction zone (AZ) included in the LSZ, but excluded from the CSZ. The figure shows a scatter plot of all patients included in the analysis, and LSZ and CSZ limits are marked on each axis (AZ is indicated by darker gray color). Overall, improvement was noted in WOMAC pain (p<0.0001), function (p<0.0001), and stiffness (p<0.0001) and SF-12 Physical Component (p<0.0001) and Mental Component (p=0.0002) from baseline. Improvement in pain was equivalent outside versus inside the LSZ (p=0.15) and CSZ (p=0.11) and between zones (p=0.75). No difference in pain improvement was noted comparing the AZ to LSZ (p=0.5304) and CSZ (p=0.4126). Cup position was not an independent risk factor for pain improvement (LSZ OR 0.91, 95% CI 0.57-1.43; CSZ OR 1.14, 95% CI 0.73-1.77) or SF-12 Physical Component improvement (LSZ OR 0.89, 95% CI 0.59-1.32; CSZ OR 0.92, 95% CI 0.63-1.34).

Discussion: In our study population, THA patients reported significantly improved WOMAC and SF-12 scores from baseline regardless of acetabular component orientation. No differences were found between the LSZ and CSZ or between cups inside either zone compared to malpositioned cups. Accurate
orientation of the acetabular component in the safe zone may not be critical to maximizing patient perceived outcomes. It is possible that the metal-on-polyethylene bearing couple may compensate for cup malposition or that other factors, such as femoral offset, quality of the hip abductor complex, and leg length may have a more significant effect.

**Significance:** Accurate positioning of the acetabular component within the safe zone of 5-25° anteversion and 30-50° abduction may not be critical to maximizing patient perceived outcomes.