Enhanced fixation surfaces do not improve acetabular cup survivorship in primary THA

Matthew Patrick Kelly, Richard Nick Chang, Heather Ann Prentice, Brian H Fasig, Andrew Kirk Battenberg, Liz Paxton

INTRODUCTION:
Enhanced fixation acetabular cups for total hip arthroplasty (THA) utilize a more porous surface and roughened texture to encourage improved initial stability and bony ingrowth compared to prior cups. This is purported to result in improved long-term fixation, which should result in a decreased revision risk for aseptic loosening. The purpose of this study was to compare overall survivorship and loosening of enhanced vs standard fixation cups, and secondarily we compared survivorship and loosening in identical cups that had both enhanced vs standard fixation options.

METHODS:
Data from a US-based healthcare system's Total Joint Replacement Registry was used to conduct a cohort study. Adult patients who underwent primary cementless THA using a highly crosslinked polyethylene liner between 2004-2024 were included. THA involving femoral head sizes 26 mm or less, a constrained or dual mobility liner, and acetabular cups with HA coating were excluded. The primary endpoint was aseptic revision where the acetabular cup was exchanged; loosening as a specific revision reason was considered as a secondary endpoint. Subanalyses compared outcomes for enhanced vs standard cups stratified by manufacturer, where both counterparts were used; one manufacturer with only enhanced cups represented in our cohort was not included. Multivariable Cox proportional hazards regression was used to evaluate revision risk by enhanced versus standard cups. Age, body mass index (BMI), sex, race/ethnicity, ASA classification, surgical indication, surgical approach, femoral head size and correlation by operating surgeon were included as covariates. Hazard ratios (HR) and 95% confidence intervals (CI) are presented. $p<0.05$ was considered statistically significant.

RESULTS:
143,035 primary THA performed by 496 surgeons at 67 healthcare centers comprised the study sample. 84,938 (59.4%) were performed using an enhanced cup. Cups were represented by 4 main manufacturers; Brand A: n=15682 cups; Brand B: n=89051; Brand C: n=8538; Brand D: n=27392. Mean age and BMI of the cohort was 66 years and 29.2 kg/m2, respectively. More THA were performed in females (56.4%) with an ASA classification <3 (64.1%). Most THA were performed through the posterior approach (55.3%).
At 10-years follow-up, crude cumulative incidence of aseptic revision where the cup was exchanged was 0.6% versus 0.5% for enhanced and standard cups, respectively (Figure 1). Incidence of loosening as the specific revision reason was 0.2% for enhanced versus 0.1% for standard cups. In adjusted analyses, a higher risk of revision was observed with the use of an enhanced cup compared to a standard cup (HR=1.51, 95% CI=1.21-1.89). No difference was observed between enhanced and standard cups when considering loosening as the reason for revision (HR=1.04, 95% CI=0.72-1.50). When comparing enhanced vs cups by manufacturer, no differences were observed in Brand A, C, and D, however, a higher risk of cup-sided revision was observed in B for enhanced vs standard cups (HR=1.54, 95% CI=1.15-2.05). Consistent with the overall analysis, no differences were observed for aseptic loosening across manufacturers.

DISCUSSION AND CONCLUSION:
We did not observe a benefit to overall survivorship or specifically for aseptic loosening in cups with enhanced fixation, either overall or within specific individual cups.

Figure 1: Crude cumulative incidence of cup revision (left) and aseptic loosening with cup revision (right) by THA cup type