Impact of Implant Design on Femoral Stem Migration following Direct Anterior and Direct Lateral Primary Total Hip Arthroplasty
Jennifer Polus, Maxwell Edward Perelgut, Edward Vasarhelyi, Matthew G Teeter, Brent Lanting

1LHSC - University Hospital, 2London Health Sciences Centre

INTRODUCTION:
Total hip arthroplasty (THA) is the only viable treatment for patients with end-stage osteoarthritis, with a growing demand to further improve patient function, minimize patient recovery times, and lower healthcare costs through rapid recovery care programs. Recently, the direct anterior approach (DAA) has been increasingly adopted by surgeons for its muscle-sparing nature compared to the intra-muscular direct lateral approach (DLA). Both surgical approaches support the use of either collared or collarless femoral stems. The objective of this study is to assess and compare implant stability between surgical approaches and implant designs. Secondarily, to determine if early patient recovery influences differences in implant migration.

METHODS:
Patients (n=100) undergoing primary THA for unilateral end-stage osteoarthritis using either the DLA or DAA approach were recruited and randomized to receive either a collared or collarless cementless femoral stem. On the day of surgery (DOS) and at six follow-up visits through to one year, patients underwent supine radiostereometric imaging, the gold standard for implant migration tracking. Preoperatively and at follow-up visits, patients completed patient-reported outcome measures (PROMs), performed the timed-up-and-go (TUG) walking test while instrumented with wearable sensors to assess their function, and logged an average daily step count to assess their activity levels. Patient function and patient activity were correlated to migration at all timepoints.

RESULTS:
Seventy-nine patients were assessed through to one-year postoperation. Forty-nine patients underwent the DAA, 23 of which received a collared stem and 26 received a collarless stem. Thirty patients underwent the DLA, 13 of which received a collared stem and 17 received a collarless stem. There were no differences in the demographics or PROMs between patient groups. Surgical approach had a significant effect on subsidence for both collared stems ($p = 0.031$) and collarless stems ($p = 0.002$). Stems within the DA group subsided more than stems in the DL group (mean difference = 0.786 mm, $p = 0.020$ for collared stems and mean difference = 3.136 mm, $p = 0.001$ for collarless stems) from the DOS to two-weeks postoperation but stabilized in both groups thereafter. Subsidence was significantly lower ($p = 0.010$) for collared stems compared to collarless stems within the DA group but was not different ($p = 0.894$) in the DL group. Migration was not correlated to function or activity at any timepoint.

DISCUSSION AND CONCLUSION:
Early functional ability and higher activity levels did not influence the magnitude of migration experienced in either group at any timepoint. The DAA experienced greater implant subsidence from DOS to two-weeks compared to the DLA for both implant designs, however the collared design mitigated the subsidence compared to the collarless design. Most subsidence occurred from the DOS baseline exam to two-weeks postoperation and stabilized thereafter, suggesting adequate fixation and a low risk for aseptic loosening in both groups.