Increased accuracy in alignment with robotic-arm assisted arthroplasty did not result in superior outcomes at 2-year follow-up

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INTRODUCTION: Precise component positioning and intraoperative soft tissue balancing is believed to allow robotic-arm assisted total knee arthroplasty (RAA-TKA) to achieve better patient outcomes. This study investigated the radiological and patient-reported outcomes of patients undergoing RAA-TKA versus conventional TKA at 2-year follow-up.

METHODS: Prospectively collected registry data of 75 conventional TKAs and 148 RAA-TKA at our institution was reviewed. A single-radius TKA implant was used by a single fellowship-trained surgeon in all cases. The 2-year follow-up rate was comparable in both groups (conventional: 76.0%, RAA-TKA: 83.1%). Propensity score matching (PSM: one case to one control) was done to match conventional TKA patients (*n=53*) to RAA-TKA patients (*n=53*) in a 1:1 ratio using the nearest neighbour method. Logistic regression generated propensity scores were used to adjust for confounding variables including age, gender, BMI, preoperative range of motion (ROM), Knee Society Scores (KSS) including Knee Society Knee (KSKS) and Knee Society Function Scores (KSFS), Oxford Knee Score (OKS) and Short Form-36 (SF-36) Physical (PCS) and Mental Component Scores (MCS). The range of motion, KSKS, KSFS, OKS, patellofemoral joint-related (PFJ) OKS subscores (3, 5, 7, 12), SF-36, satisfaction and expectation fulfilment were compared prior to operation, 6-months and 2-years. Minimal clinically important difference (MCID) attainment in KSKS, KSFS, OKS, SF-36 were also analysed. Postoperative hip-knee-ankle axis (HKA), component femoral angle (CFA) and component tibial angle (CTA) were compared. Surgical duration, complications and revisions were recorded.

RESULTS: There was significant improvement from baseline in all functional outcomes for both groups at 6-month and at 2-years ($p<0.05$). There were significantly fewer CFA radiological outliers (<87 or >93 degrees) in RAA-TKA ($p<0.05$). However, there were no significant difference in KSKS, KSFS, OKS, PFJ-OKS subscores, SF-36 or MCID attainment between the 2 groups (n.s). Both groups attained >95% expectation fulfilment and satisfaction rates at 2-years. At 6-months post-operation, there was a significantly higher satisfaction rate for RAA-TKA patients compared to conventional TKA patients ($p<0.05$). There was no significant difference in length of unilateral surgery for both groups (n.s). There were no significant differences in terms of surgical duration, complications or revisions between groups.

DISCUSSION AND CONCLUSION: Despite achieving more accurate alignment, RAA-TKA resulted in similar functional outcomes, MCID attainment, patellofemoral function and satisfaction when compared to conventional TKA. Increased alignment accuracy within 3 degrees of HKA, CFA or CTA did not contribute to superior outcomes. More research is needed to define alignment or soft-tissue balance targets for robotic-assisted TKA to demonstrate superiority over conventional TKA.