

Wearable Gait Monitoring Demonstrate Superior Functional Outcomes of Hip Resurfacing and Unicompartamental Knee Replacement Compared to Total Joint Arthroplasty: A Propensity-Matched UK Biobank Study

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INTRODUCTION:

Hip and knee arthroplasty surgeries, play a central role in reducing pain and restoring joint function. Despite advances in objective activity measurement using accelerometry, the comparative effectiveness of these procedures remains underexplored. This study aims to assess the physical activity outcomes following total hip replacement (THR), hip resurfacing (HR), unicompartamental knee replacement (UKR), and total knee replacement (TKR), compared to matched healthy controls.

METHODS: Data were obtained from the UK Biobank, including accelerometer records from participants aged 40–69 who wore Axivity AX3 devices for seven consecutive days. Validated machine learning algorithms were applied to classify activity intensity and extract physical activity metrics, including daily step count, cadence, acceleration, and moderate-to-vigorous physical activity (MVPA). Arthroplasty groups (TKR, UKR, THR, HR) were compared to healthy controls using propensity score matching (PSM), adjusting for age, sex, BMI, deprivation index, and comorbidities.

RESULTS:

A total of 2,283 participants were included (TKR: n=860; UKR: n=162; THR: n=1,168; HR: n=93). Patients who underwent TKR or THR demonstrated significantly lower activity levels compared to their propensity-matched non-arthritic controls. In contrast, UKR and HR patients demonstrated activity patterns broadly similar to those of their matched controls. Direct comparisons between procedures showed that UKR patients walked 1,530 more steps/day than TKR patients pre-matching (+20%, $p < 0.001$), with more MVPA (+37%, $p = 0.003$) and higher cadence ($p < 0.001$). After PSM, UKR patients retained a step count advantage (+1,000/day, $p < 0.001$) and higher cadence ($p = 0.005$), although MVPA differences were no longer significant. HR patients similarly outperformed THR patients: 1,360 more steps/day ($p < 0.001$), 43% more MVPA ($p < 0.001$), and higher cadence ($p = 0.014$). After matching, step count (+860/day, $p = 0.032$) and cadence ($p = 0.024$) remained significantly higher for HR vs. THR.

DISCUSSION AND CONCLUSION: UKR and HR were associated with higher levels of postoperative physical activity compared to TKR and THR, closely resembling healthy control levels. These findings reinforce the functional benefits of joint-preserving procedures and should inform both surgical selection and postoperative management strategies.