Tibial Baseplate Positioning in Robotic-Assisted and Conventional Unicompartmental Knee Arthroplasty

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INTRODUCTION: Tibial baseplate alignment (TBA) is an important factor in unicompartmental knee arthroplasty (UKA), particularly in fixed bearing designs as loosening has been a leading cause of failure. Surgeons aim to place the tibial component within a safe zone (SZ) of 0-3° varus and 3-9° posterior slope. Robotic-arm assistance (RAA) technology is believed to improve implant position over conventional techniques (CONV). The objective of this study was to compare TBA for varus and slope between both techniques. We hypothesized that RAA would improve TBA accuracy versus CONV, increasing the percentage of implants within the SZ.

METHODS: A consecutive cohort of 305 medial UKA cases was prospectively followed through our center’s patient registry. After excluding incomplete data sets, two cohorts of 177 CONV and 87 RAA were monitored through an average follow up of 2.7 years. Two fellowship-trained orthopaedic surgeons performed all procedures at a single institution. Two blinded reviewers retrospectively measured TBA on routine knee radiographs and determined the percentage of implants within the SZ. Failure was defined as cases that required revision surgery for mechanical causes.

RESULTS: Positioning the TBA within the SZ for varus was better for RAA (2.6 ± 1.5°) compared to CONV (3.9 ± 2.4°), (p<0.0001). Conversely, TBA within the SZ for slope was significantly better for CONV (4.9 ± 2.8°) compared to RAA (2.4 ± 1.6°), (p<0.0001). RAA was associated with increased precision for varus (p<0.0001) and slope (p<0.0001). The figure depicts each component’s alignment for RAA (open dot) and CONV (solid dot) and SZ boundaries are indicated (open square denotes failure). Twenty-three RAA knees (26%) were properly positioned compared to 48 (27%) of the CONV knees (p=1.0). Six of 10 failures occurred inside the SZ and seven of 10 failures occurred in CONV knees. TBA was an independent risk factor for failure (OR 4.36, 95% CI 1.2-15.9), but surgical technique was not a risk factor (OR 0.9, 95% CI 0.2-3.4). Six of nine failures occurred with more than 6° posterior slope, although readjusting the SZ limits for slope to 3-6° failed to show statistical significance (OR 3.1, 95% CI 0.7-14.3). Operative time for RAA (103.7 ± 19.7) was significantly longer than CONV (87.1 ± 15.0) by 16.6 minutes, (p < 0.0001).

DISCUSSION AND CONCLUSION: RAA did not improve the percentage of tibial components positioned within the SZ as compared to CONV. However, precision for varus and slope was significantly improved in the RAA group, as was accuracy for varus. The data suggests that a slope of more than 6° is associated with a higher likelihood of implant failure, however no statistical differences were found. RAA also significantly lengthened operative time over CONV. RAA did not improve overall TBA over CONV and

may add unnecessary time and cost to this procedure.