

Functional vs Kinematic Knee Alignment in Total Knee Arthroplasty, A Two-Years Follow-Up Study, of Clinical and Radiological Outcomes.

Purpose: Total knee arthroplasty is a common orthopedic procedure. Various alignment strategies exist, including mechanical alignment (MA), and kinematic alignment (KA). While MA has been the gold standard, KA demonstrated improved outcomes and faster recovery by replicating native knee kinematics. Functional alignment (FA), a novel approach integrating preoperative images, computer-assisted surgery, and intraoperative soft tissue balance for implant positioning. FA restores native joint line and medial pivot mechanics while preserving key ligamentous structures. Early studies suggest FA may provide superior balance and stability; functional outcomes and patient satisfaction is under investigation. This study aims to compare the functional, clinical and radiological outcomes of kinematic vs functional alignment in TKA performed at a tertiary care center.

Methods: Retrospective cross-sectional study, conducted at a tertiary hospital in Riyadh, Saudi Arabia. Eligible patients were those who underwent robotic-assisted KA or FA TKA with adequate follow-up data. Descriptive analysis summarized demographic data. Pre and postoperative radiographs and weightbearing scanograms evaluated implant position and limb alignment parameters. To compare outcomes between the two groups, independent t-tests were used for continuous variables, and Chi-square or Fisher's exact tests were used for categorical variables. Paired t-tests were utilized to assess within-group changes from pre to post-operative outcome scores Knee Injury and Osteoarthritis Outcome Score (KOOS), Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), and Forgotten Joint Score (FJS). The p-value of <0.05 was considered statistically significant.

Results: Total of 116 patients, majority were females 93 (80.2%), mean age of 63.8 years. Equal distribution between KA and FA. Mean range of motion was 0-115. Preoperatively, KOOS was significantly higher in the KA group (20.26 ± 2.52) compared to FA group (15.7 ± 10.2 , $p=0.001$). Both groups showed significant improvement of KOOS, FJS and WOMAC scores from preoperative scores, with comparable post-operative scores between the two groups. Majority were classified as CPAK 1, which was restored to CPAK 2 or CPAK 5 in 23 (59.0%) among KA, and in 16 (41.0%) among FA. Both KA and FA were noted to remain in slight knee varus post operatively (1.48 and 0.67), respectively.

Conclusion: Both KA and FA, yielded comparable results, with no superiority of each technique over the other. With less need for soft tissue release and less invasive bony cuts, FA and KA offered superior clinical, functional and radiological results, than those reported in MA.