Which is the Best Total Knee Arthroplasty Alignment Philosophy? A Network Meta-Analysis of Randomized Controlled Trials

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INTRODUCTION: Although various total knee arthroplasty (TKA) philosophies exist, with different component and limb alignment targets, there is no consensus on which is superior. This study compared outcomes among randomized controlled trials (RCTs) of TKAs performed to achieve mechanical (MA), anatomical (AA), kinematic (KA), restricted KA (rKA), and functional alignment (FA).

METHODS: Scopus, Ovid/MEDLINE, PubMed, Cochrane Database of Systematic Reviews, and Cochrane Central Registry of Controlled Trials were queried in April 2025. A frequentist model network meta-analysis of eligible prospective RCTs assessed complications, revisions, and patient-reported outcomes (PROs) using P-scores.

RESULTS: Among 3605 studies, 22 RCTs totaling 1411 patients (1428 primary TKAs) with median (IQR) age of 68.2 years (6.8) and follow-up of 29.1 months (48) were included for meta-analysis. The distribution of alignment philosophies was MA (*n*=708, 49.6%), AA (*n*=101, 7.1%), KA (*n*=394, 27.6%), rKA; (*n*=160, 11.2%), or FA (*n*=65, 4.6%). Compared to MA, mean KSS knee score improvements from baseline were statistically lower (worse) with AA (MD -0.503; 95% CI -0.96 to -0.04; *p*=0.0320) and KA (MD -0.623; 95% CI -1.07 to -0.18; *p*=0.006), and mean KSS combined changes were statistically lower (worse) with KA (MD -0.314; 95% CI -0.55 to -0.08; *p*=0.009) compared to MA. However, each statistically significant change had high heterogeneity and failed to reach the MCID. There were no significant changes in mean WOMAC, KSS function, Oxford Knee, or Forgotten Joint scores among each alignment philosophy. In addition, postoperative knee flexion, complications, and reoperation rates with or without implant removal were similar among all techniques.

DISCUSSION AND CONCLUSION: This study found no clinically-meaningful difference in PROs nor complication rates among TKA alignment philosophies, supporting comparable short to mid-term outcomes. However, longer follow-up is required to accurately assess implant failure and revision rates.