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No Difference in 2-Year Functional Outcomes Using Kinematic Versus Mechanical Alignment in TKA: A Randomized Controlled Clinical Trial

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Summary:
In this randomized controlled trial, no difference in 2 year functional outcome was seen between kinematic versus mechanical alignment in TKA.

Abstract:
Background
Neutral mechanical alignment (MA) in total knee arthroplasty (TKA) aims to position femoral and tibial components perpendicular to the mechanical axis of the limb. In contrast, kinematic alignment (KA) attempts to match implant position to the prearthritic anatomy of the individual patient with the aim of improving functional outcome. However, comparative data between the two techniques are lacking.
Questions/purposes
In this randomized trial, we asked (1) Are 2-year patient-reported outcome scores enhanced in patients with KA compared with an MA technique? (2) How does postoperative component alignment differ between the techniques? (3) Is the proportion of patients undergoing reoperation at 2 years different between the techniques?
Methods
Ninety-nine primary TKAs in 95 patients were randomized to either MA (n = 50) or KA (n = 49) groups. A pilot study of 20 TKAs was performed before this trial using the same patient-specific guides positioning in kinematic alignment. In the KA group, patient-specific cutting blocks were manufactured using individual preoperative MRI data. In the MA group, computer navigation was used to ensure neutral mechanical alignment accuracy. Postoperative alignment was assessed with CT scan, and functional scores (including the Oxford Knee Score, WOMAC, and the Forgotten Joint Score) were assessed preoperatively and at 6 weeks, 6 months, and 1 and 2 years postoperatively. No patients were lost to followup. We set sample size at a minimum of 45 patients per treatment arm, based on a 5-point improvement in the mean OKS (the previously reported minimum clinically significant difference for the OKS in TKA), a pooled SD of 8.3, 80% power, and a two-sided significance level of 5%.
Results
We observed no difference in 2-year change scores (postoperative minus preoperative score) in KA versus MA patients for the Oxford Knee Score (mean 21.4 SD 7.9 vs 20.4 SD8.3, least square means 1.0 95% confidence interval [CI] -1.4 - 3.4, p = 0.4), WOMAC score (mean 38 SD17.8 vs 35 SD 8.3, least square means 2.8 95% CI -3.2 – 8.9 p = 0.3), or Forgotten Joint score (28.4 SD 37 vs 27.6 SD28, least square means 0.8 95%CI -9.1-10.7 p = 0.8). Postoperative hip-knee-ankle axis was not different between groups (mean KA 0.4° varus SD 3.5 versus MA 0.7° varus SD 2.0), but in the KA group, the tibial component was a mean 1.9° more varus than the MA group (95% CI, 0.8°-3.0°, p = 0.003) and the femoral component in 1.6° more valgus (95% CI, -2.5°to -0.7°, p = 0.003). Complication rates were not different between groups.
Conclusions
We found no difference in 2-year patient-reported outcome scores in TKAs implanted using the KA versus an MA technique. The theoretical advantages of improved pain and function that form the basis of the design rationale of

KA were not observed in this study. Currently, it is unknown if the alterations in component alignment seen with KA will compromise long-term survivorship of TKA.