Title: Effect of TKA Alignment on Post-Operative Patient Reported Outcomes and Range of Motion

Authors: Jennifer Liu, MD; Bradley Lambert, PhD; Pradyumna Gurusamy, MD; Thomas Sullivan; Terry Clyburn, MD; Stephen Incavo, MD

Introduction: During total knee arthroplasty (TKA), it is common practice to correct coronal malalignment (varus/valgus) intraoperatively. However, the ideal target alignment of TKA post-operatively is still widely debated and varies between surgeons. Many surgeons aim for neutral alignment $(0° \pm 2)$, while others aim for slight valgus alignment, and others aim to match the alignment of the native knee without any correction. However, little data exists on the effect of TKA coronal alignment on patient reported outcomes (PROs) postoperatively, especially when looking at degree of change from pre-operative to post-operative alignment. The purpose of this investigation was to compare patient reported outcomes (PROs) and knee range-of-motion (ROM) following TKA for varus and valgus patients corrected to either neutral, under correction, or cross over. **Methods:** This was a single institution retrospective analysis, all patients who underwent primary TKA by 4 joint reconstruction orthopedic surgeons from 2016-2022 were assessed for eligibility. 2308 patients were identified, exclusion criteria were applied, and 409 patients were included in the final cohort. Coronal knee alignment was measured using full leg length radiographs taken pre- and post-operatively. Patients were divided into those with pre-operative varus (>0°) and valgus (<0°) alignment and then further divided based on post-operative alignment. Neutral alignment (NEUT) was defined as post-operative alignment within $0° \pm 2$. Under Correction (UC) and Cross Over (CO) was defined as >2° of under or over correction from neutral. KOOS JR survey scores were taken at pre-op and at 6-weeks, 3-months, 6-months, and 1-year post-op visits. ROM measures were also collected at 2-weeks, 6-12 weeks, and >6-months post-op. An ANOVA repeated on time was used to compare PROs and ROM measures followed by a Bonferroni post-hoc test for pairwise comparisons. Significance was set at $p<0.05$ for all analyses. **Results:** The 409 patients included in this study had a mean age of 68.3 ± 8.1 years, mean BMI of 31.0 ± 6.1, and had a gender ratio of 62.3% female. Out of the 288 patients that had pre-op varus alignment, 143 had post-op neutral alignment, 98 were under corrected, and 47 had crossed over into valgus alignment (Table 1). Out of the 121 patients that had pre-op valgus alignment, 50 had post-op neutral alignment, 50 were under corrected, and 21 had crossed over into varus alignment. For pre-op varus patients, those in the CO group were observed to have lower KOOS JR scores at 3-months, 6-months, and 1-year post-op compared to those in the NEUT group (Figure). CO group patients were more likely to have reduced flexion ROM at 6-12 weeks post-op compared to NEUT and UC ($p<0.05$). For valgus patients, no differences in KOOS JR scores were observed. However, those in the UC group were observed to have reduced knee flexion at 6-12 weeks post-op. **Discussion:** For pre-op varus patients, crossing over into valgus resulted in worse PROs and ROM compared to those corrected to neutral or under corrected. While no differences were observed for PROs within valgus patients, those left in valgus via under correction had worse ROM in the early stages of rehabilitation. **Clinical Significance:** Crossing over from varus to valgus TKA alignment should be avoided and may result in worse patient reported outcomes and ROM post-operatively. These findings suggest that for both pre-op varus and pre-op valgus patients, the ideal target alignment should be neutral or slightly varus.

PRE-OP VARUS ALIGNMENT			
	Post-Op NEUTRAL	Post-Op UNDERCORRECT	Post-Op CROSSOVER
N	143	98	47
Pre-Op Alignment (deg.)	6.00° ± 3.65	8.71° ± 5.65	5.12° ± 4.50
Post-Op Alignment	0.36° ± 1.13	4.86° ± 2.32	-4.03° ± 1.95
PRE-OP VALGUS ALIGNMENT			
	Post-Op NEUTRAL	Post-Op UNDERCORRECT	Post-Op CROSSOVER
N	50	50	21
Pre-Op Alignment (deg.)	-5.78° ± 5.22[a]	-6.56° ± 4.06[a]	-7.89° ± 4.84[a]
Post-Op Alignment	-0.16° ± 1.26[a]	-4.39° ± 1.39	3.65° ± 2.07

Figure: Patient Reported Outcomes and Knee Range of Motion