

Larger changes in arthritic hip-knee-ankle angle were associated with postoperative lateral laxity and worse patient-reported outcomes in coronal plane alignment of the knee type I

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INTRODUCTION: In the coronal plane alignment of the knee (CPAK) classification by MacDessi et al., CPAK type I is associated with worse soft tissue balance and worse clinical outcomes when total knee arthroplasty (TKA) is performed using mechanical alignment (MA) compared with kinematic alignment. However, there is known to be a large differences and wide distributions in the degree of varus as measured by arthritic hip-knee-ankle angle (aHKA) and joint line obliquity (JLO) among patients with CPAK type I. Hence, in MA TKA, the clinical benefit of surgery may vary depending on the degree of preoperative constitutional varus. We hypothesized that larger pre- to postoperative change in aHKA would result in increased postoperative lateral laxity and worse patient-reported outcome measures (PROMs) in CPAK type I. Accordingly, the purpose of this study was to evaluate the association between changes in aHKA and postoperative joint laxity or PROMs in patients with CPAK type I.

METHODS: Subjects were 111 consecutive knees of 92 patients with osteoarthritis who underwent primary TKA (Smith & Nephew JourneyII, Memphis, TN) between April 2017 and March 2021. During this period, robotic-assisted TKA was not performed at our institution, and mechanically aligned TKA was performed in all cases. According to the CPAK classification, 80 knees (72.1%) were the CPAK type I phenotype (constitutional varus, Figure 1). The pre- to postoperative change in aHKA was defined as Δ aHKA. The knees were divided into a larger Δ aHKA group ($> 7^\circ$) and a smaller Δ aHKA group ($\leq 7^\circ$). PROMs including the Knee Society Score (KSS) and Forgotten Joint Score-12 (FJS-12) were obtained preoperatively and at 2 years postoperatively. As with Δ aHKA, the pre- to postoperative changes in PROMs were defined as Δ KSS and Δ FJS-12. Pre- and postoperative joint laxity was assessed using an arthrometer (Telos SD 900 Stress Device, Telos Medical Co., Ltd., Campbell, CA). Joint laxity was defined as the angle between the line through the distal convex margin of the femoral condyles and the tibial boundary, which is deemed to be positive if the lateral gap is greater than the medial gap under varus stress. Two independent blinded observers (K.Y., J.I.) assessed aHKA, and intra- and interobserver reliability was evaluated. Descriptive statistics are reported as the mean (standard deviation) or number (percentage).

RESULTS SECTION: Mean age at surgery was 72.9 (7.1) years, and 20 patients (25.0%) were male. Mean preoperative aHKA was -6.4 (2.6), mean postoperative aHKA was -0.9 (2.4), and mean Δ aHKA was 5.4 (3.2). Twenty-two knees showed a larger Δ aHKA ($> 7^\circ$), and these patients has significantly greater postoperative lateral joint laxity in varus stress than those with smaller Δ aHKA (6.8° vs. 4.5° , $p=.006$). In addition, the larger Δ aHKA group showed worse Δ KSS and Δ FJS-12, but these were not statistically significant (Table 1). Intra-observer reliability was 0.91, and inter-observer reliability was 0.82.

CONCLUSION: Greater aHKA changes were associated with postoperative lateral laxity and worse PROMs compared with smaller aHKA changes in CPAK type I.

SIGNIFICANCE/CLINICAL RELEVANCE: In cases of severe varus knee, kinematic alignment TKA might be preferred over MA TKA.

REFERENCES: [1] MacDessi SJ et al., BJJ 2020, [2] Dossett HG et al., BJJ 2014, [3] Toyooka S et al., JKS 2023

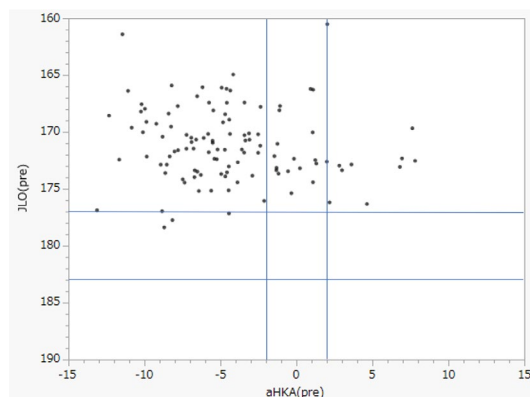


Figure 1. Distribution of native coronal plane alignment of the knee phenotype in this study (n = 111).

	Larger Δ aHKA group ($> 7^\circ$, n=22)	Smaller Δ aHKA group ($\leq 7^\circ$, n=58)	p-value
Age, years	74.9 (5.2)	72.3 (7.5)	0.17
Male, n (%)	6 (27.3)	14 (24.1)	0.77
Preoperative varus stress, deg	6.9 (2.4)	6.5 (2.4)	0.47
Postoperative varus stress, deg	6.2 (2.4)	4.4 (2.0)	0.006
Δ aHKA, deg	9.6 (2.2)	3.9 (1.8)	<0.001
Δ KSS total	49.7 (35.8)	56.4 (30.9)	0.39
Δ FJS-12	34.3 (28.3)	40.2 (24.4)	0.23

Table 1. Patient characteristics, radiological data, and changes in PROMs