Short-term Outcomes of Femoral Internal Rotation with Robotic-Assisted Total Knee Arthroplasty

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INTRODUCTION: Robotic-assisted total knee arthroplasty (RA-TKA) allows for intra-operative adjustment of component position for alignment and gap balancing in extension and flexion. While classic teaching has been to avoid femoral component internal rotation, robotic-assisted ligament balancing can suggest internally rotating femoral components to improve flexion balance. We sought to determine whether it is safe to internally rotate the femoral component and to explore any limits on safe internal rotation in combination with coronal plane alignment.

METHODS: We retrospectively reviewed 933 RA-TKA cases performed using a CT-based robotic planning software combined with a single radius femoral component with a 6° trochlear sulcus angle from January 2023 to August 2024. Planned femoral component rotation and coronal implant positioning were collected from the robotic software. Femoral component rotation was defined as internal (IR) and external rotation (ER) relative to the transepicondylar axis (TEA). Femoral component coronal alignment was defined as varus (Var) or valgus (Val) relative to the mechanical axis. RA-TKAs were categorized into Var-ER, Val-ER, Var-IR, and Val-IR. Patient reported outcome measures (PROMs) were collected at 6-week, 3-month, and 1-year post-operative; these included KOOS, JR and PROMIS scores. Demographics and outcomes were collected and analyzed using ANOVA, independent samples t-tests, and Chi-square tests.

RESULTS: There were 445 (48%) Var-ER, 242 (26%) Val-ER, 105 (11%) Var-IR and 141 (15%) Val-IR cases in each cohort. The KOOS, JR at 6-weeks was lowest in the Var-IR cohort (52.7, P<0.03), while at 3-months and 1-year showed no difference between cohorts. The change in KOOS, JR from preoperative to 1-year was the greatest for the Val-IR cohort (27.9), though this was not associated with statistical significance. There were no additional differences in PROMIS pain intensity, pain interference, and physical function scores at 6-weeks, 3-months and 1-year between cohorts. There were three patella-related complications, two of which had further reoperations, all occurring in the Val-IR cohort (P<0.001).

DISCUSSION AND CONCLUSION: While planned femoral component internal rotation had no difference in 6-month and 1-year KOOS, JR and PROMIS scores for RA-TKA, all patella-related complications occurred in the Val-IR cohort. We caution surgeons from placing excessive combined valgus and internal rotation with femoral implants designed with more narrow trochlear sulcus angles.

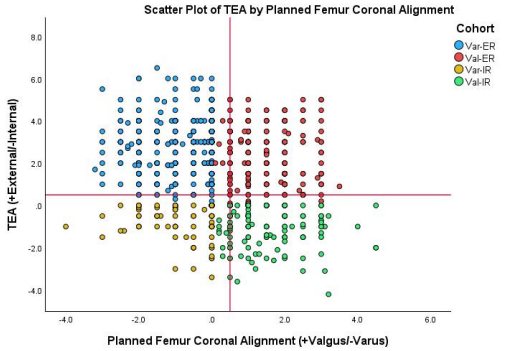

Table 1. Clinical Outcomes and PROMs

	Varus External (n=445)	Valgus External (n=242)	Varus Internal (n=105)	Valgus Internal (n=141)	
	Mean (range)	*Mean (range)*	*Mean (range)*	*Mean (range)*	*P*-value
Readmissions	4 (0.9)	3 (1.2)	2 (1.9)	3 (2.1)	0.652
90-day	4 (0.9)	3 (1.2)	2 (1.9)	2 (1.4)	0.837
Reoperations	25 (5.6)	11 (4.5)	6 (5.7)	7 (5)	0.934
90-day	15 (3.4)	5 (2.1)	1 (1)	4 (2.8)	0.498
Patella	0 (0)	0 (0)	0 (0)	2 (1.4)	**0.010**
Patella Complications	0 (0)	0 (0)	0 (0)	3 (2.1)	**<0.001**
MUA	24 (5.4)	7 (2.9)	4 (3.8)	4 (2.8)	0.347
KOOS, JR 6-Week	**(n=38)**	**(n=30)**	**(n=130)**	**(n=54)**	
Preop	49.0 (4.0 - 68.0)	47.1 (0.0 - 67.0)	43.6 (0.0 - 85.0)	42.9 (0.0 - 71.0)	0.076
6-Week	58.6 (34.0 - 73.0)	57.7 (34.0 - 73.0)	52.7 (0.0 - 79.0)	55.1 (34.0 - 76.0)	**0.031**
Δ Preop-6-Week	9.6 (-16.0 - 38.0)	10.6 (-21.0 - 42.0)	9.1 (-32.5 - 62.5)	12.1 (-37.0 - 57.0)	0.549
KOOS, JR 3-Month	**(n=22)**	**(n=22)**	**(n=112)**	**(n=47)**	
Preop	50.1 (21.0 - 68.0)	44.8 (0.0 - 67.0)	44.2 (0.0 - 85.0)	42.6 (8.0 - 71.0)	0.171
3-Month	62.4 (47.0 - 85.0)	60.8 (37.0 - 92.0)	62.8 (34.0 - 100.0)	65.5 (44.5 - 92.5)	0.439
Δ Preop-3-Month	12.3 (-21.0 - 40.0)	16.0 (-8.0 - 68.0)	18.6 (-10.0 - 90.2)	22.8 (-21.0 - 64.0)	0.110
KOOS, JR 1-Year	**(n=9)**	**(n=14)**	**(n=35)**	**(n=13)**	
Preop	53.3 (42.0 - 68.0)	47.3 (0.0 - 66.0)	43.7 (0.0 - 66.0)	45.5 (25.0 - 55.0)	0.358
1-Year	66.8 (52.0 - 73.0)	67.1 (34.0 - 100.0)	70.1 (45.0 - 100.0)	73.4 (56.5 - 100.0)	0.624
Δ Preop-1-Year	13.5 (-16.0 - 29.0)	19.8 (-1.0 - 62.0)	26.5 (3.4 - 92.0)	27.9 (8.8 - 75.0)	0.083