

Does Implant Choice Affect Early Range of Motion Following Total Knee Arthroplasty? A Retrospective Comparative Study

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INTRODUCTION: Early range of motion (ROM) is integral to functional recovery and satisfaction following total knee arthroplasty (TKA), with most improvement achieved within the first 6–12 weeks. Despite advances in surgical technique, up to 20% of patients remain dissatisfied after TKA, often due to persistent stiffness or functional limitations. Implant design, particularly designs intended to better replicate native knee kinematics, has been proposed as a means to improve early recovery. However, evidence remains mixed regarding whether implant choice significantly impacts early ROM. Therefore, this study evaluates 6-week ROM across multiple implant types in a single-surgeon cohort to help guide shared decision-making.

METHODS: In this IRB-approved retrospective chart review, we identified 570 primary TKAs (performed between June 2024 - June 2025) with complete preoperative, 2-week, and 6-week follow-up data. Implants included DePuy Attune Trumatch (DAT) (n=203), Zimmer Persona PSI (ZPSI) (n=186), Zirc Journey Visionaire (ZJV) (n=142), and various others (n=39). Primary outcomes were 6-week postoperative flexion, extension deficit, and total ROM arc. Predictors included implant type, age, body mass index (BMI), sex, diabetes mellitus (DM), renal disease (RD), deep-vein thrombosis (DVT), contralateral TKA history, and baseline/2-week flexion and extension ROM. Analyses included ANOVA, ANCOVA, and multivariable linear regression. Secondary analysis examined weekly ROM gain (between 2–6 weeks). Significance was set at p<0.05.

RESULTS: The cohort (mean age 68.2±8.2 years; BMI 31.1±5.2 kg/m²; 42.1% male) (Figure 1) showed no significant unadjusted differences in 6-week postoperative ROM (p=0.788) or flexion (p=0.794) across implants (Figure 2). ANCOVA adjusted for covariates confirmed implant type as non-significant (p=0.695), while age (p=0.012), BMI (p=0.00033), male sex (p=0.012), and preoperative ROM (p<0.001) were significant predictors of reduced flexion. Multivariable regression identified higher 2-week ROM (p<0.001), lower BMI (p<0.001; negative), male sex (p=0.0003; positive), and higher preoperative ROM (p<0.001). ZPSI demonstrated a modest but significantly higher 6-week ROM compared to DAT (+5.18°, p=0.032) and higher flexion (+4.86°, p=0.032) (Figure 3). Rate-of-recovery analysis identified BMI (p<0.001; negative), male sex (p<0.001; positive), preoperative ROM (p<0.001; positive), and 2-week ROM (p<0.001; negative ceiling effect) as significant predictors. Comorbidities (DM, RD, DVT) were not independent predictors, and implant-DM interaction was not significant (p=0.129).

DISCUSSION: These findings are consistent with prior studies showing that early functional gains after TKA are driven predominantly by patient-specific factors, particularly BMI, sex, and baseline ROM, rather than implant selection. While no implant demonstrated large or consistent advantages, ZPSI provided small but statistically significant benefits in absolute ROM and rate of recovery, consistent with studies suggesting potential kinematic and early functional advantages of anatomically contoured implants. Our results suggest that perioperative strategies should emphasize optimization of modifiable risk factors and early indication of lagging progress at 2 weeks, while acknowledging that certain implant designs may confer modest early benefits. Future prospective, randomized trials should validate these findings over longer follow-up to determine whether early advantages persist and translate into improved mid and long-term outcomes.

SIGNIFICANCE/CLINICAL RELEVANCE: Early postoperative ROM is a key determinant of functional recovery and patient satisfaction after TKA. This study reinforces that modifiable patient-specific factors such as BMI and early ROM trajectory have greater influence on early outcomes than implant selection, providing actionable targets for perioperative optimization and rehabilitation planning.

Table 1. Patient Demographics

Variable	Value
Number of patients	570
Age, mean ± SD (years)	68.1 ± 8.2
Gender, n (%) male	240 (42.1%)
BMI, mean ± SD (kg/m ²)	31.1 ± 5.2
Diabetes, n (%)	82 (14.4%)
Renal disease, n (%)	30 (5.3%)
History of DVT, n (%)	35 (6.1%)
Contralateral TKA, n (%)	140 (24.6%)

Table 2. Six-Week ROM Outcomes by Implant Type

Implant	6-week Flexion (°)	6-week Extension Deficit (°)	6-week ROM Arc (°)	n
Depuy Attune Trumatch	124.7 ± 10.7	0.1 ± 0.7	124.6 ± 10.7	203
Zimmer Persona PSI	124.3 ± 12.4	0.4 ± 2.0	123.9 ± 13.0	186
Zirc Journey Visionaire	124.0 ± 10.0	0.4 ± 1.9	123.6 ± 10.4	142
Conformis	122.5 ± 12.4	0.0 ± 0.0	122.5 ± 12.4	16
Zirc Journey Brainlab	128.6 ± 6.9	0.0 ± 0.0	128.6 ± 6.9	7
Zirc Journey XR	128.6 ± 14.1	0.7 ± 1.9	127.9 ± 14.4	7
Depuy Attune Brainlab	121.0 ± 6.5	0.0 ± 0.0	121.0 ± 6.5	5
Zimmer Persona Brainlab	128.8 ± 7.5	0.0 ± 0.0	128.8 ± 7.5	4
Overall	124.4 ± 11.1	0.3 ± 1.6	124.1 ± 11.4	570

Table 3. Multivariable Analysis: Predictors of 6-Week ROM (p-values)

Variable	p-value
Pre-Op ROM (°)	**<0.001**
2-Week ROM (°)	**<0.001**
BMI (kg/m ²)	**<0.001**
Age (years)	0.1365
Male sex	**<0.001**
Diabetes	0.7916
Renal disease	0.1249
History of DVT	0.8863
Contralateral TKA	0.5369
Implant type (Zimmer Persona PSI vs DePuy Attune Trumatch)	**0.0283**
Other implants vs DePuy Attune Trumatch	0.2365