

Patellofemoral Alignment Following Total Knee Arthroplasty: A Radiographic Analysis of 300 Patients with Two Implant Designs

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INTRODUCTION: With large variations in patient patellofemoral trochlear morphology, implant selection may be a critical factor influencing clinical outcomes following primary total knee arthroplasty (TKA). In addition, the decision to resurface the patella during TKA remains controversial. Recent studies have reported progressive osteosclerosis at the patella following TKA without patellar resurfacing, along with increased revision rates. It is hypothesized that patellofemoral complications following TKA could be due to (1) variations in trochlear geometries of implant designs, and (2) decreased patellofemoral congruency in the case of non-resurfacing. Therefore, the objective of this study was to analyze the changes in patellofemoral alignment following TKA making two different comparisons: (1) a symmetrical femoral component vs. an asymmetrical design, and (2) patellar resurfacing vs. non-resurfacing TKAs.

METHODS: After obtaining IRB approval, a retrospective analysis of 300 patients (67.9 ± 9.2 years old) who underwent primary TKA in our department was conducted. The patients were categorized into three groups based on the implant design and if the patella was resurfaced. One hundred patients received the Total Joint Orthopedics (TJO) Klassic implant with patellar resurfacing (Group I), another 100 received the Stryker Triathlon implant with resurfacing (Group II), and the final 100 were Stryker Triathlon without resurfacing (Group III). Preoperative and postoperative radiographic images were retrospectively evaluated by three independent observers using Fujifilm Cloud Viewer v7.4.020. After controlling for mediolateral positioning of the femoral components, the patellar position and orientation were quantified based on four radiographic measures: patellar overstuffing, patellar tilt, joint space, and patellar lateral displacement (Figure 1). The intraclass correlation coefficient (ICC) was calculated to assess inter-rater reliability. Differences in the measures were compared between implant designs and patellar resurfacing status using unpaired t-tests with statistical significance set at $p < 0.05$.

RESULTS: From the perspective of implant design, post-op patellar overstuffing and patellar tilt were significantly higher in the symmetric design (Group I) compared to the asymmetric design (Group II) (Table 1). When comparing resurfacing status, no significant differences were observed between Groups II and III except patellar lateral displacement (Figure 2). Within the resurfacing comparison, patellar position between pre- and post-op conditions was observed: patellar overstuffing and joint space were significantly lower post-op, but patellar tilt was significantly higher post-op. Patellar lateral displacement was significantly higher post-op in non-resurfaced patellae only.

DISCUSSION: Different trochlear design of femoral components can have a large impact on patellofemoral alignment following TKA, but the effects of patellar resurfacing are limited. A limitation of this study was the short post-op time frame in which the measurements were conducted, failing to consider long-term outcomes. Literature cites higher revision rates with non-resurfaced patellae long-term. Further extensions of this study would include tracking patient-reported outcome measures or range of motion over time with various implants and resurfacing rates.

SIGNIFICANCE/CLINICAL RELEVANCE: The results are expected to determine whether certain TKA implant designs replicate the native trochlea more closely, leading to fewer complications like patellar maltracking, anterior knee pain, crepitus, and limited range of motion.

IMAGES AND TABLES:

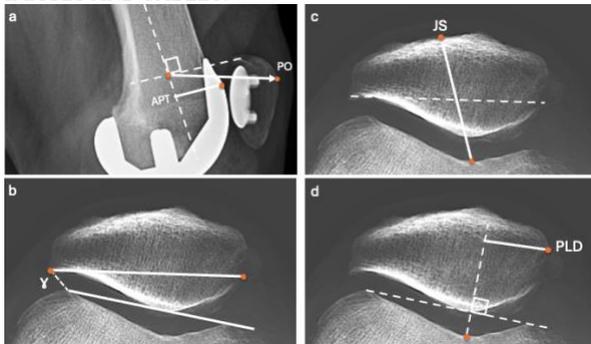


Figure 1. Radiographic measurements of patellar position

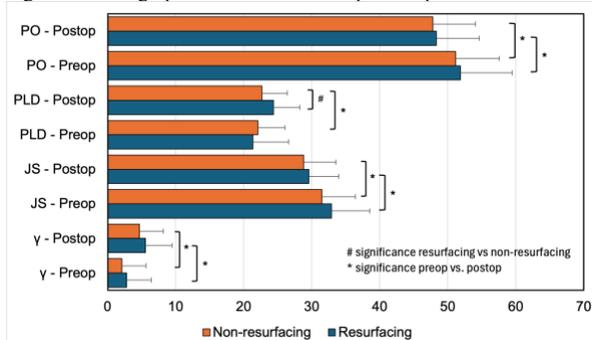


Figure 2. Comparison of patellar position with and without resurfacing

Variable	Group I	Group II	Group III	ICC	95% CI	p-value Group I vs II	p-value Group II vs III
Medial-lateral displacement, m/l	1.02±0.09	0.99±0.06	1.00±0.07	0.93	[0.92, 0.95]	0.004	0.13
Valgus alignment, α, (°)	97.0±2.0	95.8±2.4	96.0±2.5	0.86	[0.83, 0.89]	0.001	0.51
Sagittal rotation, β (°)	87.8±2.6	86.8±3.6	86.8±3.8	0.92	[0.90, 0.94]	0.04	0.98
Anterior position of trochlea, APT (mm)	21.6±3.7	22.3±3.5	22.6±3.5	0.88	[0.83, 0.90]	0.25	0.57
Patellar overstuffing, PO (mm)	42.6±8.0	48.4±6.3	47.8±6.3	0.98	[0.97, 0.98]	<0.001	0.56
Patellar tilt, γ (°)	1.9±3.5	5.5±3.9	4.6±3.5	0.88	[0.85, 0.90]	<0.001	0.10
Joint space, JS (mm)	28.8±4.1	29.6±4.4	28.8±4.8	0.98	[0.98, 0.99]	0.22	0.23
Patellar lateral displacement, PLD (mm)	24.3±3.3	24.4±3.8	22.7±3.7	0.94	[0.93, 0.95]	0.92	0.002

Table 1. Comparison of radiographic measurements of patellar position for all three groups