Early Clinical Outcomes of Medial Congruent versus Posterior Stabilized Inserts in Robot-Assisted Total Knee Arthroplasty

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INTRODUCTION: Total knee arthroplasty (TKA) has become one of the most successful surgical procedures for end-stage knee osteoarthritis, offering substantial pain relief and functional improvement. However, up to 20% of patients remain dissatisfied after TKA, therefore, therefore, various insert designs have been developed and implemented to improve patient satisfaction. Posterior stabilized (PS) inserts replace posterior cruciate ligament (PCL) function using a post-cam mechanism, promoting femoral rollback during flexion. Medial congruent (MC) inserts attempt to reproduce the medial pivot motion of the native knee, providing a highly conforming medial compartment and a less constrained lateral compartment. Although both designs are widely used, limited evidence is available comparing their early clinical outcomes, particularly in robot-assisted TKA, where precise bone resections and reproducible balancing may reduce confounding variables. To our best knowledge, there are no reports about to compare the laxity between TKA using MC inserts and PS inserts. The present study aimed to compare early clinical outcomes and intraoperative laxity between MC and PS inserts in robot-assisted TKA.

METHODS: This retrospective analysis included 123 consecutive robot-assisted mechanical aligned TKAs performed between 2021 and 2023 for varus osteoarthritis. All procedures employed midvastus approach and PCL resection. Fifty knees underwent TKA with MC insert in 2021 (MC group) and 73 knees underwent TKA with PS insert between 2022 to 2023. Clinical outcomes included range of motion (ROM), the 2011 Knee Society Score (2011 KSS: symptoms, satisfactions, expectations, functional activities, and overall), and the Forgotten Joint Score-12 (FJS-12). These were evaluated at 6 weeks, 3 months, 6 months, 1 year, and 2 years. Laxity was evaluated intraoperatively. After implant placement and capsular closure, varus–valgus stress was applied manually at 0° extension and 30°, 60°, 90°, and 120° flexion to measure medial, lateral, and medio-lateral laxities. Postoperative coronal alignment was assessed using standing long-leg radiographs. Differences between the two groups were tested with Mann-Whitney-U test and Chi-squared test. Wilcoxon signed-rank test was used for continuous variables. Spearman's rank correlation test was used for correlation analysis. Multiple regression analysis was also performed. Significance was set at $p < 0.05$. This study was approved by the institutional review board of our hospital, and informed consent was obtained from each patient.

RESULTS SECTION: No significant differences were observed in demographic characteristics between the two groups (Table 1). There were no significant differences in preoperative ROM, overall 2011 KSS, and its subscores between the two groups. Postoperatively, both groups demonstrated significant improvements in ROM and 2011 KSS (symptoms, satisfactions, functional activities, and overall) compared with baseline at all postoperative periods. The mean ROM at 6 weeks in the MC groups was 126° and 121° in the PS group, with significant difference between the two groups, whereas no differences were observed at other postoperative periods. No significant differences were observed in overall 2011 KSS and its subscores between the two groups at any postoperative period. No significant differences were observed in postoperative FJS-12 between the two groups at any postoperative period. Clinical outcomes at 2 years postoperatively were shown in Table 2. With respect to intraoperative laxity, medial laxity at 0° extension was significantly lower in the MC group, whereas no differences were detected at 30°, 60°, 90°, or 120° of flexion. Lateral laxity was significantly smaller in the MC group at 0°, 30°, 60°, and 90°, but not at 120°. Similarly, mediolateral laxity was significantly smaller in the MC group from 0° through 90°, with no difference at 120° (Table 3). Mean postoperative HKA was −0.4° in the MC group and −0.3° in the PS group (ns). No postoperative HKA outliers exceeding 3° from target HKA were observed in either group.

DISCUSSION: Lee et al. reported that the PS TKA and PCL retained MC TKA using portable navigation system achieved similar 1-year outcomes, but the PS TKA group had faster improvement in ROM, the Oxford Knee Score (OKS), the Knee Society Score Function score (KS-FS), and KS Knee Score (KS-KS) [1]. Khoo et al. compared MC with PCL resection and PS inserts in TKA using portable navigation system and found that one-year outcomes were similar in ROM, OKS, KS-FS, and KS-KS, although PS inserts achieved faster recovery in the first three months [2]. In this study, no significant differences were observed in almost all clinical outcomes between MC and PS inserts up to 2 years postoperatively, except for transient difference in ROM observed at 6 weeks postoperatively. The higher medial constraint of the MC inserts may have reduced mediolateral laxity, however, this reduction did not result in superior clinical outcomes compared with the PS insert. Previous study reported that medio-lateral laxity did not affect patient satisfaction or expectations in robot-assisted TKA [3]. The limitation of this study is that the follow-up period is short.

SIGNIFICANCE/CLINICAL RELEVANCE: Clinical outcomes were significantly improved in both MC group and PS group up to 2 years postoperatively. No significant differences were observed between the two groups, other than ROM at 6 weeks postoperatively. Mediolateral laxity was significantly lower in the MC group, however, this reduction did not result in superior clinical outcomes compared with the PS group.

REFERENCES: [1] Lee WC, et al. Musculoskelet Surg. 2024. [2] Khoo KMS, et al. Musculoskelet Surg. 2024. [3] Hasegawa M, et al. Sci Rep. 2024.

IMAGES AND TABLES:

Table 1. Demographic characteristics

	MC group (n=50)	PS group (n=73)	p-value
Sex (males/females)	10/40	12/61	ns
Age (year)	73 (58-87)	74 (57-86)	ns
Body mass index (kg/m^2)	27 (20-45)	26 (19-35)	ns
Diagnosis			
Osteoarthritis (knee)	50	73	ns
KL grade			
3 (knee)	20	35	ns
4 (knee)	30	38	
Hip knee ankle angle (°)	–9 (–17–1)	–10 (–22–1)	ns
Range of motion (°)	115 (55-140)	112 (35-140)	ns
2011 knee society sore			
Symptoms	8 (0-20)	10 (0-21)	ns
Satisfaction	15 (0-34)	16 (6-38)	ns
Expectations	14 (8-15)	13 (6-16)	ns
Functional activities	49 (11-92)	48 (17-93)	ns
Overall	85 (17-145)	87 (45-161)	ns

Table 2. Clinical outcomes at 2 years postoperatively

	MC group	PS group	p-value
Range of motion (°)	126 ± 18	126 ± 14	ns
2011 knee society sore			
Symptoms	21 ± 5	22 ± 3	ns
Satisfaction	28 ± 9	30 ± 8	ns
Expectations	10 ± 3	10 ± 3	ns
Functional activities	70 ± 18	70 ± 17	ns
Overall	129 ± 30	130 ± 27	ns
FJS-12	68 ± 22	70 ± 21	ns

Table 3. Medio-lateral laxity

Knee Flexion Angle (°)	MC group (°)	PS group (°)	p-value
0	3.9 ± 1.7	5.6 ± 2.3	p<0.05
30	5.8 ± 2.8	7.5 ± 3.2	p<0.05
60	4.8 ± 3.1	6.0 ± 3.1	p<0.05
90	5.5 ± 2.9	7.8 ± 3.8	p<0.05
120	6.4 ± 2.9	6.0 ± 2.8	ns