

# **Do Cementless and Cemented Total Knee Arthroplasty Differ in Early Clinical Improvement Timelines? A Propensity Score Matched Analysis of Minimal Clinically Important Difference, Substantial Clinical Benefit, Patient Acceptable Symptom State, and Time to Achieve MCID in 1,680 Procedures**

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## **INTRODUCTION:**

There is renewed interest in cementless primary total knee arthroplasty (TKA). Some studies suggest that cementless implant micromotion prior to osseointegration may result in early postoperative pain. This could theoretically lead to delayed recovery and prolonged time to achievement of improvement milestones. Yet existing studies do not utilize extensive, robust methodologies including minimal clinically important difference (MCID), substantial clinical benefit (SCB), patient acceptable symptom state (PASS), and 'Time to Achieve MCID' analyses. Intuitively, MCID reflects 'feeling better', SCB reflects 'feeling much better', PASS reflects 'feeling good', and Time to Achieve MCID reflects 'how long it took to feel better'. We compared MCID, SCB, PASS, and Time to Achieve MCID between cementless and cemented primary TKA. We hypothesized that a similar percentage of cementless and cemented TKA patients would achieve MCID, SCB, and PASS, but that cemented TKA patients would achieve MCID more quickly than cementless TKA patients.

## **METHODS:**

A group of 420 cementless primary TKAs were retrospectively sourced from a prospectively-maintained multi-institutional arthroplasty registry. A 1:3 propensity-score match identified 1,260 cemented primary TKAs with similar characteristics (**Table 1**). The Knee Osteoarthritis Outcome Score-Physical Function Short-form (KOOS-PS) was collected preoperatively and at multiple postoperative time points (approximately 1 month, 2 months, 4 months, 6 months, 9 months, 1 year, and 2 years after surgery). Literature-derived, anchor-based MCID (+8.0), SCB (+15.0), and PASS ( $\geq 70.3$ ) thresholds were utilized. Time to Achieve MCID was assessed using survival curves with interval-censoring. Interval-censoring is a statistical technique in survival analysis that accounts for variations in questionnaire completion timelines, enabling robust inferences of when MCID achievement most likely occurred, even if it was an unknown timepoint between two assessments.

## **RESULTS:**

Cementless and cemented primary TKA did not differ in the proportion of patients achieving MCID (72% (302/420) vs. 73% (920/1,260);  $p = 0.66$ ), SCB (57% (240/420) vs. 61% (769/1,260);  $p = 0.16$ ), or PASS (68% (286/420) vs. 71% (895/1,260);  $p = 0.25$ ) (**Table 2**). No difference was detected in Time to Achieve MCID (2.97-3.03 months vs. 3.27-3.33 months;  $p = 0.08$ ) (**Table 3**). **Figure 1** depicts a survival curve of MCID achievement for cementless and cemented primary TKA patients.

## **DISCUSSION AND CONCLUSION:**

As the usage of cementless TKA implants increases, it is critical that arthroplasty surgeons are highly informed of factors that may differ between cementless and cemented primary TKA. A body of research literature has compared continuous PROM scores, revision rates, and other clinical outcomes between cementless and cemented TKA. Some prior studies have suggested that cementless implant micromotion prior to osseointegration may lead to increased early postoperative pain, which could delay clinically significant improvement timelines. However, existing studies have not utilized a robust and extensive PROM methodology, including not only MCID, SCB, and PASS, but also a Time to Achieve MCID analysis with interval censoring.

This study compared MCID, SCB, PASS, and Time to Achieve MCID in cementless and cemented primary TKA in a large multi-institutional propensity score-matched cohort. There were no clinically significant differences in early postoperative recovery and clinical improvement timelines, nor were there any differences in minimal clinically important difference (MCID), substantial clinical benefit (SCB), or patient acceptable symptom state (PASS) achievement.

Taken together, our findings suggest that there is ultimately no significant difference in postoperative recovery and clinical improvement timelines in the early- to mid- follow-up period, nor is there a difference in 1-year clinically significant patient-centered outcomes, between cementless and cemented primary TKA.

Arthroplasty surgeons deciding between cemented and cementless fixation in primary TKA can therefore prioritize other factors such as revision risk, osseointegration, bone quality, learning curves, patient activity, age, obesity, and financial considerations in their patient counseling and clinical decision-making. Future research is needed to explore whether there is a subset of patients – such as patients with osteoporosis – for whom there may be a difference between cementless and cemented TKA in early postoperative clinical improvement timelines.

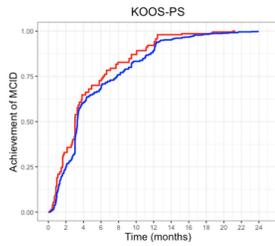


Figure 1. Comparison of time to achieve MCD between cementless (blue) and cemented (red) primary TKA with interval censoring for the KOOS-PS. The median MCD achievement time was similar between cementless and cemented primary TKA (3.27-3.33 months vs 2.97-3.03 months,  $p = 0.88$ ).

Table 1. Patient Demographics and Baseline Characteristics for Cementless and Cemented Primary Total Knee Arthroplasty Patients.

Characteristic	Final Primary TKA Cohort After Propensity-Score Matching			P-value
	Overall (N = 1,680)	Cementless (N = 420)	Cemented (N = 1,260)	
Age (years)	66.1 ± 9.3	65.9 ± 9.4	66.1 ± 9.3	0.62
Sex				0.80
Men	883 (53%)	223 (53%)	660 (52%)	
Women	797 (48%)	197 (47%)	600 (48%)	
Body Mass Index (kg/m <sup>2</sup> )	31.3 ± 6.0	31.5 ± 6.0	31.3 ± 6.0	0.65
Charlson Comorbidity Index	1.1 ± 1.6	1.1 ± 1.6	1.1 ± 1.6	0.99
Length of stay (days)	1.6 ± 1.4	1.6 ± 1.4	1.5 ± 1.4	0.37
Discharge Disposition				0.59
Home	1,618 (96%)	404 (96%)	1,214 (96%)	
Skilled Nursing Facility	36 (2%)	11 (3%)	25 (2%)	
Rehab Facility	26 (2%)	5 (1%)	21 (2%)	

Continuous variables are expressed as the mean and standard deviation. Categorical variables are expressed as the number of patients with the percentage in parentheses.

Table 2. Patient-Reported Outcomes for Cementless and Cemented Primary Total Knee Arthroplasty Patients.

Characteristic	Overall (N = 1,680)	Cementless (N = 420)	Cemented (N = 1,260)	P-value
	Prospective KOOS-PS Score	55.9 ± 14.0	55.4 ± 14.0	55.9 ± 14.0
Delta KOOS-PS Score	+17.8 ± 16.2	+17.0 ± 16.4	+18.0 ± 16.5	0.11
1-Year Postoperative KOOS-PS Score	73.7 ± 15.5	72.4 ± 15.6	73.9 ± 15.4	0.12
1-Year Achievement of MCD	1,222 (73%)	302 (72%)	920 (73%)	0.66
1-Year Achievement of SCB	1,009 (60%)	240 (57%)	769 (61%)	0.16
1-Year Achievement of PASS	1,181 (70%)	286 (68%)	895 (71%)	0.25

Continuous variables are expressed as the mean and standard deviation. Categorical variables are expressed as the number of patients with the percentage in parentheses. KOOS-PS, Knee Disability and Osteoarthritis Outcome Score Physical Function Short Form; MCD, minimal clinically important difference; PASS, patient acceptable symptom state; PF-10, physical function short form 10; PROMIS, Patient-Reported Outcomes Measurement Information System; SCB, substantial clinical benefit.

Table 3. Median Times to Achievement of the MCD between Cementless and Cemented Primary Total Knee Arthroplasty with Interval Censoring.

Characteristic	Cementless TKA		Cemented TKA		Stat's Score	Finkelstein's Score	P-value*
	Lower Range (months)	Upper Range (months)	Lower Range (months)	Upper Range (months)			
KOOS-PS	3.27	3.33	2.97	3.03	0.17	0.17	0.88

Bold values indicate statistical significance ( $P < .05$ ).

\*Wilcoxon test p-value.

Interval ranges represent the interval where 50% of patients achieved MCD.

MCD, minimal clinically important difference; KOOS-PS, Knee Disability and Osteoarthritis Outcome Score Physical Function Short Form; PF-10, physical function short form 10; PROMIS, Patient-Reported Outcomes Measurement Information System; TKA, total knee arthroplasty.