

Comparing Minimal Clinically Important Difference in Patient Reported Outcome Measures Between Patients Undergoing Primary Total Hip Arthroplasty with a Cemented or Cementless Stem: A Propensity Matched Study

Muhammad Hamza Ilyas, MD¹; Hahn Kang, BSc¹; Oh-Joon Kwon¹; William Sampson, BA¹; Zhijun Li, PhD¹; Carlo Mannina, BSc¹; Oh-Jak Kwon¹; Michelle Shimizu, MD¹; Isaiah Freeman, BSc¹; Margaret Arthur¹; Sina Afzal, MD¹; Pengwei Xiao, PhD¹; Young-Min Kwon, MD, PhD¹
¹Bioengineering Laboratory, Massachusetts General Hospital/Harvard Medical School, Boston, MA
 ymkwon@mgh.harvard.edu

Disclosures: Muhammad Hamza Ilyas (N), Hahn Kang (N), Oh-Joon Kwon (N), William Sampson (N), Zhijun Li (N), Carlo Mannina (N), Oh-Jak Kwon (N), Michelle Shimizu (N), Isaiah Freeman (N), Margaret Arthur (N), Sina Afzal (N), Pengwei Xiao (N), Young-Min Kwon (5- MicroPort; 5- DePuy; 5-Smith & Nephew; 5- Stryker; 5- Zimmer Biomet; 5- Medacta)

INTRODUCTION: According to the American Joint Replacement Registry, cemented femoral stem fixation accounted for 5.1% of all elective THA procedures in 2023, up from 3.0% in 2012. Cement fixation is of increasing interest in primary THA, especially among elderly patients, to reduce the occurrence of periprosthetic fractures. Cemented stems are associated with lower rates of periprosthetic fractures; however, cementless stems may offer shorter operative times and a greater potential for stronger biological fixation. Previous studies have compared postoperative outcomes in patients who undergo primary THA using cemented and cementless femoral stems. However, there are inherent differences in the characteristics of patients who undergo cemented and cementless femoral stem fixation, with cemented femoral fixation generally preferred for older patients, women, and individuals with significant comorbidities due to their generally poorer bone quality. Therefore, this propensity-matched study aims to determine the potential difference in patient-reported outcome measures (PROMs) between cementless stems and cemented stems in patients undergoing elective THA.

METHODS: This retrospective study reviewed 8,085 consecutive patients who underwent primary THA at a single institution between 2016 and 2023 following IRB approval. Patients were categorized into two cohorts based on whether they received a cementless or cemented stem as documented on the operative report. A 1:3 nearest neighbor propensity-controlled matching with a caliper of 0.2 was conducted using the following covariates: age, body mass index, sex, diabetes, chronic kidney disease, heart failure, osteopenia, osteoporosis, smoking status, and alcohol use. The mean preoperative, postoperative, and delta (the difference between the two) scores for each PROM were calculated. The delta was used to determine the threshold at which point patients experienced a minimal clinically important difference in improvement or worsening after primary THA. Ninety-day medical and one- and two-year surgical complications were recorded and compared between cohorts.

RESULTS SECTION: After propensity-matching, 211 cementless THA and 633 cemented THA patients remained for analysis, with no significant differences in demographics ($p > 0.05$). There were no significant differences in 90-day complications following THA between cohorts. Periprosthetic fracture had similar incidence rates in both groups at one and two years postoperatively ($p > 0.05$). All other surgical one- and two-year complication rates were equal between the cementless and cemented cohort ($p > 0.05$). No significant differences were seen in preoperative, postoperative, or deltas scores between groups in any of the PROMs ($p > 0.05$). Proportions of each group that worsened or did not experience change were equal in each PROM ($p > 0.05$). A higher proportion of cementless THA patients achieved clinically significant improvement in the PROMIS Mental (61% vs 48%; $p = 0.0022$). Proportions of improvement were similar in the other PROMs of interest ($p > 0.05$) (Table 2).

DISCUSSION: Cemented femoral stem fixation is of increasing interest in primary THA to mitigate the risk of periprosthetic fracture. In this propensity-matched study, patients with cementless THA experienced similar complication rates as those with cemented TKA, including periprosthetic fracture. Despite differences in the proportion of improvement in the PROMIS Mental, similar preoperative, postoperative, and delta scores in all PROMs indicate that patients experience similar improvement trajectories regardless of cement use. Patients planning to undergo cemented femoral stem fixation for primary THA may be counseled regarding expectations for recovery after surgery.

SIGNIFICANCE/CLINICAL RELEVANCE: No consensus differences across Patient-Reported Outcome Measures were observed between patients undergoing cemented and cementless primary total hip arthroplasty.

Variable	Cementless (N = 211)	Cemented (N = 633)	P-value
Age (years)	66.0 ± 10.0	66.4 ± 9.5	0.768
Body mass index (kg/m ²)	28.9 ± 5.0	28.9 ± 5.4	0.982
Female	110 (52.1%)	326 (51.5%)	0.937
Diabetes	47 (22.3%)	139 (22.0%)	1.000
Chronic Kidney Disease	17 (8.1%)	44 (7.0%)	0.701
Heart Failure	14 (6.6%)	42 (6.6%)	1.000

Table 1. Demographics of cementless and cemented total hip arthroplasty cohorts following propensity-match.

Patient-Reported Outcome Measure	Cementless	Cemented	P-Value
SF10-a	N = 199	N = 593	
Postoperative Score	46.11 ± 8.72	45.49 ± 9.30	0.4762
Delta Score	9.92 ± 8.76	9.63 ± 8.32	0.6675
Improved	153 (77%)	444 (75%)	0.635
PROMIS Mental	N = 203	N = 592	
Postoperative Score	53.08 ± 8.98	53.89 ± 9.36	0.2346
Delta Score	2.81 ± 6.64	3.06 ± 7.33	0.7994
Improved	123 (61%)	283 (48%)	0.0022
PROMIS Physical	N = 203	N = 591	
Postoperative Score	49.10 ± 9.29	49.32 ± 9.63	0.7249
Delta Score	8.63 ± 8.33	8.35 ± 8.25	0.4648
Improved	154 (76%)	420 (71%)	0.2201
HOOS-PS	N = 171	N = 496	
Postoperative Score	84.14 ± 15.78	82.66 ± 16.50	0.3924
Delta Score	26.52 ± 19.69	26.76 ± 18.79	0.8268
Improved	141 (82%)	430 (87%)	0.2168

Table 2. Patient-Reported Outcome Measures for patients who underwent cementless and cemented primary total hip arthroplasty following propensity-matching.