

# Prospective Evaluation of Triple-Tapered Collared Stem in Primary Total Hip Arthroplasty

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**INTRODUCTION:** A hydroxyapatite-coated triple-tapered collared stem was designed using extensive femoral morphology data to achieve the desired implant fit and stability<sup>1,2</sup>. This study prospectively assessed this stem's early radiographic and clinical outcomes in primary total hip arthroplasty (THA).

**METHODS:** This study was registered and approved through ClinicalTrials.gov (NCT05313321) and approved by the local Institutional Review Board. Eligible patients were adults with hip osteoarthritis indicated for primary THA. Exclusion criteria included inflammatory or pyogenic arthritis, body mass index greater than 40, and inadequate bone stock for cementless fixation. All participants provided informed consent prior to study enrollment. Patient reported outcome measures (PROMs) were completed pre-operatively, and at 6 weeks, 6 months, and 1 year post-operative. PROMs included Patient-Reported Outcomes Measurement Information System (PROMIS) physical function, physical health, global health, and pain as well as the Hip Disability and Osteoarthritis Outcome Score, Joint Replacement (HOOS JR). Radiographic assessments were conducted at six weeks and one year postoperatively. Statistical analysis included paired t-tests to compare preoperative and postoperative PROMs in addition to means and standard deviations. A total of 100 patients (50% female) underwent primary THA with this stem.

**RESULTS SECTION:** The mean patient age was  $62.2 \pm 11.2$  years, mean BMI was  $27.1 \pm 4.6$ , and mean American Society of Anesthesiologists score was  $2.1 \pm 0.6$ . Mean limb length differences and offset restorations were  $1.2 \pm 1.8$  millimeters and  $0.1 \pm 3.5$  millimeters, respectively. Five patients had collar overhang, all of which were less than two millimeters. One patient sustained a periprosthetic femur fracture after a fall on postoperative day one, requiring revision. Otherwise, no other reoperations occurred within one year. Subsidence of four millimeters occurred in one patient at six weeks with no further migration upon further follow-up. No radiographic loosening was observed for any patients. All PROMs significantly improved by postoperative week six (all  $P < 0.05$ ) and were maintained at one year.

**DISCUSSION:** This prospective study demonstrates that this hydroxyapatite-coated triple-tapered collared stem provides reliable early fixation with excellent radiographic stability and significant improvements in PROMs after primary THA. Designed using femoral morphology data, this stem reliably restored limb length and offset with minimal collar overhang. Importantly no cases of radiographic loosening were observed, suggesting stable femoral fixation. All PROMs significantly improved by six weeks and were sustained at one year, which highlights the early functional recovery. These findings are consistent with expectations from modern cementless femoral stems. The low complication rate further supports the implants' early safety profile, as the one revision in this series was secondary to a traumatic fall. The consistent radiographic and clinical improvements observed in this early follow-up cohort suggests that this particular stems achieves its intended goals of anatomic fit, initial stability, and early functional improvement. Continued follow-up will be critical to confirm long-term fixation and durability.

**SIGNIFICANCE/CLINICAL RELEVANCE:** This hydroxyapatite-coated triple-tapered collared stem demonstrated reliable restoration of limb length and offset, minimal subsidence, no loosening, and significant PROM improvements at one year, further supporting its early efficacy in primary THA. Long-term follow-up will be necessary to assess long-term survivorship and durability, but these short-term data support the continued use of this stem in contemporary primary THA.

## REFERENCES:

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Figure 1: Patient-Reported Outcomes Measures over time for a) pain b) HOOS JR

