

Cemented Femoral Taper-Slip Stem Designs Associated with Increased Periprosthetic Fracture Risk Compared to Composite-Beam Stem Designs in a US Healthcare System Arthroplasty Registry

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INTRODUCTION:

Recent total hip arthroplasty (THA) studies have highlighted a benefit of cemented femoral fixation for avoidance of periprosthetic fractures (PPF). However, there are two competing fixation philosophies: a collarless and polished “taper slip” (TS) and a collared and matted “composite beam” (CB). TS and CB follow different fixation mechanisms: TS by a dynamic subsidence of a smooth and unimpeded taper into an accommodating cement mantle, and CB by an immediate load transfer from the collar to the calcar with a static lock between implant, cement, and bone. These two mechanisms may have different implications for PPF and loosening. Therefore, a registry-based cohort study was undertaken to evaluate complications between these two designs.

METHODS: We conducted a cohort study using data from a US healthcare system’s THA registry. Adult patients who underwent primary cemented THA with a crosslinked polyethylene liner and large diameter femoral head (≥28mm) were included (2002-2022). THA using a TS stem was compared to THA using a CB stem. Multivariable Cox proportional hazards regression was used to evaluate aseptic revisions overall, revision due to periprosthetic fracture (PPF), and revision due to loosening specifically. Regression models included age, body mass index (BMI), gender, race/ethnicity, ASA classification, indication, femoral head size, femoral head material, surgical approach, and operating surgeon as covariates. Hazard ratios (HR), 95% confidence intervals (CI), and p-values are reported.

RESULTS: The final study sample included 4,283 primary cemented THA: 1,116 TS and 3,167 CB. The crude cumulative aseptic revision incidence at 18-year follow-up was 5.9% for TS and 4.5% for CB. The 18-year cumulative incidence of PPF was 3.1% vs 1.5%, and incidence of loosening was 0.9% vs 1.7% for TS and CB, respectively. In adjusted analysis, no difference in overall aseptic revision risk was observed between stem design (HR=1.36, 95% CI=0.90-2.04, p=0.139). A higher risk of revision for PPF was observed with TS (HR=3.25, 95% CI=1.38-7.66, p=0.007). No difference in loosening was observed between TS and CB (HR=0.53, 95% CI=0.14-2.06, p=0.361).

DISCUSSION AND CONCLUSION:

TS stems were associated with a higher risk of revision for PPF compared to CB. However, after considering the aggregate effects of all complications, overall long-term revision rates were ultimately similar between the two stem designs. Increased fracture risk is paradoxical for TS, given that the goal of cementing is to avoid fracture. Therefore, if utilizing cement to avoid PPF, we recommend CB and maintain reservations over the role of TS, especially given the competing concern for loosening was not significantly different.

