Title: Stability of a Tapered Femoral Stem in Total Hip Arthroplasty using Radiostereometric Analysis

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Introduction:
Early femoral implant stability is essential to long-term success in total hip replacement (THR). Radiostereometric analysis (RSA) provides highly precise measurements of stem micromotion relative to the femur that are otherwise not detectable by routine radiographs. This study characterized micromotion of a tapered, cementless femoral stem using RSA up to 5 years following THR.

Methods:
This IRB-approved, prospective, randomized, blinded study, involved 46 patients with a mean age of 58 and BMI of 30. All patients received a cementless, porous-coated titanium double tapered stem (M/L Taper, Zimmer) manufactured with 3 tantalum RSA beads and underwent primary THR by a single surgeon (DCA). RSA examinations, Harris Hip, UCLA, WOMAC, SF-36 scores were obtained at 10 days, 6 months, and annually through 5 years.

Results:
Thirty-four patients have RSA analyses at five years. The y-axis stem subsidence was greatest in the first 6 months (0.09 mm/yr), and stabilized thereafter with minimal further micromotion. The median stem subsidence was 0.01 ± 0.06 mm (standard error, SE) at 5 years. There was a statistically significant difference in subsidence between the 6-month interval and the 5-year interval ($p = 0.027$). Two outlying patients had significantly higher stem subsidence values at 6 months (0.7 mm and 1.0mm). One stem stabilized without further subsidence after 6 months (0.7mm), and the other stem continued to subside throughout the postoperative period. Neither patient has clinical evidence of loosening. All patients had a statistically significant improvement in pain and function measures following THA ($p <= 0.05$).

Conclusion:
This cementless, double-tapered femoral stem shows excellent stability in young THR patients through 5 years, with no clinical or radiologic episodes of failure. The small amount of micromotion is less than that previously reported for similar tapered, cementless stems and approaches the accuracy of RSA (0.05 mm).