

Paper #24

Does Taper Design Affect Taper Fretting Corrosion in Ceramic on Polyethylene Total Hip Arthroplasty? A Retrieval Analysis

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Introduction: Ceramic-on-polyethylene (CoP) implants have exhibited lower fretting and corrosion scores than metal-on-polyethylene (MoP) implants. This study aims to investigate the effect of taper design on taper corrosion and fretting in modular ceramic total hip arthroplasty (THA) systems.

Methods: Under an IRB-approved protocol, a query of an implant retrieval library from 2002 – 2017 identified 120 retrieved CoP THA systems with zirconia toughened alumina (ZTA) femoral heads, with four different taper designs (11/13, 12/14, 16/18, V40). Femoral stem trunnions were visually evaluated and graded for fretting, corrosion and damage at the taper interface. Medical records were reviewed for patient demographics and implant characteristics. Data was statistically analyzed using Spearman correlation and rank sum tests with a Dunn's post-hoc test, with a significance level of $\alpha=0.05$.

Results: Four different taper designs were evaluated including: 11/13 (n=18), 12/14 (n=53), 16/18 (n=21), and V40 (n=28). There were no statistically significant demographic differences between taper groups for duration of implantation, laterality, patient age, and patient sex, but patients with 16/18 tapers had a higher BMI than V40 tapers ($p=0.012$). Duration of implantation had a weak positive correlation with both trunnion fretting ($\rho=0.224$, $p=0.016$) and corrosion ($\rho=0.253$, $p=0.006$). Summed fretting and corrosion scores were significantly greater on the V40 and 16/18 tapers compared with the 12/14 tapers (all $p=0.001$).

Conclusions: Taper fretting and corrosion were observed in ceramic THA implants and were greatest on implants with V40 and 16/18 tapers and lowest on implants with 12/14 tapers. Differences in taper design characteristics may lead to greater micromotion at the taper-head interface, leading to increased fretting and corrosion.