Paper #21

Titanium Alloy Sleeves do not Prevent Fretting Corrosion in Modular THA

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Introduction: During revision surgery with a well-fixed stem, a titanium sleeve is used in conjunction with a ceramic head to achieve better stress distribution. In vitro testing suggests that corrosion is not a concern in sleeved ceramic heads[1]; however, little is known about the in vivo fretting corrosion of the sleeves. The purpose of this study was to investigate fretting corrosion in sleeved ceramic heads.

Methods: Thirty-five sleeved ceramic heads were collected during revision surgery as part of a multi-center retrieval program. The sleeves were all fabricated from titanium alloy and manufactured by 4 companies (CeramTec (n=14), Smith & Nephew (Richards, n=11), Stryker (n=5), and Zimmer (n=5)). The femoral heads were made from 3 ceramics (Alumina (n=7), Zirconia (n=11), and Zirconia-toughened Alumina (n=17)). Sleeve dimensions were measured using calibrated calipers. Fretting corrosion was scored using a 4-point, semi-quantitative scoring system[2]. Five sleeves could not be extracted; thus the external surface was not scored.

Results: Moderate-to-severe fretting corrosion scores (Score≥2) were observed in 97% (34/35) of internal tapers (sleeve-femoral stem contact), 57% (17/30) of external tapers (sleeve-femoral head contact), and 65% (11/17) of the stems. The internal sleeve had higher fretting corrosion scores than the external taper ($p=0.001$) and stem ($p=0.016$). Fretting corrosion scores were correlated with implantation time at all surfaces ($Rho\geq0.53$; $p\leq0.015$). Fretting corrosion scores of the external sleeve correlated directly with activity level ($p=0.005$).

Conclusion: The retrieval data shows that fretting corrosion occurs in sleeves, particularly on the internal surface. The corrosion scores were similar to levels observed in prior studies of CoCr heads[3]. Implantation time was the main predictor of increased fretting corrosion. The impact of ceramic material and sleeve design currently remain unclear as the analyses were confounded with implantation time. Thus, quantitative analyses are required to determine the factors that influence fretting corrosion of sleeved ceramic heads.