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Will New Metal Heads Restore the Mechanical Integrity of Corroded Trunnions at Revision THR?

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Introduction: Mechanically-assisted corrosion at the head-neck junction can be seen at revision THA. Many surgeons exchange the femoral head to avoid the morbidity of revising a well-functioning femoral stem. Our study asks: 1. Will new metal heads on corroded tapers restore the mechanical integrity of the original junction? 2. Which variables affect the stability of the new interface created at revision THR?

Methods: Twenty-two tapers (CoCr, n=12; TiAlV, n=10) were obtained for use in this study from our retrieval collection. Ten stems were in pristine condition, while 12 stems were with corroded trunnions (Goldberg scale 4). Twenty-two new matching metal heads were obtained for use in the study. The following test states were performed using a MTS Machine: 1. Assembly, 2. Disassembly, 3. Assembly, 4. Toggling and 5. Disassembly. During loading, 3D motion of the head-trunnion junction was measured using a custom jig. Relative displacement of the head was continuously monitored using 6 high resolution displacement transducers with an accuracy of ±0.6μm.

Results: The average micromotion was greatest at initial loading and stabilized after approximately 50 loading cycles at an average of 30.6±3.2μm. For CoCr couples, interface motion dropped by 17% with a pristine head on a corroded stem compared to a new stem (25.7±2.7μm (pristine stem), vs. 30.1±4.6μm (corroded stem), p= 0.4023). However, a new CoCr head on a corroded titanium stem led to an 73% increase in interface motion (Corroded: 43.4±9.8μm, Pristine: 25.2±7.0μm, p=0.1661). Resistance to head-neck disruption was 15% higher in TIALV/CoCr couples compared to CoCr/CoCr (TiAlV: 2558 ±63N, CoCr: 2226±99N, p=0.0111) and was not affected by trunnion corrosion.

Conclusion: Trunnion corrosion does not disrupt the mechanical integrity of the junction when a CoCr head is replaced on a CoCr taper. We are less sure about TiAlV tapers as demonstrated by a trend towards increased micromotion at the head-neck junction.