Paper #27

Fretting Corrosion and Polyethylene Damage Mechanisms in Modular Dual Mobility Total Hip Arthroplasty

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Introduction: Dual mobility (DM) implants can be helpful in minimizing instability in patients at risk for dislocation following THA. However, the additional articulation raises concerns about increased polyethylene liner damage, while an added metal interface of a modular DM design (MDM) can be a source of corrosion. This retrieval study aims to characterize in vivo damage and fretting corrosion of MDM hips.

Methods: Twenty-nine MDM explants with both ceramic and metal femoral heads were collected. A custom fixture and a mechanical testing frame were used to disengage the femoral heads from the polyethylene liners. The inner and outer liner surfaces were assessed using a modified Hood method to evaluate 7 different damage mechanisms. Fretting corrosion damage at the metal interfaces was assessed using a modified Goldberg method.

Results: A minimal fretting corrosion score of 1 was assigned to 70% of the femoral head tapers, 77% of the CoCr acetabular liner backsides, and 78% of the femoral stems. Corrosion tended to occur at the acetabular liner edges rather than at the pole. There were no cases of severe corrosion on any of the components. Surface damage, primarily scratching, burnishing, pitting, and embedded debris, was observed on all 29 polyethylene liners. There was no significant difference between the overall damage of the inner and outer surface for each component ($p = 0.07$). However, pitting and surface deformation scores were greater for the outer surface ($p = 0.01$, $p = 0.002$) while embedded debris scores were greater for the inner surface ($p = 0.01$).

Conclusion: Fretting corrosion and polyethylene damage was measurable in MDM articulations at short term follow up. While the clinical significance is unknown, it demonstrates the need for continued investigation as longer-term MDM retrievals become available.

Notes