Effect of Contamination on Torque Testing of the Taper Junction in Total Hip Arthroplasty

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Introduction: The advantages of a modular head-neck taper junction has established this technology as the mainstay in total hip replacement. However, the modular junction has the potential to create clinically significant corrosion. It is our hypothesis contamination is one of a series of variables that contributes to trunnion corrosion. We aim to evaluate the effect of contamination on the torque resistance of a CoCr head on a Ti-alloy trunnion.Methods 36 mm +0 CoCr femoral heads were tested with Ti6Al4V trunnions.

Methods: The samples were separated into Control, Gross Blood, Micro Blood, Gross Fat, and Micro Fat groups (n=5). The femoral heads were assembled onto the trunnions with a 2kN axial force. Dynamic torque testing was performed with an axial force of 2450 N and a cyclic torque of 0-5 Nm at a rate of 1Hz for 500 cycles. Static torque testing was then performed on the same specimen, maintaining an axial force of 2450N and rotating the trunnion 0.3 degrees/sec.

Results: Dynamic torque testing revealed two gross blood specimen which had slips of the taper, constituting failures. Static torque testing evaluated torque at 1 degree, with no significant differences. The control and micro blood groups had a larger steady state torque than the gross fat group ($p<0.05$) at 15 degrees.

Conclusions: We have found gross contamination, in the form of blood, provided for more slips of the taper when subjected to a dynamic torque. Slipping of the taper junction constitutes a failure, which could provide for increased micro-motion. Contamination showed no significant differences when evaluating the energy to statically rotate the specimen 1 degree. However, when the taper reaches a steady state torque at 15 degrees, we found significant variability in the gross fat group. We conclude contamination may contribute to increased micro-motion at the taper, and potentially corrosion production.