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An Electrochemical Analysis of Fretting Corrosion in Metal-on-Metal Hip Implants Subjected to High Impaction Loads

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Research & Scholarship SYMPOSIUM

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The metal-on-metal total hip arthroplasty, a procedure where the hip joint is replaced by a femoral prosthesis with a metal femoral head and a metal socket, has been a popular option for patients requiring a hip joint replacement. Metal on metal hip implants have been a successful implant design until recently where there has been an increased number of failures of this type of implant due to fretting corrosion, believed to be caused from the use of large femoral heads. Fretting corrosion in hip implants results from cyclic micromotion at the taper-trunnion interface; this interface motion removes the protective oxidation layer from the metal allowing the fluid environment of the body to react with the metal and ultimately leads to the release of metal ions into the surrounding tissue and bloodstream. The objective of this research is to quantify the amount of fretting corrosion at the taper-trunnion interface after a static load of 991 lbs is applied, and compare results to a previous study where 450 lbs impaction force was applied. For both studies all specimens are cyclically loaded between 10 lbs and 460 lbs while fretting corrosion data is collected. Fretting corrosion was characterized through the implementation of an electrochemical experiment in order to measure the amount of metal ions released from the implant during loading, which is directly correlated to the amount of fretting corrosion. Results of this study will elucidate the importance of impaction load in the process of fretting corrosion at the metal taper-trunnion interface.

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