N Munroe et al., J Material Sci Eng 2014, 3:3
http://dx.doi.org/10.4172/2169-0022.S1.014

OMICS Group Conferences
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3rd International Conference and Exhibition on
Materials Science & Engineering
October 06-08, 2014 Hilton San Antonio Airport, USA

Corrosion assessment and failure analysis of explanted hip prostheses

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Recent increase in the recall of prosthetic devices used for total hip replacement, have prompted researchers to investigate tribological (metal on metal) interactions of implants. The increased failure rates are sometimes associated with the deleterious effect of metallic debris on surrounding tissues, which have led to tumors.

The bearing surfaces of hip prostheses are not the only source of metallic debris. Tribocorrosion at the taper surfaces of modular hip prostheses is a critical issue that becomes progressively worse with time and has in some cases been identified as the cause of early failure. The recent increase in the use of bimodular systems, alongside a trend towards younger patients with more demanding needs, creates an imperative to research the complex interactions at these interfaces. The inadequacy of hip simulator based testing, as evidenced by recent MoM recalls, makes the use of large sample sets of explanted hip prostheses necessary for any comprehensive investigation.

In this investigation, explanted arthroplasty samples are examined using macroscopic light and scanning electron microscopy and energy dispersive X-ray analysis, as well as transmission electron microscopy. Evidence of *in vivo* fretting-assisted crevice corrosion of the mating surfaces of modular head-neck components and galvanic corrosion are assessed via potentiodynamic polarization tests in accordance with ASTM G5 standard. Attempts are made to determine whether the artifacts on the surface of samples are influenced by factors such as manufacturing method, type of material, design and length of implantation.

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