INVESTIGATION OF WEAR AND CORROSION PRODUCTS FROM AROUND EXPLANTED COCRMO TAPERS

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Metallic contacts in hip replacements are susceptible to wear and corrosion processes which lead to the release of particles and metal ions. Adverse local tissue reactions (ALTRs) and systemic manifestations to solid and soluble debris can be debilitating for the patients. It is believed that particles originating from CoCrMo taper junctions trigger more severe body reactions compared to debris from MoM hip bearings. The body’s reaction is highly dependent on particle characteristics, such as size, morphology, composition and aggregation state, which can reflect the specific wear and corrosion conditions at the site of release. Here we proposed to investigate wear and corrosion flakes collected from around CoCrMo tapers at the time of revision. The particles were initially characterised with scanning electron microscopy (SEM) and energy dispersive X-ray analysis (EDX). This revealed the microstructure of the corrosion products, which appeared to be made of smaller metallic aggregates, entrapped in a biological matrix. The in depth characterisation of the particles released from the organo-metallic composite, was performed with transmission electron microscopy (TEM) and scanning transmission electron microscopy (STEM), both fitted with EDX. The investigation revealed clusters and individual nanoparticles, as small as 3 nm, which represent the building blocks of the large corrosion flakes, reported and characterised in the past mainly with low resolution microscopy techniques. The majority of the particles consisted of Cr and O, potentially in the form of chromium oxides, with little evidence of Co and Mo. Particles size distribution (PSD) provided by STEM and TEM characterisation showed statistically different results. The STEM technique was able to resolve tiny particles found in close proximity and provided a PSD shift towards the smaller end of the size range. The study is the first to show microscopy evidence of Cr rich nanoparticles (3-60 nm) released *in vivo* from the modular taper interface, which can have important health implications caused by their increased potential to disseminate and corrode within the body.