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Isolation of low volumes of silicon nitride particles from tissue

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Adverse biological responses to wear debris generated by total hip replacements (THRs) limit the lifetime of such devices. This has led to the development of biocompatible coatings for prostheses. Silicon nitride (SiN) coatings are highly wear resistant and any resultant wear debris is soluble, reducing the possibility of a chronic inflammatory reaction. SiN wear debris produced from coatings has not been characterized *in vivo*. The aim of this research is to develop a sensitive method for isolating low volumes of SiN wear debris from periprosthetic tissue. Commercial silicon nitride particles of <50 nm (Sigma Aldrich) were incubated with formalin fixed sheep synovium at a volume of 0.01 mm3/g of tissue (n=3). The tissue was digested with papain (1.56 mg/ml) and proteinase K (1 mg/ml) and samples were subjected to density gradient ultracentrifugation using sodium polytungstate (SPT) to remove protein from the particles. Control tissue samples, to which no particles were added, were also subjected to the procedure. Particles were washed to remove residual SPT and filtered onto 15 nm filters. The filtered particles were imaged by scanning electron microscopy and positively identified by elemental analysis before and after the isolation procedure. To validate whether the isolation method affected particle size or morphology, imaging software (imageJ) was used to determine size distributions and morphological parameters of the particles. A Kolmogorov-Smirnov test was used to statistically analyze the data. The particle size distributions of isolated and non-isolated particles were similar. Morphology in terms of roundness and aspect ratio was unchanged by the procedure. Future work aims to test the method on titanium and cobalt chrome wear debris generated by a pin-on-plate wear simulator. The method will then be applied to isolate and characterize particles from *in vivo* studies of novel SiN coated prostheses in a rabbit and sheep model.

Biography

Richard M Hall is a Member of the University of Leeds with an interest in motion preservation devices as well as research in to spinal cord injury and augmentation procedures such as vertebroplasty. He currently coordinates the LifeLongJoints project and is the Director of Postgraduate Research Studies in Engineering.

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