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Surface microstructure of retrieved hip and knee endoprostheses

Microstructure is a neglected factor in implant design, and a detailed characterization is required to determine the role of prematurely failed implants that determine the biological responses, such as the composition and structure of the surface oxide film, the surface contamination and the surface topography. The release of metal ions and the lack of the wear resistance of biomaterials result in implant loosening, which leads to implant failure. The release of metal nanoparticles and polyethylene debris into the soft tissue at the site of the implants is decisive for osteolysis and the implants'longevity. The surface chemistry of Ti alloys (Ti6Al4V, Ti6Al7Nb) and the CoCrMo alloy of (retrieved and new) hip and knee endoprostheses components were studied in detail using advanced electron spectroscopy techniques FE-SEM, EDS, EBSD, AES and XPS. We will present the findings from the clinical and from the materials science points of view. All the retrieved implants were sent for sonication in Ringer's solution for cleaning and pathology analysis. Afterwards, they were dried and stored in special sterile Wipak Medical Steriking bags. All the X-ray images of implants in the patients are stored in the database of the UKC. The surface chemistry results showed that thin oxide films on the Ti alloys prevent further corrosion, improve the biocompatibility, and affect the osseointegration. It is obvious that we need to keep an optimal microstructure with regards to the corrosion and mechanical properties, which can be controlled through processing parameters and be standardized in the near future.

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