

Possibilities of PIXE microbeam in localising metals around dental and orthopaedic implants

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The degree and the modalities of a possible leakage of metals and other elements in the tissues from dental and orthopaedic implants has been not fully understood yet. Even the best materials suitable for endosseous prosthetic devices, as far as the release of their components in the biological environment is concerned, have not been completely assessed. In order to check the potentialities of the PIXE microbeam analysis to investigate this problem, some block sections of five dental implants, removed from humans for various reasons, mainly for the fracture of components, and the tissues surrounding one metal spine plate and two hip prostheses removed from patients after a few years due to inflammation, were examined.

These devices were built with commercially pure titanium, Ti-6Al-4V alloy, 316 LWM surgical steel, this latter either nickel coated or uncoated. After proper fixation, histologic preparation and optical microscope examination, the specimens, mounted on plastic holders, were investigated by the PIXE microbeam facility at the AN2000 Accelerator of the INFN Laboratori Nazionali di Legnaro, obtaining several suitable elemental maps. Localised amounts of Ti, Ni and Cr were found, while V was never detected in the tissues, at least with the actual sensitivities. Al, on the other hand, showed a widespread diffusion into the peri-implants tissues. These preliminary results suggest that PIXE microbeam may be a very useful mean to investigate the presence of metals in the tissues around endosseous devices, and the patterns of their release.