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**Ion implantation of titanium, nanotopography and osseointegration**

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Permanent musculoskeletal implants require a fast, reliable and consistent osseointegration, i.e. intimate bonding between bone and implant, so biomechanical loads can be safely transferred. Among the parameters that affect this process, it is widely admitted that implant surface topography, surface energy and composition play an important role.

Most surface treatments to improve osseointegration focus on microscale features, as few can effectively control the effects of the treatment at nanoscale. On the other hand, ion implantation allows controlling such nano-features.

This study has first investigated the nano-features of natural bone tissue, and on a second stage the nano-features induced on medical grade titanium by ion implantation. In the first case, atomic force microscopy analysis, AFM, has confirmed the nano-composite nature of bone and the relevance and importance of the interaction between such bone nano-features and those of the implant surface when osseointegration occurs.

In the second case, the effect of different ion implantation treatments on the surface topography of medical grade titanium has been studied. The effect of treatment parameters such as energy (40 – 80 keV), fluence (1 – 2e17 ion/cm²) and ion spices (Kr, Ar, Ne, Xe) on the nano-topography has been measured and assessed by AFM. Furthermore, these ion implantation parameters and their associated nano-topographies have also been related to changes in the hydrophilicity of the surfaces.

**Keywords**

ion implantation
nanotopography
bone
osseointegration
hydrophilicity