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Selected area ammine and carboxylic functionalization on titanium for dental implants

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The surface morphology and chemistry of titanium dental implants are key parameters for the adhesion and growth of the osteoblast cells. Plasma polymers deposited in vacuum or at atmospheric pressure have shown to be able to supply the needed surface chemistry to improve cells growth. Nevertheless, vacuum or DBD systems used for the deposition of the ammine or carboxylic functional groups have several limitations such as implant size and the inability to select the treatment area. The implementation of the functionalization processes by atmospheric plasma jet devices would allow an easier application and the ability to apply different coatings in different parts of the implant. Up to now plasma jet experimentation has yet been limited to surface activation processes.
In this work we present the deposition by an innovative atmospheric pressure plasma jet of ammine and carboxylic functionalization on titanium substrates. The ammine and carboxylic groups have been obtained respectively using APTES and MMA precursors. The coatings have been investigated by FT-IR spectroscopy, XPS and surface energy measurements.
In the in-vitro tests, the treated samples have shown a higher quantity of absorbed proteins and improved osteoblast cells adhesion on the surfaces compared to the nude titanium control; in particular the carboxylic functionalization has led to a nearly two-fold improvement. On the other side the amine rich surfaces are significantly less viable than the control, while the number of cells grown on the carboxylic functionalization resulted similar to the nude titanium.
The tailoring of the surface chemistry in different implant areas following medical requirements is therefore possible by use of a single plasma jet device.

Keywords
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