

Enhanced osteoblast responses to poly ether ether ketone surface modified by water plasma immersion ion implantation.

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Abstract

Poly ether ether ketone (PEEK) offers a set of characteristics superior for human implants; however, its application is limited by the bio-inert surface property. In this work, PEEK surface was modified using single step plasma immersion ion implantation (PIII) treatment with a gas mixture of water vapor as a plasma resource and argon as an ionization assistant. Field emission scanning electron microscopy, atomic force microscopy and X-ray photoelectron spectroscopy were used to investigate the microstructure and composition of the modified PEEK surface. The water contact angle and zeta-potential of the surfaces were also measured. Osteoblast precursor cells MC3T3-E1 and rat bone mesenchymal stem cells were cultured on the PEEK samples to evaluate their cytocompatibility. The obtained results show that the hydroxyl groups as well as a "ravined structure" are constructed on water PIII modified PEEK. Compared with pristine PEEK, the water PIII treated PEEK is more favorable for osteoblast adhesion, spreading and proliferation, besides, early osteogenic differentiation indicated by the alkaline phosphatase activity is also up-regulated. Our study illustrates enhanced osteoblast responses to the PEEK surface modified by water PIII, which gives positive information in terms of future biomedical applications.

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KEYWORDS:

Hydroxyl groups; Nanostructure; Osteoblast; PEEK; Plasma immersion ion implantation
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