

## **Differentiation of human mesenchymal stem cells on plasma-treated polyetheretherketone.**

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### **Abstract**

Polyetheretherketone (PEEK) generally exhibits physical and chemical characteristics that prevent osseointegration. To activate the PEEK surface, we applied oxygen and ammonia plasma treatments. These treatments resulted in surface modifications, leading to changes in nanostructure, contact angle, electrochemical properties and protein adhesion in a plasma power and process gas dependent way. To evaluate the effect of the plasma-induced PEEK modifications on stem cell adhesion and differentiation, adipose tissue-derived mesenchymal stem cells (adMSC) were seeded on PEEK specimens. We demonstrated an increased adhesion, proliferation, and osteogenic differentiation of adMSC in contact to plasma-treated PEEK. In dependency on the process gas (oxygen or ammonia) and plasma power (between 10 and 200 W for 5 min), varying degrees of osteogenic differentiation were induced. When adMSC were grown on 10 and 50 W oxygen and ammonia plasma-treated PEEK substrates they exhibited a doubled mineralization degree relative to the original PEEK. Thus plasma treatment of PEEK specimens induced changes in surface chemistry and topography and supported osteogenic differentiation of adMSC in vitro. Therefore plasma treated PEEK holds perspective for contributing to osseointegration of dental and orthopedic load-bearing PEEK implants in vivo.

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