

## **An in vitro investigation of bacteria-osteoblast competition on oxygen plasma-modified PEEK.**

[Rochford ET1](#), [Subbiahdoss G](#), [Moriarty TF](#), [Poullsson AH](#), [van der Mei HC](#), [Busscher HJ](#), [Richards RG](#).

### **Author information**

### **Abstract**

Polyetheretherketone (PEEK) films were oxygen plasma treated to increase surface free energy and characterized by X-ray photoelectron microscopy, atomic force microscopy, and water contact angles. A parallel plate flow chamber was used to measure *Staphylococcus epidermidis*, *Staphylococcus aureus*, and U-2 OS osteosarcomal cell-line adhesion to the PEEK films in separate monocultures. In addition, bacteria and U-2 OS cells were cocultured to model competition between osteoblasts and contaminating bacteria for the test surfaces. Plasma treatment of the surfaces increased surface oxygen content and decreased the hydrophobicity of the materials, but did not lead to a significant difference in bacterial or U-2 OS cell adhesion in the monocultures. In the *S. epidermidis* coculture experiments, the U-2 OS cells adhered in greater numbers on the treated surfaces compared to the untreated PEEK and spread to a similar extent. However, in the presence of *S. aureus*, cell death of the U-2 OS occurred within 10 h on all surfaces. The results of this study suggest that oxygen plasma treatment of PEEK may maintain the ability of osteoblast-like cells to adhere and spread, even in the presence of *S. epidermidis* contamination, without increasing the risk of preoperative bacterial adhesion. Therefore, oxygen plasma-treated PEEK remains a promising method to improve implant surface free energy for osseointegration.

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### **KEYWORDS:**

PEEK; *Staphylococcus*; bacterial adhesion; biomaterial-associated infections; coculture; osteoblasts; plasma treatment; surface modification