Bio-inspired Zirconium Based Micro and Nanoarray: Fabrication, Antibacterial Performance and Cell Adhesion Study

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Abstract

The infection caused by bacteria after the implant surgery is a serious problem, which can lead to inflammation and some other diseases. Thus, the orthopedic implant with both excellent antibacterial and osteoconductive performance is desirable in the biomedical field. It was found that natural structures with nanoarrays including cicada or dragonfly wings exhibited inherent antibacterial ability due to the mechanical rupture of the bacterial shell or the movement of the bacteria away from the surface [1,2]. This bactericidal mechanism is superior to some other traditional methods, such as immobilization of bactericidal agents on the surface of biomaterials, which may cause the resistance of bacteria to antibiotics and possible adverse effect on cell adhesion and proliferation activities. In this work, we used colloid lithography to fabricate zirconium related nanoarrays on the surface of titanium alloy. The size, height and the density of the nanoarrays can be adjusted by the size of polystyrene micro/nanosphere, the etching time of reactive ion etching (RIE) and the disposition time of zirconium. The effect of these structural parameters on the bactericidal performance and cell adhesion of the nanoarrays can be studied in detail. The work may give a promising way to develop novel biomaterials in surface science and have potential clinical application.

References
