Effect of low concentration of Mn$^{2+}$ and Zn$^{2+}$ on the physicochemical and biological properties of porous coatings

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Abstract

Pure titanium (Ti) and titanium alloys are considered as bio-inert materials in clinical use. The modification of micro-arc oxidation (MAO) technique is an effective method to improve biocompatibility of titanium. This study aimed to investigate the coatings formed in the electrolytes with different ions content of low concentration, which is beneficial for biological performance. The physicochemical characteristics were investigated using scanning electron microscope (SEM) observation, thin film X-ray diffraction (TF-XRD) analysis, and electron spectroscopy for chemical analysis (ESCA). Cell behavior included morphology observation and number count by methylthiazoletetrazolium assay of MC3T3-E1 cells. The surface morphology exhibited uniform porous structure on titanium and the elements of calcium, phosphorus, zinc and manganese were detected in the porous coatings by ESCA. The XRD results indicated that phase of porous coatings was anatase and rutile. The cell behavior of porous coatings containing zinc or manganese shows the excellent performance. Consequently, this study indicates that zinc or manganese incorporated into porous coatings did not change the physicochemical characteristics but exhibited an effect on biological responses.