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In vitro and In vivo Studies of Hydrogel and BMP-2 Coated ZrO_2-HAp Multi Layers for Bone Tissue Engineering

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D-3

Effect of Hot Water and Heat Treatment on the Apatite-forming Ability of Titania Films Formed on Titanium Metal via Anodic Oxidation in Acetic Acid Solutions

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Titanium and its alloys have been widely used for orthopedic implants because of their good biocompatibility. We have previously shown that the crystalline titania layers formed on the surface of titanium metal via anodic oxidation can induce apatite formation in simulated body fluid, whereas amorphous titania layers do not possess apatite-forming ability. In this study, hot water and heat treatments were applied to transform the titania layers from an amorphous structure into a crystalline structure after titanium metal had been anodized in acetic acid solution. The apatite-forming ability of titania layers subjected to the above treatments in simulated body fluid was investigated. The XRD and SEM results indicated hot water and/or heat treatment could greatly transform the crystal structure of titania layers from an amorphous structure into anatase, or a mixture of anatase and rutile.The abundance of Ti-OH groups formed by hot water treatment could contribute to apatite formation on the surface of titanium metals, and subsequent heat treatment would enhance the bond strength between the apatite layers and the titanium substrates. Thus, bioactive titanium metals could be prepared via anodic oxidation and subsequent hot water and heat treatment that would be suitable for applications under load-bearing conditions.

Keywords: Apatite-forming ability, Titania films, Anodic oxidation