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Bioceramics Composed of Octacalcium Phosphate Demonstrate Enhanced Biological Behavior

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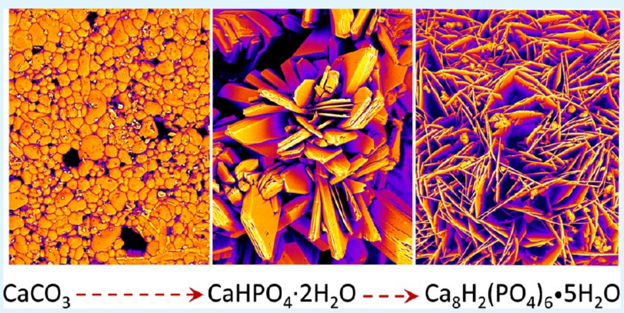
Supporting Information

ABSTRACT: Bioceramics are used to treat bone defects but in general do not induce formation of new bone, which is essential for regeneration process. Many aspects related to bioceramics synthesis, properties and biological response that are still unknown and, there is a great need for further development. In the most recent research efforts were aimed on creation of materials from biological precursors of apatite formation in humans. One possible precursor is octacalcium phosphate (OCP), which is believed to not only exhibit osteoconductivity but possess osteoinductive quality, the ability to induce bone formation. Here we propose a relatively simple route for OCP ceramics preparation with a specifically designed microstructure. Comprehensive study for OCP ceramics including biodegradation, osteogenic properties in ortopic and heterotopic models and limited clinical trials were performed that demonstrated enhanced biological behavior. Our results provide a possible new concept for the clinical applications of OCP ceramics.



KEYWORDS: *octacalcium phosphate, ceramics, bone graft, osteoconductive, osteoinductive, osteotransductive features*

1. INTRODUCTION

Tissue-defect management relies on auto- or allografting techniques.[1] Synthetic tissue graft substitutes have been developed to avoid the problems posed by the surgically induced morbidity of autologous grafts and by the inherent immunogenicity of allografts. Over the last few decades, a number of calcium phosphate biomaterials have been developed for engineering of artificial bone grafts.[2] Thus, the clinical applications of sintered hydroxyapatite (HA) ceramics—although not so many were used in the replacement of bone defects yet—face an intrinsic limitation because of the low biodegradability and new bone formation rate. A better control of the process of an artificial graft biodegradation and bone substitution was based on the concept of a biphase HA – tricalcium phosphate (TCP) ceramic composites or different anion and cation substitutions in apatite.[2,3] However, HA phase remained essentially unaltered at the implantation site throughout the patient's life.[4] The graft was "included" in the repaired bone rather than being "substituted" by newly formed bone matrix. TCP ceramics alone are well-characterized and are reliable, biodegradable commercially available materials.[5−7] However, the biodegradation of TCP materials do not match the parallel rate of bone growth. All of them can be classified as osteoconductive materials. In other words, the major drawback

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