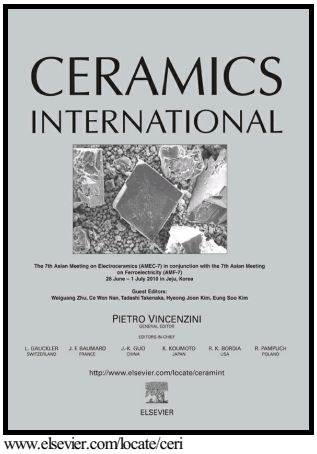

www.elsevier.com/locate/ceri

Multiphasic calcium orthophosphate ($CaPO_4$) bioceramics and their biomedical applications

Sergey V. Dorozhkin

PII: S0272-8842(16)00093-6
DOI: http://dx.doi.org/10.1016/j.ceramint.2016.01.062
Reference: CERI12038

To appear in: *Ceramics International*

Received date: 30 November 2015
Revised date: 10 January 2016
Accepted date: 10 January 2016

Cite this article as: Sergey V. Dorozhkin, Multiphasic calcium orthophosphate ($CaPO_4$) bioceramics and their biomedical applications, *Ceramics International* http://dx.doi.org/10.1016/j.ceramint.2016.01.062

Multiphasic calcium orthophosphate ($CaPO_4$) bioceramics and their biomedical applications

Sergey V. Dorozhkin

Kudrinskaja sq. 1-155, Moscow 123242, Russia. E-mail: *sedorozhkin@yandex.ru*

Abstract

Due to the chemical similarity to the inorganic constituents of calcified tissues of mammals, biologically relevant calcium orthophosphates ($CaPO_4$) have been applied as artificial bioceramics suitable for reconstruction of various types of bone defects. Since none of the known individual types of $CaPO_4$ appears to be able to mimic both the composition and the properties of natural bones, various attempts have been sought to overcome this problem and a multiphasic (polyphasic) concept is one of the reasonable solutions. In general, this approach is determined by advantageous formulations consisting of homogeneous blends of two (biphasic), three (triphasic) or more (multiphasic) individual $CaPO_4$ phases possessing diverse solubility and, therefore, bioresorbability, while the optimum ratios among the phases depend on the definite applications. Therefore, all currently known multiphasic $CaPO_4$ formulations are sparingly soluble in water and, thus, after being implanted they are gradually resorbed inside the body, releasing calcium and orthophosphate ions into the biological medium and, hence, seeding a new bone formation. They have already demonstrated a proven biocompatibility, osteoconductivity, safety and predictability *in vitro, in vivo,* as well as in clinical trials. More recently, *in vitro* and *in vivo* studies have shown that some of them might possess osteoinductive properties. Hence, in tissue engineering, multiphasic $CaPO_4$ bioceramics represent promising formulations to construct various scaffolds capable of carrying and/or modulating the behavior of cells. This review summarizes the available information on biphasic, triphasic and multiphasic $CaPO_4$ bioceramics including their biomedical applications. New formulations have been proposed as well.

Key words: calcium orthophosphates, hydroxyapatite, phase, biphasic, triphasic, multiphasic, polyphasic, bioceramics, bone grafts, tissue engineering.