Analysis of β-tricalcium phosphate granules prepared with different formulations by nano-computed tomography and scanning electron microscopy

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Résumé en anglais	Among biomaterials used for filling bone defects, beta-tricalcium phosphate (β-TCP) is suitable in non-bearing bones, particularly in dental implantology, oral and maxillofacial surgery. When β-TCP granules are placed in a bone defect, they occupy the void 3D volume. Little is known about the 3D arrangement of the granules, which depends on the nature and size of the granules. The aim of this study was to examine the 3D architecture of porous β-TCP granules. Granules were prepared with different concentrations of β-TCP powder in slurry (10, 11, 15, 18, 21, and 25 g of β-TCP powder in distilled water). Granules were prepared by the polyurethane foam method. They were analyzed by nano-computed tomography (nanoCT) and compared with scanning electron microscopy (SEM). Commercial granules of hydroxyapatite-β-TCP prepared by the same methodology were also used. The outer and inner architectures of the granules were shown by nanoCT which evidenced macroporosity, internal porosity and microporosity between the sintered grains. Macroporosity was reduced at high concentration and conversely, numerous concave surfaces were observed. Internal porosity, related to the sublimation of the polyurethane foam, was present in all the granules. Microporosity at the grain joints was evidenced by SEM and on 2D nanoCT sections. Granules presented a heterogeneous aspect due to the different mineralization degree of the sintered powder grains in the β-TCP granules; the difference between hydroxyapatite and β-TCP was also evidenced. NanoCT is an interesting method to analyze the fine morphology of biomaterials with a resolution close to synchrotron and better than microcomputed tomography.
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