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Evaluation of mechanical properties of Ti6Al4V-ZrO_2 composites for dental implants

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The aim of this work is the design of an innovative Ti6Al4V-ZrO_2 metal-ceramic functionally graded material (FGM) in order to obtain a new material which can surpass the possibility of ions release and also present better aesthetical properties than conventional titanium solutions. In this study, the influence of Zirconia (ZrO_2) volume fraction as reinforcement, when regarding mechanical properties of the Ti6Al4V-ZrO_2 composites was investigated. For this purpose, different ZrO_2 reinforced titanium (Ti6Al4V) composites with different volumes % of ZrO_2 were produced by powder metallurgy method. The micro structural characterization of composites was carried out by means of SEM. EDS and XRD analyses were performed in order to investigate the Ti6Al4V/ZrO_2 interface reaction. The obtained results of Ti6Al4V-ZrO_2 composites were evaluated in order to assess the optimum ZrO_2 volume fraction when regarding mechanical properties.

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Physical and biological characterization of magnetic responsive hydroxyapatite nanocrystals aimed at bone applications

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Synthetic hydroxyapatite nanocrystals (n-HA) can be tailored to have physicochemical properties suitable for natural bone substitutions. Similarly, magnetic nanoparticles (MNPs) are being given a growing attention because of their therapeutic potentialities in anticancer hyperthermic treatment. Bearing this in mind, we intended to investigate MNPs-decorated n-HA as putative agents against malignant bone disease. The goal of this study is, in fact, to provide magnetic responsiveness to bone-mimicking n-HA. To this aim, dextran-grafted magnetite nanoparticles (DM) have been prepared by an easy and scalable synthesis based on a previously reported method1. Then, magnetic nano-architectures based on n-HA decorated by DM nanoparticles (DM-HA) have been synthesized by an aqueous precipitation technique in the presence of different amounts of DM (i.e., DM-HA weight ratio: 1/1, 2/1, 3/1). For each DM-HA ratio X-Ray diffraction patterns are consistent with single-phase low crystalline HA similar to deproteinized bone apatite. Magnetic susceptibility of DM-HA shows modulation of the magnetization as a function of the DM content. Cytocompatibility parameters of DM-HA were assessed by using a bone derived human cell line. Morphological and physical interactions between DM-HA and cells were evaluated and compared to DM and n-HA alone. Nanoparticles internalization was investigated by analyzing the intracellular iron content, via atomic emission spectroscopy. Finally, the effects of DM-HA were analyzed in terms of changes in gene expression of adhesion, proliferation and morphology markers, to identify possible interplay with physiological cells responses. Overall, we developed the synthesis of DM-HA particles as bone substitute and anticancer materials due to their magnetic properties.

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