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Calcium phosphate-based hybrid biomaterials for bone regeneration and local antibacterial therapy

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Composites based on hydroxyapatite (HA) and/or tricalcium phosphate (TCP) along with polymers, are widely used in bone regeneration due to their excellent biocompatibility. However, one of the challenges associated with their implantation procedures is the occurrence of inter- and post-operative bacterial infections. To address this issue biomaterials can be enriched with antibacterial agents such as: metallic nanoparticles (eg. AgNPs, AuNPs), ions (Cu^{2+} , Ag^+) or antibiotics, which can effectively inhibit the growth and proliferation of a wide range of bacteria.

In this study, composites based on α TCP and hybrid granules were developed and examined. Hybrid granules composed of hydroxyapatite, methylcellulose and/or chitosan were obtained via wet-chemical method. Materials were enriched with various nanoparticles, including AuNPs, AgNPs and CuONPs. The chemical and phase composition (XRF, XRD), setting times (Gillmore Apparatus), and compressive strength (Instron 3345) were examined. Microstructure was observed using SEM. Furthermore, the bioactive potential *in vitro* in SBF as well as antibacterial activity against *E. coli*, and *S. aureus* were evaluated.

In the present study, some key features were improved by developing novel biomaterials. The designed composites offer biocompatibility, sufficient mechanical and antibacterial properties. Based on the obtained results, it can be concluded that the developed materials hold promise as candidates preventing post-surgical infections in hard tissue applications. Further biological studies are necessary to comprehensively characterize these biomaterials.

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