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Influence of $BaTiO_3$ on the Biological Behaviour of Hydroxyapatite: Collagen Composites

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Abstract : The human bone presents in its dry form piezoelectric properties, which means that a mechanical stress results in electric polarization and an applied electric field causes strain. The immediate consequence was the revealing of piezoelectricity role in bone remodelling, as well as the integration of ceramic materials with piezoelectric behaviour in the composition of unitary or composite biomaterials. Thus, we prepared hydroxyapatite - collagen hybrid materials with barium titanate addition in order to achieve a better osseointegration. Barium titanate powder synthesized by a combined sol-gel-hydrothermal method, commercial hydroxyapatite and laboratory extracted collagen gel were employed as starting materials. Before the composites, fabrication, the powder with piezoelectric features was characterized in detail from the compositional, structural, morphological and electrical point of view. The next step was to elucidate the influence of barium titanate presence especially on the biological properties of the final materials. The biocompatibility of the hybrid supports without or with piezoelectric addition was investigated on mouse osteoblast cells through LDH cytotoxicity assay, LIVE/DEAD cell viability assay, and MTT cell proliferation assay. All results indicated that the analysed materials do not exert cytotoxic effects and present the ability to sustain cell survival and to promote their proliferation. In conclusion, barium titanate nanoparticles exhibit a good biocompatibility and osteoinductive properties, while the derived composite materials based on hydroxyapatite as oxide phase and collagen as polymeric phase can be successfully used for tissue engineering applications.

Keywords : barium titanate, hybrid composites, piezoelectricity, tissue engineering
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