Developments in injectable multiphasic biomaterials. The performance of microporous biphasic calcium phosphate granules and hydrogels

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Résumé en anglais	Calcium phosphate bioceramic granules associated with hydrosoluble polymers were developed as bone substitutes for various maxillofacial and orthopaedic applications. These injectable bone substitutes, support and regenerate bone tissue and resorb after implantation. The efficiency of these multiphasic materials is due to the osteogenic and osteoconductive properties of the microporous biphasic calcium phosphate. The associated hydrosoluble polymers are considered as carriers in order to achieve the rheological properties of injectable bone substitutes (IBS). In this study, we used 2 semi synthetic hydrosoluble polymers of polysaccharidic origin. The hydroxy propyl methyl cellulose (HPMC), with and without silane, was combined with microporous BCP granules. The presence of silane induced considerable gelation of the suspension. The 2 IBS used (without gelation, IBS1, with gelation, IBS2) were implanted in critical size femoral epiphysis defects in rabbits. No foreign body reactions were observed in either sample. However, because of the higher density from gelation, cell colonisation followed by bone tissue ingrowth was delayed over time with IBS2 compared to the IBS1 without gelation. The results showed resorption of the BCP granule and bone ingrowth at the expense of both IBS with different kinetics. This study demonstrates that the hydrogel cannot be considered merely as a carrier. The gelation process delayed cell and tissue colonisation by slow degradation of the HPMC Si, compared to the faster release of HPMC with IBS1, in turn inducing faster permeability and spaces for tissue ingrowth between the BCP granules.
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