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Development of an injectable cement allowing multiple drug delivery for the treatment of breast cancer bone metastasis

Habib Belaid, Catherine Teyssier, David Cornu, Vincent Cavailles and Mikhael Bechelany
University of Montpellier, France

Cancer is a tremendous health problem millions of people are diagnosed with this disease around the world every year. In breast cancer, bone metastasis cause considerable pain and high patient morbidity. Calcium Phosphate based Cements (CPCs) are often applied as bone substitute materials in orthopedics but their use is hindered because of their slow *in vivo* re-sorption rate. A novel route presented in this work is based on a bio-inspired 3D material scaffold which is based on the incorporation of degradable poly(lactic-co-glycolic acid; PLGA) microspheres into the CPC. The controlled porosity created allows a modulation of the cement degradation time. Furthermore, PLGA microspheres are also used as carriers for two drugs including Raloxifene Hydrochloride (RH) and Alendronate (AL). The ultimate goal of this work is therefore to develop a biomimetic and biodegradable injectable cement, allowing for both bone regeneration and inhibition of breast cancer cell proliferation through the local release of osteogenic and anticancer drugs. The physicochemical properties of the CPC scaffolds have been determined using scanning electron microscopy and UV-spectrometry. The results showed the successful encapsulation of the drugs in the microsphere and the loaded microspheres were well incorporated in the CPC scaffold. Finally, initial biological testing has been carried out in order to define the properties of the scaffolds. A cell viability test using MG63 cells has also been conducted to determine the scaffold biocompatibility and its effects on cell proliferation and differentiation. These first results are therefore very promising and open prospects for bone metastasis treatment in breast cancers.

habib.belaid@umontpellier.fr