Synergic use of fluorescent hyaluronan and core-shell nanoparticles for enhanced in-vitro osteoinductivity and osteoconductivity

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The broad field of therapeutic approaches to bone pathologies – which can be arising from either traumas, from illnesses such as cancer, or from aging – demands for enhancing the quality and the rapidity of growth of new bone tissue. In this context, there is an urgent need for scaffolds that allow for the growth of bone tissue also via an enhanced differentiation of osteoprogenitor stem cells. Osteoinductivity can indeed boost the efficacy of transplantations, beside decreasing the recovery time of a variety of orthopedic diseases.

Here we show that the synergic application of two nanomaterials, i.e., a fluorescent hyaluronan and a class of core-shell silica nanoparticles, can enhance both osteoconductivity and osteoinductivity of a novel type of scaffolds, made of engineered magnesium hydroxyapatite and of type I collagen. The two nanomaterials have been demonstrated to intimately interact, with a synergic role for bioavailability and cell internalization. Their fluorescence properties allow for live monitoring of their distribution at the microscale revealing an easy, stable and effective scaffold coating. Our in-vitro study shows promising aspect of this hybrid approach which merges the advantages of an ostheoconductive scaffold with the versatile and facile coating with nanomaterials that may also convey drug delivery functionalities.