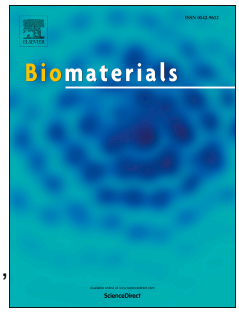
Accepted Manuscript



Evaluation of the osteoinductive potential of a bio-inspired scaffold mimicking the osteogenic niche, for bone augmentation

Silvia Minardi, Bruna Corradetti, Francesca Taraballi, Monica Sandri, Jeffrey Van Eps, Fernando Cabrera, Bradley K. Weiner, Anna Tampieri, Ennio Tasciotti

PII: S0142-9612(15)00461-5

DOI: 10.1016/j.biomaterials.2015.05.011

Reference: JBMT 16848

To appear in: *Biomaterials*

Received Date: 19 February 2015

Revised Date: 2 May 2015

Accepted Date: 14 May 2015

Please cite this article as: Minardi S, Corradetti B, Taraballi F, Sandri M, Van Eps J, Cabrera F, Weiner BK, Tampieri A, Tasciotti E, Evaluation of the osteoinductive potential of a bio-inspired scaffold mimicking the osteogenic niche, for bone augmentation, *Biomaterials* (2015), doi: 10.1016/j.biomaterials.2015.05.011.

Evaluation of the osteoinductive potential of a bio-inspired scaffold mimicking the osteogenic niche, for bone augmentation

Silvia Minardi [a,b], Bruna Corradetti [a,c], Francesca Taraballi [b], Monica Sandri [a], Jeffrey Van Eps [b], Fernando Cabrera [b], Bradley K. Weiner [b,d], Anna Tampieri [a], Ennio Tasciotti [b]*.

[a] Department of Bioceramics and Bio-hybrid materials, National Research Council of Italy – ISTEC, Via Granarolo 64, 48018, Faenza RA, Italy
[b] Department of Nanomedicine, Houston Methodist Research Institute, 6670 Bertner Ave. Houston, TX 77030 (USA)
[c] Department of Life and Environmental Sciences, Universita' Politecnica delle Marche, via Brecce Bianche, 60131, Ancona, Italy
[d] Houston Methodist Hospital, 6565 Fannin Street, Houston, TX 77030 (USA)

Abstract:

Augmentation of regenerative osteogenesis represents a premier clinical need, as hundreds of thousands of patients are left with insufficient healing of bony defects related to a host of insults ranging from congenital abnormalities to traumatic injury to surgically-induced deficits. A synthetic material that closely mimics the composition and structure of the human osteogenic niche represents great potential to to successfully address this high demand. In this study, a magnesium-doped hydroxyapatite/type I collagen scaffold was fabricated through a biologically-inspired mineralization process and designed to mimic human trabecular bone. The composition of the scaffold was fully characterized by XRD, FTIR, ICP and TGA, and compared to human bone. Also, the scaffold microstructure was evaluated by SEM, while its nano-structure and nano-mechanical properties were evaluated by AFM. Human bone marrow-derived mesenchymal stem cells were used to test the *in vitro* capability of the scaffold to promote osteogenic differentiation. The cell/scaffold constructs were cultured up to 7 days and the adhesion, organization and proliferation of the cells were evaluated. The ability of the scaffold to induce osteogenic differentiation of the cells was assessed over 3 weeks and the correlate gene expression for classic genes of osteogenesis was assessed. Finally, when tested in an ectopic model in rabbit, the scaffold produced a large volume of trabecular bone in only two weeks that subsequently underwent maturation over time as