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Development of 3D printed ceramic scaffolds for treatment of segmental bone defects

During the past two decades, research on ceramic scaffolds for bone regeneration has progressed rapidly; however, currently available porous scaffolds remain unsuitable for load-bearing applications. The key to success is to apply microstructural design strategies to develop ceramic scaffolds with mechanical properties approaching those of bone. We previously reported on the development of a unique microstructurally designed ceramic scaffold, strontium–hardystonite–Gahnite (Sr–HT–Gahnite) with 85% porosity, 500 micro pore size, a competitive compressive strength of 4.1 ± 0.3 Mpa; a compressive modulus of 170 ± 20 Mpa. We demonstrated their *in vitro* and *in vivo* biocompatibility and the ability to repair critical-sized bone defects under normal load.

Here we utilised 3D printing technology to further optimise the structure and mechaincal properties of the Sr-HT-Gahnite scaffolds. The developed 3D printed ceramic scaffolds of the Sr-HT Gahnite demonstrated outstanding mechanical properties with compressive strength and modulus values close to that of cortical bone. We further established that the design of the 3D printed Sr-HT Gahinte scaffold, i.e., the strut and truss shapes, would have a profound effect on mechanical properties of the scaffolds.

Biography

Hala Zreiqatis a National Health and Medical Senior Research (NHMRC) Fellow, Head of the Tissue Engineering and Biomaterials Research Unit in the Faculty of Engineering, and the Bosch Institute, Faculty of Medicine, University of Sydney, Australia. She has 93 peer-reviewed publications; 6review papers; 12 book chapters and 4 patents. She is the Immediate Past President of the Australian and New Zealand Orthopedic Research Society (2010-2012); Advisor, World Orthopedic Alliance (since October 2012); Founder and Chair of the Alliance for Design and Application in Tissue Engineering; recipient of the Australia-Harvard Fellowship (2013) and the NHMRC awards (2006, 2011).

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