Tuning the nanotexture of bioinspired bone substitutes: interaction with proteins and *in vivo* bone formation

Maria-Pau Ginebra[1,2,3]
Y. Raymond[1,2,4], M. Bonany[1,2], J. Konka[1,2], C. Lehmann[1], E. Thorel[4], R. Benítez[2], J. Franch[5], M. Espanol [1,2], X. Solé-Martí[1,2], C. Canal[1,2], M.C. Manzanares[6]

[1]Biomaterials, Biomechanics and Tissue Engineering Group, Department of Materials Science and Engineering, Universitat Politècnica de Catalunya (UPC), Av. Eduard Maristany 16, 08019 Barcelona, Spain
[2] Biomedical Engineering Research Center, UPC, Barcelona, Spain
[3]Institut de Bioenginyeria de Catalunya (IBEC), Barcelona, Spain
[4]Mimetis Biomaterials S.L., Barcelona, Spain
[5]Bone Healing Group, Small Animal Surgery Department, Veterinary School, Universitat Autònoma de Barcelona, Spain
[6]Human Anatomy and Embryology Unit, Department of Pathology and Experimental Therapeutics, Universitat de Barcelona, Spain

Maria.pau.ginebra@upc.edu

Abstract

The recent advances in 3D printing technologies have opened the door to the design of customized bone substitutes, mainly based on calcium phosphates. In this context, we have recently developed self-hardening calcium phosphate inks based on the combination of reactive ceramic particle suspensions with hydrogel binders, which harden at low temperature through a dissolution-precipitation process. This approach has several advantages. On the one hand, it avoids the shrinkage associated with high-temperature sintering processes and, on the other hand, the final product is a nanostructured biomimetic apatite, very close to the mineral phase of bone and more reactive than calcium phosphate ceramics.

The reaction kinetics of these self-hardening inks can be adjusted by modifying the reaction conditions, using biomimetic or hydrothermal methods. In addition to influencing the reaction duration, this allows for tailoring the crystalline morphogenesis in the hydrolysis process, resulting in changes in the physicochemical and textural properties of the final product [1,2]. Thus, in addition to the external shape of the implant, it is possible to control the internal pore architecture of the scaffold.

This presentation will focus on the effect of the nanoscale textural properties of 3D printed calcium phosphate scaffolds on their biological performance, highlighting the extent to which differences in nanostructure, nanoporosity and nanopore size are key to both the interaction with proteins in solution [3] and the osteogenic potential of the materials *in vivo*.

References

[1] Raymond Y. et al., *Acta Biomater.* 2021, 135: 671–88
[2] Raymond S. et al., *Acta Biomater.* 2018, 75: 451-62;
[3] Konka J. et al., *Materials Today Bio* 2021, 12: 100137

Figures

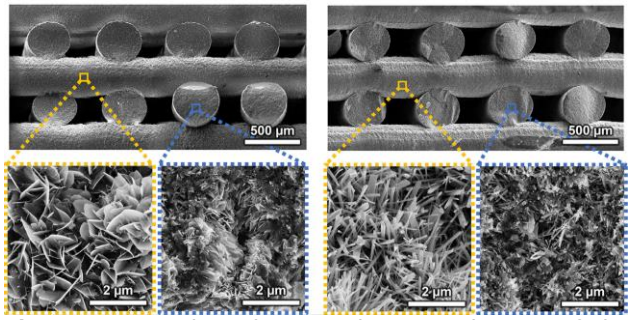

Figure 1. Scanning Electron Microscopy images of the architecture and nanostructure of 3D-printed biomimetic apatite bone grafts.

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