Hybrid Calcium-Carbonate/Modified Polysaccharide Matrix As New Injectable Biomaterial For Bone Reconstruction. Synthesis and Characterization.

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With the development of minimally invasive surgical techniques, there is growing interest in the research and development of injectable biomaterials with controlled rheological properties, as bone substitute to promote bone reconstruction1. In the last few years, biomimetic fast-setting calcium-phosphate bone cements have been studied in depth and developed industrially, due to their excellent biocompatibility, bioactivity and injectability as a paste. However, several difficulties limit their implantation and efficiency, notably the "cement washout" phenomena (disintegration of the paste on contact with fluids or tissue) and the slow in vivo bone ingrowth of CaP bone cement. In this context, we have proposed to develop a new injectable composite biomaterial for bone regeneration, based on the association of two innovative systems: synthetic calcium carbonates and/or calcium phosphates and tailor-made thermogelling polysaccharides.
The polysaccharide selected is hyaluronic acid (HA) which is naturally present in the body and often used for biomedical applications (osteoarthritis, post-surgical adhesion, tissue engineering, dermatology, cosmetics). Indeed, it is a natural polysaccharide exhibiting excellent biocompatibility, biodegradability with unique biologic and viscoelastic properties.
For this purpose, we have focused our work first in the synthesis of tailor-made HA derivatives that should optimize the injectability and self-setting properties of the cement composition as well as cellular adhesion promoting bone repair.
The next steps will be to study rheological and biological properties of the modified polymers to select the best polysaccharide candidate for the development of composite materials.

[1] C. Combes, S. Tadier, H. Galliard, S.Girod Fullana, C. Charvillat, C. Rey, R. Auzély-Velty, N. El Kissi, Acta Biomateriala, 6 (2010) 920-927
[2] G. Abatangelo, P.H. Weigel, Editors, New Frontiers in Medical Sciences: Redefining Hyaluronan. (Proceedings of the Symposium held in Padua, Italy, 17-19 June 1999.), 2000.