3D technology and antibacterial post-treatments: the process for the future manufacturing of bone substitutes?

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Various 3D methods have been more and more used for the manufacturing of macroporous bioceramics for bone substitution applications. It is then legitimate to question the relevance of these methods regarding cellular behavior and recolonization of the ceramic parts in healthy or pathogenic biological conditions as nosocomial diseases. A first part of this talk will present the results of Chamary's PhD work devoted to the comparison of macroporous calcium phosphate architectures manufactured by a series of techniques: the replica technique from a polymer ball skeleton impregnated with ceramic slurry, the ice templating from ceramic slurry and the additive SLA method with regard to bone recolonization. These methods lead to very different porosity structures in terms of size and shape which has a real impact on cell migration inside the bone substitute. The second part of the talk will present three different routes developed in our laboratories in order to implement antibacterial properties in bone substitutes: ceramic surface modification by laser treatment, antiviral phage deposition on ceramic powder and substrate and synthesis of antimicrobial peptides (AMPs) by recombinant technology and grafting on biomaterials.