

Ceramics for better healthcare

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Nowadays, ceramic materials are of growing importance in medical applications as bone substitutes or diagnostic devices. For orthopaedic applications, ceramics can be classified into two broad types of interactions between ceramic and living tissue: an inert response for dense ceramic parts in alumina, zirconia or composites for joint replacement devices such as hip or knee prosthesis, and as materials with bioactive response for macro-porous osteo-conductive materials composed of calcium phosphate, carbonate and sulphates for bone substitute applications characterized by colonization by living cells, tissue remodelling and facilitation of new bone growth. For the last decades, ceramists have studied the bioactivity and reactivity of these mineral compositions in vivo to optimise the best ceramic material in terms of osteogenic kinetics. Calcium phosphate ceramics like hydroxyapatite, β -tricalcium phosphate or biphasic mixtures are currently used extensively owing to similarity of their chemical composition close to that of the mineral phase of bone. Researchers are now focused on two topics: i) design of the best macro-porosity structures to promote cell colonization and vascularization by various methods such as impregnation ceramic slurries of a polymeric skeleton made of bonded organic PMMA beads, freeze-casting of ceramic suspensions, 3D-printing techniques of ceramic slurries, and, ii) functionalizing the as-prepared macro-porous ceramics in order to add some osteogenic or therapeutic property.

This talk will be focused on the research work performed in the LMCPA-UVHC since the 90s, often with collaboration with other European laboratories especially the fabrication of porous substitutes via different methods, the comparison of their colonization by mouse and human cells and the functionalization of these structures by specific virus called phages. The phagotherapy allows a more targeted therapeutic action and constitutes an interesting alternative therapeutic for conventional antibiotics.