Abstract

Musculoskeletal diseases affect millions of people across the world. When the bone self-healing process is insufficient to repair a defect, a bone implant or filler is needed. Synthetic biomaterials are the best candidates to overcome these problems. The host response to a biomaterial is critical for its success and it is dictated by proteins adsorbed on the surface preparing the material for the cells.

First, the protein adsorption between first and second generation biomaterials was tested. Bioinert ceramics absorbed a lower quantity of proteins such as albumin or fibrinogen. In addition, soft proteins such as albumin was absorbed mainly through a denaturation process, but proteins with β-sheet structures tend to absorbed higher in their native state. Then, surface modifications such as chemical treatment of surface functionalization were tested. The use of culture media on bioactive glass produced a deposition of calcium carbonate in contrast with the better known calcium phosphate and the functionalization with heparin attract the albumin with high percentage of β-sheet structures, which could reduce the protein aggregation locally. Finally, the effect of proteins in dissolution of calcium phosphates was reviewed. No important dissolution was observed and in hydroxyapatite and tricalcium phosphate, but a phosphate bond redistribution was observed indicating a release of calcium which in the case of hydroxyapatite was clearly reduced due to protein presence. It is known that calcium plays a key role in the activation of osteoblasts. These results indicate the importance of cell driven degradation and further studies should be done in order to understand the importance of calcium release, protein adsorption and osteoblast behavior.

As a conclusion, we have modelled a wide portion of today's most used biomaterials and tested their interactions with proteins. This contribution improves the understanding of biomaterial performance in their most fundamental basis.