In vitro studies on the biological response to bone-substitute biomaterials and regenerative medicine

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Even though diverse methodologies are nowadays clinically employed in regenerative or corrective bone therapy, including the gold-standard use of autologous bone-grafts, much effort has been put, In the last decades, on the development of novel materials and methodologies, including bioengineering and the use of biomaterials as scaffolds or substitute materials. Smart materials, which may contribute to modulate desired physiological responses on the surrounding grafted tissues, are constantly proposed/developed by association with recombinant proteins and molecules or mesenchymal stem cells, net substitution with bioactive ions, modifications of surface properties, and development of nanostructured materials, among other strategies aiming for better interactions with the biological microenvironments. However, the increasingly amount of combinations of novel materials and strategies also increase the need for straighforward methodologies for the assessment of the safety and efficacy of these strategies, prior to human use. In this context, in vitro assays might play a crucial role, by reducing animal testing, animal-to-human extrapolation of data from in vivo studies, as well as contributing to unveil the molecular mechanisms under the observed physiological phenomena. Evolving from the simpler single-endpoint cytotoxicity tests to advanced human-on–a-Chip and mini-bone tridimensional tissue-equivalent models, the present work aims to present data and discuss the advantages and challenges of the main strategies, employed on in vitro biocompatibility studies and assessments of bone cell response to graft materials, such as tridimensional cell-culture and high-throughput and multiplex protein assays, on the light of the new frontiers and paradigms of the 21st century toxicology and bone biology.

Palavra chave: Biomaterials; osteoblasts; biocompatibility

Patrocínio: CNPq and CAPES