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Book of Abstracts

YOUNG CERAMISTS NETWORK

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HOW NOVEL BIOMATERIALS BASED ON BIOACTIVE GLASS AND β-TRICALCIUM PHOSPHATE CAN BE EVALUATED UNDER PHYSIOLOGICALLY RELEVANT CONDITIONS?

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Comprehensive preclinical studies are essential for the development of novel biomaterials that can be used in biomedical applications. However, traditional methods used for the evaluation of biomaterials have certain limitations. *In vitro* testing in cell monolayers is fast and easily accessible, but the 2D environment can affect cell metabolism and morphology, leading to unreliable results. On the other hand, *in vivo* animal studies are complex, time-consuming, expensive, and raise ethical concerns.
Biomimetic bioreactors, primarily developed for tissue engineering to provide a physiologically relevant, strictly controlled environment that mimics the conditions in specific tissues or organs, could be indispensable tools in physiologically relevant biomaterial characterization and step between *in vitro* and *in vivo* studies. They offer the majority or all the necessary biochemical (e.g. pH, nutrients, gases, growth factors) and biophysical signals (e.g., shear stress, hydrostatic pressure, mechanical strains) highly relevant for biomaterial assessment and prediction of material behavior after implantation.
Our group has developed two types of potential biomaterials aimed for bone and osteochondral tissue engineering based on bioactive glass (BAG), β-tricalcium phosphate (β-TCP), and different natural polymers (gellan gum and alginate). Scaffolds' integrity and mechanical properties were monitored continuously under the physiological level of mechanical compression using a dynamic compression bioreactor coupled with medium perfusion during 14 days. Formation of hydroxyapatite (HAp) within the scaffolds was investigated in a perfusion bioreactor, in the presence of simulated body fluid (SBF) during 14 and 28 days for scaffolds based on BAG and β-TCP, respectively. SEM, EDS, and XRD results have shown a significant increase in the formation of HAp under bioreactor conditions compared to static control conditions. Beyond that, formed HAp crystals were more uniformly distributed throughout scaffolds and presented more cauliflower-like morphology. The obtained results demonstrated the utilization potential of biomimetic bioreactors in physiologically relevant biomaterial characterization.