OB04

Design of a portable high-pressure reactor for the in situ foaming of polymer implants using carbon dioxide as a porogen agent

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More than 20 years ago, polymer foaming using dense carbon dioxide as porogen agent has been proposed as a new strategy for the preparation of porous and interconnected 3D architectures for bone regeneration. Many reports in the literature highlight the potential of the technology to prepare biocompatible porous materials, with adequate properties for bone implants, with or without the incorporation of bioactive agents. In this work, we designed and developed a portable high-pressure syringe capable to locally inject a polymeric foam and provide 3D volumetric filling of the defect site. The possibility to deliver in situ a moldable porous scaffold, able to acquire the shape of the defect while maintaining the stability of the bone, and further promote its healing, is a major breakthrough in the field. To our knowledge polymer foaming and polymer extrusion were never described in an in situ procedure. Herein, we modified polycaprolactone (PCL) with polydopamine and polymethacrylic acid (PCL pDA PMAA) in order to enhance PCL adhesive properties. The morphological and physicochemical characterization of the PCL pDA PMAA produced is presented. As proof of concept, PCL pDA pMAA was extruded into an ex vivo porcine intervertebral defect at 50 bar and 60 ºC, and the morphological characterization of the foamed samples was carried out by micro-computed tomography. In situ foaming resulted in immediate stabilization of osseous components, while resulting in a 3D structure with properties similar to those found in trabecular bone.