

Abstract

3D Bio printed Biodegradable PLGA-HAp Composite Material for Pediatric CranioMaxilloFacial Implants

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The conventional manufacturing methods (such as solvent casting, particle leaching, freeze drying, thermally induced phase separation, and gas foaming [1]) are not applicable to create pre-determined complex anatomical geometries and utilization of polymer-ceramic material composition with these types of manufacturing methods is a challenge. Nevertheless, additive manufacturing methods have been introduced in the medical field and one of such methods, Fused Deposition Modelling (FDM)- pneumatic method (Allevi 1 by 3D Systems) is provided as a cutting-edge solution in terms of producibility of such complex geometries with referred composite materials. In particular, Poly lactic co glycol acid (PLGA): micro/nano Hydroxyapatite (m/n HAp) weight ratio, printing parameters, physical characterization of constructs after printing and in vitro or in vivo tests were examined in order to understand their compatibility with bone tissue engineering applications [1],[2],[3]. These applications have been provided a starting point to give a solution for pediatric craniomaxillofacial implant treatment. Therefore, the method developed in this paper is dedicated to children, as such craniomaxillofacial (CMF) implants do not hinder the physical growth of these developing children. Moreover, the lattice geometries have been introduced last decades as a new scaffold design [4]. In this study, one of the Triply Periodic Minimal Surface Lattice types, Gyroid has been chosen both for osteointegration and self-supporting features for biological response and producibility respectively. In this article, three different HAp weight percentages within the final PLGA/m/nHAp composite material (10, 20, and 30 %, w/w) and producibility of innovative patient-specific geometry design with these materials will be discussed.

AUTHOR'S STATEMENT

Conflict of interest: It should be mentioned that the application will be used commercial purposes under TraBTech Medical Advanced Technologies company.

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