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Optimization of bone tissue scaffolds fabricated by robocasting technique

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Abstract

While excellent biological and mechanical properties of ceramic scaffolds place them amongst the main candidates for applications of bone and cartilage repair, an optimum trade-off between critical biological and mechanical functions remains challenging during design process. These ceramic scaffolds should not only enhance tissue regeneration function, but also be of adequate mechanical strength particularly in load-bearing applications. One of the techniques used for the fabrication of ceramic scaffolds is robocating which has so far received little attention in the currently available optimization analyses related to the design of these scaffolds. In this study a vigorous optimization analysis based on finite element (FE) method is performed to maximize compressive strengths of such scaffolds while maintaining the minimum biological functions required for tissue ingrowth. The results demonstrate that an optimized functionality of ceramic scaffolds fabricated by robocasting needs a careful design of critical geometrical features.

Keywords: Robocasting, bone tissue engineering, ceramic scaffolds, optimization.