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Advancement in Adhesion and Osteogenesis of Stem Cells with Histatin Coated 3D-Printed Bio-Ceramics

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Abstract : Mesenchymal stem cell and 3D printing-based bone tissue engineering present a promising technique to repair large-volume bone defects. Its success is highly dependent on cell attachment, spreading, osteogenic differentiation, and in vivo survival of stem cells on 3D-printed scaffolds. In this study, human salivary histatin-1 (Hst1) was utilized to enhance the interactions between human adipose-derived stem cells (hASCs) and 3D-printed β-tricalcium phosphate (β-TCP) bioceramic scaffolds. Fluorescent images showed that Hst1 significantly enhanced the adhesion of hASCs to both bioinert glass and 3D-printed β-TCP scaffold. In addition, Hst1 was associated with significantly higher proliferation and osteogenic differentiation of hASCs on 3D-printed β-TCP scaffolds. Moreover, coating 3D-printed β-TCP scaffolds with histatin significantly promotes the survival of hASCs in vivo. The ERK and p38 but not JNK signaling was found to be involved in the superior adhesion of hASCs to β-TCP scaffolds with the aid of Hst1. In conclusion, Hst1 could significantly promote the adhesion, spreading, osteogenic differentiation, and in vivo survival of hASCs on 3D-printed β-TCP scaffolds, bearing a promising application in stem cell/3D printing-based constructs for bone tissue engineering.

Keywords : 3d printing, adipose-derived stem cells, bone tissue engineering, histatin-1, osteogenesis
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