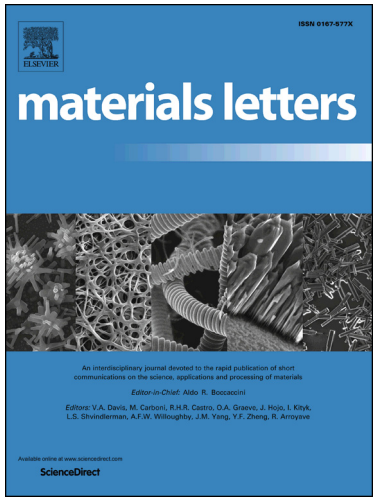

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3D bioprinting of cell-laden scaffolds for intervertebral disc regeneration

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Abstract

Mimicking the three-dimensional (3D) biological structure of native tissues and organs has remained a challenge for tissue engineering. The current use of hydrogels for intervertebral disc (IVD) repair is not ideal for insufficient mechanical properties. To overcome this limitation, we combine the excellent mechanical performance of poly(lactic acid) (PLA) with the biocompatibility and bioprintability of gellan gum-poly (ethylene glycol) diacrylate (GG-PEGDA) double network hydrogel to meet the necessary requirement of IVD regeneration. The cell-laden constructs were fabricated using 3D bioprinting technology. Mechanical and degradation properties of the dual printed scaffolds can be regulated by controlling the infill patterns and density of the PLA frameworks. Bone marrow stromal cells co-printed into the PLA/GG-PEGDA scaffolds remained high viability and showed excellent spreading within the hydrogels. Considering positive biocompatibility accompanied with suitable mechanical properties, this hybrid scaffolds have the potential to assist IVD regeneration.

Keywords:

3D bioprinting; Hydrogel; Poly(lactic acid); Polymeric composites; Biomaterials

1. Introduction

3D bioprinting with precise positioning of the biomaterials, bio-chemical signals and living cells, is being applied in regenerative medicine [1]. Hydrogel has been proven as