Journal of
Cellular and Molecular Biology Research

Abstract

Biomimetic 3D bioprinting of cellular laden nanocomposite scaffold through co-axial and core-co-cultured structure

Fahimeh Shahabipour
National Cell Bank of Iran, Iran

Abstract:
There is a need to recapitulate the native complexity of bone structure within engineered 3D structures with tailored biological and mechanical properties. In this study, we suggest an innovative cell-printing process, supplemented with core/shell nozzle and co-cultured/mono-cultured methods, to achieve 3D osteon-like structures through cell-laden bioinks using an extrusion-based 3D bioprinter in one-step. In this study, vascularization promoting and osteogenic bioinks were developed based on different concentration of GelMA-alginate hydrogels with the incorporation of hydroxyapatite nanoparticles. These hydrogels were chosen due to their suitable mechanical stability, swelling ratio, and printability. To obtain a core/shell osteon-like structure (CSBP), we used a vascularization bioink combined HUVECs in the core region, and used osteogenic-MC3T3-E1 cells-laden bioinks in the shell region. Pure gelatin was concentration in all bioinks to support both of core and shell structures during 3D bioprinting. Core-co-cultured osteon-like structure (CCBP) was fabricated through co-culturing of HUVECs and MC3T3 cells within bioink in the core region. Mono-cultured printed structure composed of single cell lines served as a control. The fabricated 3D-core-cocultured of HUVECs-MC3T3 cells showed significantly higher cell viability (84%) compared to that (78%) of a 3D-core/shell of HUVECs/MC3T3 cells. Both fabricated structures exhibited outstanding cell viability in comparison with (65%) of mono-cultured 3D cell-laden scaffold (control). In addition, significant increases in osteogenic properties were observed in the co-culture samples versus the mono-culture controls. We demonstrated that both co-culture configurations were able to promote mineral deposition in the absence of exogenous osteogenic factors. Although the CSBP configuration displayed less viability than CCBP, this structure still exhibited good osteogenic and angiogenic properties. In conclusion, this investigation provided highlighted the potential of both structures as biomimetic bone scaffolds for complex bone tissue and other tissue engineering application.

Biography:
Fahimeh Shahabipour currently works at the national cell bank of Iran, Pasteur Institute of Iran (IPI). Fahimeh does research in Biotechnology and Bioengineering.

Publication of speakers:

- Cell–cell interaction in a co□culture system consisting of CRISPR /Cas9 mediated GFP knock□ in HUVECs and MG □63 cells in alginate□GelMA based nanocomposites hydrogel as a 3D scaffold, Mar 2020.
- Key Components of Engineering Vascularized Three-Dimensional Bioprinted Bone Constructs, Sep 2019.
- Evaluation of testis hormonal and histopathological alterations in type I and type II diabetic rats, May 2019
- Naturally occurring anti-cancer agents targeting EZH2, Mar 2017
- Exosomes: Nanoparticulate Tools for RNA Interference and Drug Delivery: Exosomes in gene and drug delivery, Jan 2017

Citation: Fahimeh Shahabipour ; Biomimetic 3D bioprinting of cellular laden nanocomposite scaffold through co-axial and core-co-cultured structure ; Genome Editing 2020; September 24, 2020 ; London, UK.