عنوان مقاله:

Surface Topography-Dependent Calcium-Phosphate Coating of 3D-Printed PCL Scaffolds: Enhanced Osteogenic by Pre-osteoblasts

محل انتشار:

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تعداد صفحات اصل مقاله: 1

نویسندگان:

Yasaman Zamani - *Department of Biomedical Engineering, Faculty of New Sciences and Technologies, University of Tehran, Tehran, Iran- Department of Biomedical Engineering, Research Center for New Technologies in Life Science Engineering, University ofTehran, Tehran, Iran*

Javad Mohammadi - *Department of Biomedical Engineering, Faculty of New Sciences and Technologies, University of Tehran, Tehran, Iran*

Ghassem Amoabediny - *Department of Biomedical Engineering, Research Center for New Technologies in Life Science Engineering, University ofTehran, Tehran, Iran- School of Chemical Engineering, College of Engineering, University of Tehran, Tehran, Iran- Department of Oral and M*

Marco N Helder

خلاصه مقاله:

Background and Aim: Poly(ε-caprolactone) (PCL; FDA approved)scaffold is often used in bone tissue engineering because of its highstiffness, long degradation time and degradation products removableby natural pathways. Since PCL is not bioactive, surface coating of PCLscaffold with calcium phosphate (CaP) is commonly used to render thesurface bioactive. We aimed to test the effect of surface topography onbiomimetic CaP coating on 3D-printed PCL scaffolds and osteogenicpotential of CaP-coated PCL scaffolds.Methods: PCL scaffolds were fabricated using an extrusion-based3D-bioprinter. Scaffolds were etched by 3 M NaOH for 24 or 72 h tocreate topography on the surface. Biomimetic CaP coating was carried outthrough alternate dipping of etched PCL scaffolds in 200 mM CaCl2 andK2HPO4.3H2O aqueous solutions. Scanning electron microscopy (SEM)was used to study the surface topography. The elemental compositionof the surface was studied by energy dispersive spectroscopy (EDS).MC3T3-E1 pre-osteoblasts were cultured up to 14 days on PCL scaffoldswith or without CaP-coating. Alkaline phosphatase (ALP) activity wasmeasured and normalized to protein content after 14 days of culture usingp-nitrophenol liberated enzymatically from p-nitrophenyl phosphate.Results: SEM showed that NaOH etching changed the scaffold surfacetopography from smooth to a honeycomb-like pattern with small (24 hNaOH-etched) and large (72 h NaOH-etched) pores. EDS showed thatafter CaP coating, percent Ca and P atoms on the surface of 24 h NaOHetchedscaffold was 2.5-fold higher than on 72 h-etched scaffolds. Cellsshowed increased ALP activity by 3.4-fold on 24 h NaOH-etched CaPcoatedscaffold and 1.5-fold on 72 h NaOH-etched CaP-coated scaffoldcompared to the scaffold without CaP coating.Conclusion: Our results suggest that a honeycomb-like surfacetopography enhances biomimetic CaP coating on 3D-printed PCLscaffolds and therefore, enhances osteogenic activity of pre-osteoblastswhich might have implications for bone tissue engineering.

کلمات کلیدی: