An engineered cell-imprinted substrate directs osteogenic differentiation in stem cells - DTU Orbit (28/12/2018)

An engineered cell-imprinted substrate directs osteogenic differentiation in stem cells

A cell-imprinted poly(dimethylsiloxane)/hydroxyapatite nanocomposite substrate was fabricated to engage topographical, mechanical, and chemical signals to stimulate and boost stem cell osteogenic differentiation. The physicochemical properties of the fabricated substrates, with nanoscale resolution of osteoblast morphology, were probed using a wide range of techniques including scanning electron microscopy, atomic force microscopy, dynamic mechanical thermal analysis, and water contact angle measurements. The osteogenic differentiation capacity of the cultured stem cells on these substrates was probed by alizarin red staining, ALP activity, osteocalcin measurements, and gene expression analysis. The outcomes revealed that the concurrent roles of the surface patterns and viscoelastic properties of the substrate provide the capability of directing stem cell differentiation toward osteogenic phenotypes. Besides the physical and mechanical effects, we found that the chemical signaling of osteoinductive hydroxyapatite nanoparticles, embedded in the nanocomposite substrates, could further improve and optimize stem cell osteogenic differentiation.

General information
State: Published
Organisations: Department of Chemistry, Amirkabir University of Technology, Pasteur Institute of Iran, Tehran University of Medical Sciences
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Number of pages: 11
Pages: 189-199
Publication date: 2018
Peer-reviewed: Yes

Publication information
Journal: Biomaterials Science
Volume: 6
Issue number: 1
ISSN (Print): 2047-4849
Ratings:
Web of Science (2018): Indexed yes
Scopus rating (2017): CiteScore 4.96 SJR 1.604 SNIP 1.009
Web of Science (2017): Impact factor 5.831
Web of Science (2017): Indexed yes
Scopus rating (2016): CiteScore 4.36 SJR 1.441 SNIP 0.932
Web of Science (2016): Impact factor 4.21
Scopus rating (2015): CiteScore 3.84 SJR 1.298 SNIP 0.932
Scopus rating (2014): CiteScore 4.15 SJR 1.206 SNIP 0.872
Web of Science (2014): Impact factor 3.831
Web of Science (2013): Impact factor
Original language: English
DOIs: 10.1039/c7bm00733g
Source: FindIt
Source-ID: 2393570098
Research output: Research - peer-review; Journal article – Annual report year: 2018