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Halloysite nanotube bio-inks support adhesion and differentiation of stem cells towards bone lineages

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Abstract

Halloysite nanotubes are naturally formed clays, which exhibit high levels of cyto-compatibility. The tubular structure of HNT enables its loading with a variety of materials for sustained and extended release. This study examined the osteogenic potential of HNTs embedded in polycaprolactone constructs. Three-dimensionally printed PCL constructs and solvent cast films were studied and compared to HNT-loaded versions. Scaffold topographies were monitored with scanning electron microscopy. Alkaline phosphatase and alizarin red staining was used to examine osteogenic differentiation of human placental-derived mesenchymal stem cells and mouse bone marrow mesenchymal stem cells on bio-ink surfaces. Cellular adhesion was monitored by optical and fluorescent microscopy and examined with Calcein AM and ethidium homodimer. Results showed that cell adhesion and ALP expression were significantly increased in both mBMSC and hPMSC by addition of HNTs, and inclusion of HNTs supported hPMSC proliferation and mineralization. Our results suggest that HNT-PCL composites have applications in 3D printer bio-inks, drug-delivery systems and bone tissue engineering.

Biography

J Steven Alexander completed his PhD in 1989 (Boston University), and a fellowship in Biomedical Engineering at Vanderbilt Univ. before joining the Molecular and Cellular Physiology Department at LSU Health Sciences Centre in 1993. He holds joint appointments in Medicine and Neurology and has over 305 publications, his publication H-index is 46.36 and serves on the board of the Centre for Tissue Engineering and Regenerative Medicine at Ochsner-LSUHSC-Shreveport.

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