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Injectable polycaprolactone nanofibers interspersed-collagen scaffold (P-NCOL) for improved MC3T3-E1 osteogenic activity

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Type I collagen is a great candidate for injectable cell-entrained bone tissue biomaterials but volume shrinkage created by encapsulated cell contraction creates voids over time in injected area. The aim of this study is to identify the effect of polycaprolactone interspersion within Type I Collagen (BD Biosciences) on collagen contraction, morphology and encapsulated MC3T3-E1 cell function. For that purpose, different (w/v) ratio of PCL-collagen with 0%, 1%, and 6% (w/v) have been prepared. PCL nanofibers interspersion within collagen Type-I scaffold provides fibrous internal and external structure that are able to promote anchorage dependent MC3T3-E1 cells attachment, and differentiation. The fibrous structure formation was increased with increased PCL ratio and reached highest for 6% (w/v) P-NCOL as assessed by Scanning Electron Microscopy (SEM) micrograph. In addition, The PCL nanofiber incorporation into collagen reduces the shrinkage ratio (area at day-14/original area) from 80% for collagen to 1% for P-NCOL with 6% (w/v). The MC3T3-E1 encapsulated in P-NCOL showed improved osteoblastic activity, as assessed by the expression of alkaline phosphatase (ALP), mineralization, Run X-2 and osteocalcin expression. The ALP activity measured at Day 14 showed that activity was increased with increased PCL ratio. The mineralization data measured by alizarin red at day-21 showed that the mineralization has been doubled on 6% (w/v) P-NCOL compared to collagen scaffold. This novel injectable material holds promise in bone regeneration because of its osteoconductivity and its ability to retain its original volume over a extend cell culture period.

Biography

Yildirim has completed her Ph.D from Drexel University. Currently she is a faculty member of the Bioengineering Department and adjunct professor at Department of Orthopaedic Surgery. Dr. Yildirim is Director of Engineered Biosystems Laboratory, at Bioengineering Department. Her research group has been focusing on creating 3D biomimetic microenvironment as tissue scaffold, and on identifying the response of bone and cancer cells to physical, chemical, mechanical, and biological changes in cellular microenvironment.

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