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TITLE: Bone Regeneration using Periodontal Ligament Cells seeded on Silk Scaffold
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ABSTRACT BODY:
Objectives: Bone replacement is one of the critical steps for management of oral bone defects. many methods have been used to restore such defect. However, biocompatibility and increasing donor site morbidity are still among the main challenges. The current study aims to investigate the potential of using human periodontal ligament cells (hPDLCs) for bone formation, with Bombyx mori fibroin (BMF) silk as a scaffold material.
Methods: Human periodontal ligament cells were isolated from human extracted molar teeth that were granted from Leeds Dental School tissue bank. Foam scaffolds were fabricated from BMF in cylindrical shapes. Sterilised scaffolds were subjected to surface modification with 20% Fetal bovine serum (FBS). Calcein fluorescence staining was used to label the cells before being seeded dynamically (4x103 cell/mm3) on BMF scaffolds. For in-vitro experiments, all samples were incubated in osteogenic medium for 21 days. Another group of seeded scaffolds were placed in diffusion chambers and implanted in peritoneal space of CD1 nude mice to evaluate the growth in-vivo. To study the cellular ingrowth, extracellular matrix formation and mineral deposition, all samples were prepared and stained for histological examination. Furthermore, the expression of osteogenic proteins e.g. collagen type I, osteopontin and osteocalcin was detected with immunohistochemical (IHC) stains
Results: After 24 hrs of in-vitro seeding, hPDLCs begin to spread over the scaffold surface as shown by fluorescence microscope images. Cell density increased over a period of 14 days. Histological examination demonstrated that both in-vitro and in-vivo samples showed ingrowth of cells and formation of abundant amounts of extracellular matrix and collagen bundles. Moreover, the presence of black-stained extracellular deposits was detected after staining with Von Kossa stain. Also, osteogenic proteins were detected in both groups.
Conclusions: Human periodontal ligament cells that isolated from extracted teeth can proliferate and differentiate into osteoblast-like cells when grown in particular culturing conditions, also, they enhance bone-like tissue formation, both in-vitro and in-vivo.
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