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# The effect of scaffold composition on bone regeneration

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## Abstract

Tissue engineering is used for creating biological substitutes to repair or replace failing organs or tissues. the ideal scaffolds should meet several criteria, including biocompatibility, biodegradability, interconnected porosity, and they should also provide a mechanically stable support for cell development and new tissue formation. Various types of synthetic biodegradable polymers have been investigated for tissue engineering, such as Polylactic acid (PLA), Poly-caprolactone (PCL), Poly-3-hydroxybutyrateco-3-hydroxyvalerate (PHB-HV), Eri -Tasar silk fibroin scaffold, poly[(L-lactide)-co-(e-caprolactone)] (PLCL) and gelatin. The feasibility of using nanoclay-enriched PCL scaffolds for tissue engineering is investigated in vitro using human mesenchymal stem cells (hMSCs). The nanoclay-enriched electrospun PCL scaffolds support hMSCs adhesion and proliferation. Nanoclayenriched PCL fibrous scaffold may be used for musculoskeletal tissue engineering. PCL/PLA blend nanofibrous scaffolds would be strongly favorable/desired for hMSCs osteogenic differentiation and cranial bone formation. Human adipose-derived mesenchymal stem cells (hASCs) are currently a point of focus for bone tissue engineering applications. Osteogenic differentiation of hASCs in poly-3 hydroxybutyrateco-3-hydroxyvalerate (PHB-HV) scaffolds with the osteogenic medium supplemented with pooled allogeneic human serum was promoted. The osteogenic capacity of hASCs seeded on PHB-HV scaffolds indicates that this scaffold is adequate for cell growth and differentiation; in addition, aHS is a promising supplement for the in vitro expansion of hASCs. Mechanical properties and osteogenic potential of composed scaffolds from Eri (Philosamia ricini) and Tasar (Antheraea mylitta) silk (ET scaffolds) resulted in greater osteogenic differentiation of hMSCs. The incorporation of gelatin in the nanofibers also stimulated the adhesion and osteogenic differentiation of hMSCs. Evidence show that electrospun biocomposite scaffolds based on biocompatible and biodegradable polyesters will hold relevance as temporary supports for hMSC development and differentiation with a high therapeutic potential in tissue regeneration processes. Altogether, these strategies seem to be useful and safe for application in bone tissue engineering.

Keywords: Tissue Engineering, Scaffolds, Mesenchymal Stem Cells, Osteogenic Differentiation

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