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Development and characterization of a bioactive porous collagen/β-tricalcium phosphate graft for bone tissue engineering

Nafiseh Baheiraei[1] and S M Javad Mortazavi[2]
[1]Tarbiat Modares University, Iran
[2]Tehran University of Medical Sciences, Iran

Statement of the Problem: Bone defects are a fundamental public health issues and are the leading cause of morbidity and disability in elderly patients. Tissue engineering techniques provide a new method of regenerating damaged or diseased bone tissue. The purpose of this study was to develop and characterize collagen (COL) and collagen/beta tricalcium phosphate (COL/βTCP) scaffolds with a βTCP/collagen weight ratio of 4 using a freeze drying method.

Methodology & Theoretical Orientation: Physicochemical and biological characteristics of the samples were evaluated. The capability of the prepared scaffolds for vascularization and differentiation of mouse mesenchymal stem cells (MSCs) were also investigated.

Findings: A microporous structure with large porosity (95-98%) and appropriate pore size (120-200 μm) was observed for prepared samples. COL/βTCP scaffolds had a much higher compressive modulus than pure COL, while remaining porous with obvious flexibility. Apatite formation was confirmed by immersing the composite scaffold in simulated body fluid for 7 days. ALP assay revealed that porous COL/βTCP can effectively activate the differentiation of MSCs into osteoblasts. Composite scaffolds also promoted vascularization with good integration with the surrounding tissue.

Conclusion & Significance: Introduction of βTCP powder into the porous collagen matrix effectively improved the mechanical and biological properties of the collagen scaffolds, thereby making them potential bone substitutes for enhanced bone regeneration in orthopedic and dental applications.

Biography

Nafiseh Baheiraei has completed her PhD in Tissue Engineering at Tehran University of Medical Sciences in Iran. She has been working as an Assistant Professor since 2015 at Faculty of Medical Sciences, Tarbiat Modares University in Iran. The main focus of her research is on bone and cardiac tissue engineering. More specifically, she is interested in novel biomaterials for tissue engineering and regenerative medicine applications. Currently she focused on better techniques for fabricating new scaffolds containing electroactive moieties including conductive polymers and nanomaterials.

n.Baheiraei@modares.ac.ir

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