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Fabrication and Evaluation of Novel Biphasic Scaffold for Osteochondral Defect Repair

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Abstract

Every year more than 2.2 million bone graft procedures are performed to treat the bone defects worldwide, which costs approximately $2.5 billion. The osteochondral defects remain a critical problem in the reconstructive cartilage surgery. The prime causes of articular cartilage injuries are age-related degeneration, trauma and other diseases. Still, these defects owing to the dissimilar intrinsic healing abilities of subchondral bones and articulate cartilage tissues. Tissue Engineering has provided the greatest options for the restoration of the injured osteochondral tissues. For this purpose, one intact bio composite scaffold must be fabricated to sustain the reconstruction of both cartilage and subcondral bone. Therefore, a biodegradable biphasic scaffold material with its unique structure was developed for osteochondral bone defect repair. The upper chondral phase was a composite of polycaprolactone (PCL) and gelatin. The lower subchondral phase was a polycaprolactone-poly lactic-co-glycolic acid (PCL-PLGA)-beta tri-calcium phosphate composite. Both layers of the scaffold exhibited interconnected porous structures. The structural identification was performed by XRD (X-ray powder diffraction analysis), and SEM (scanning electron microscopy) techniques. The mechanical properties were also performed in order to check the compressive strength and overall porosity of the sample. As the consequence, this biphasic scaffold may be a promising material and open up new horizons in the field of osteochondral tissue engineering.

Keywords: Biphasic scaffold; Osteochondral regeneration; Mechanical properties; PCL; Gelatin

Recent Publications

1. Xiaqing Zhou, Gan Zhou, Radoslaw Junka, Ningxiao Chang, Aneela Anwar, et al. (2021) Fabrication of polylactic acid (PLA)-based porous scaffold through the combination of traditional bio-fabrication and 3D printing technology for bone regeneration. Colloids and Surfaces B: Biointerfaces 197.

2. Kumar Alok, Mohammad Mir Seyed , Aldulijan Ibrahim, Mahajan Agrim, Anwar Aneela, et al. (2020) Load-bearing biodegradable PCL-PGA-beta TCP scaffolds for bone tissue regeneration. Journal of Biomedical Materials Research Part B: Applied Biomaterials.

3. Zhou Gan, Wei Chang, Xiaqing Zhou, Chen Yifan, Futao Dai, et al. (2020) Nanofibrous Nerve Conduits with Nerve Growth Factors and Bone Marrow Stromal Cells Pre-Cultured in Bioreactors for Peripheral Nerve Regeneration. ACS Applied Materials & Interfaces.

4. Anwar Aneela, Akbar Samina, Kazmi Mohsin Ayesha, Sadiqa, Syeda Rubina Gilani (2018) Novel Synthesis and Antimicrobial Studies of Nanoscale Titania Particles. Ceramics International 44: 21170-21175.

5. Anwar Aneela, Rehman Ihtesham U, Darr Jawwad A (2016) Low Temperature Synthesis and Surface Modification of High Surface Area Calcium Hydroxyapatite Nanorods Incorporating Organofunctionalized Surfaces. The Journal of Physical Chemistry C 120: 29069-29076.

Biography

Fulbright Postdoctoral Fellowship from Stevens Institute of Technology, USA, PhD from University College London, UK, author of multiple cutting-edge publications, speaker at various International podia, Dr. Aneela, Associate Prof. of Chemistry and the Chairperson of Basic Sciences and Humanities Department, University of Engineering and Technology Lahore is instrumental in running the Environmental Science program owing to her matchless expertise. Her innovative research focuses on analysis of various high purity nanoscale biomedical materials for healthcare.

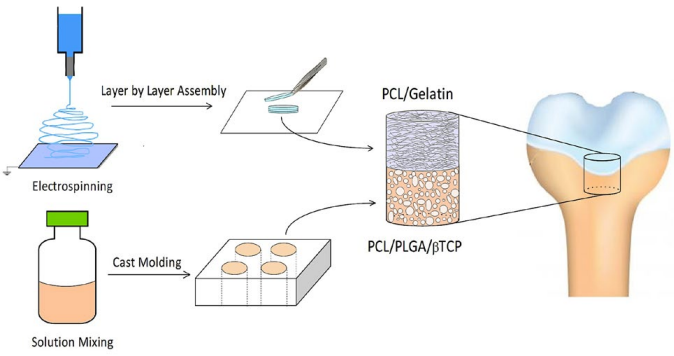

Figure 1: Schematic representation of biphasic scaffold formation for osteochondral defect repair.

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