COLLEGE OF ENGINEERING AND COMPUTER SCIENCE
FLORIDA ATLANTIC UNIVERSITY

Announces the Ph.D. Dissertation Defense of

Enze Qian

for the degree of Doctor of Philosophy (Ph.D.)

"Development of Multifunctional beta-Tricalcium Phosphate Scaffolds for Bone Tissue Regeneration"

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ABSTRACT OF DISSERTATION

Development of Multifunctional beta-Tricalcium Phosphate Scaffolds for Bone Tissue Regeneration

Rapid and efficient vascularization is still a considerable challenge of a tissue engineered β-tricalcium phosphate (β-TCP) scaffold. To overcome this challenge, branched channels were created in the porous scaffold to stimulate the instant flow of blood supply. The branched channeled porous β-TCP scaffold was fabricated by using 3D printing and template-casting method. human bone mesenchymal stem cells (hBMSC) and human umbilical vein endothelial cells (HUVEC) were seeded in the scaffolds and characterized through double-stranded DNA (dsDNA) assay, alkaline phosphatase (ALP) assay, and cell migration. Scaffolds were then implanted in the subcutaneous pockets in mice. Hematoxylin and eosin staining and Immunohistochemical staining on vascularization, bone-related markers were carried out. Results showed that branched channels significantly promoted HUVECs' infiltration, migration, proliferation and angiogenesis, and also promoted the proliferation and osteogenesis differentiation of hBMSCs. Scaffolds did not show significant pro-inflammatory effects. In vivo results showed that in the early stage after implantation, cells significantly migrated into branched channeled scaffolds compared to non-channeled and straight channeled scaffolds. More and matured blood vessels formed in the branched channeled scaffolds compared that in non-channeled and straight channeled scaffolds. Beside promoting vascularization, the branched channels also stimulated the infiltration of bone-related cells into the scaffolds. These results suggested that the geometric design of branched channels in the porous β-TCP scaffold promoted rapid vascularization and potentially stimulated bone cells recruitment.

BIOGRAPHICAL SKETCH
Born in Changzhou, Jiangsu, China
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M.S., Florida Atlantic University, Boca Raton, Florida, 2018

CONCERNING PERIOD OF PREPARATION
& QUALIFYING EXAMINATION

Time in Preparation: 2018 - 2023

Qualifying Examination Passed: Spring 2019

Published Papers:

Wen, N.; Qian, E.; Kang, Y. Effects of Macro-/Micro-Channels on Vascularization and Immune Response of Tissue Engineering Scaffolds. Cells 2021, 10, 1514. https://doi.org/10.3390/cells10061514

Wen, N.; Qian, E.; Kang, Y. Development and characterization of laponite-enhanced tannic acid-based hydrogels. Materials Letters 2023, 134116, https://doi.org/10.1016/j.matlet.2023.134116.

Qian, E.; Kang, Y. Engineering beta-Tricalcium Phosphate Scaffolds with Vascular-like Channels for Bone Tissue Regeneration – under review