May 20th, 12:30 PM

High Performance Amphiphilic Polymer/Hydroxyapatite Composite Tissue Scaffolds

Artem B. Kutikov
University of Massachusetts Medical School

Et al.

High performance amphiphilic polymer/hydroxyapatite composite tissue scaffolds.

Artem Kutikov, Jie Song
Department of Orthopedics and Physical Rehabilitation, Department of Cell and Developmental Biology
University of Massachusetts Medical School
55 Lake Ave North, Worcester MA, 01655

Contact:
Jie.Song@umassmed.edu
Phone: 508-334-7168

There is a critical clinical need for alternatives to autograft and allograft bone for over 500,000 bone grafting operations performed each year in the United States. Current synthetic bone grafts suffer from poor handling characteristics, brittle mechanical properties, and inconsistent bioactivity. By blending a biodegradable amphiphilic polymer with hydroxyapatite (HA), the main mineral component in bone, we developed an improved synthetic bone graft. The polymer/HA composites were fabricated in both 2-D and 3-D forms by electrospinning and 3-D printing. These materials exhibited unique handling characteristics such as high tensile elasticity (>200% failure strain) and self-stiffening properties upon hydration, allowing their facile/stabile fixation around an open defect or within a confined defect. They are also superhydrophilic, enabling the absorption of aqueous cell suspensions and protein therapeutics. We showed that bone marrow-derived mesenchymal stem cells (MSCs) readily attached to these scaffolds and expressed increased levels of osteogenic genes with and without osteogenic induction in culture. These scaffolds also supported the retention and sustained release of rhBMP-2. These high-performance composite materials are being explored for guided bone regeneration and skeletal tissue repair in various formats.