Public Abstract

First Name:Richard
Middle Name:Joseph
Last Name:Lebens
Adviser's First Name:Hao
Adviser's Last Name:Li
Co-Adviser's First Name:
Co-Adviser's Last Name:

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Title:THE STUDY OF HYDROXYAPATITE REINFORCED POLYLACTIC ACID COMPOSITES FOR ORTHOPEDIC APPLICATIONS

Polylactic acid and calcium phosphate ceramic composite are widely accepted in orthopedic fixation and are mainly replacing metal soft tissue fixation devices, such as interference screws and suture anchors. However, the critical disadvantages of poor biological properties and poor mechanical strength compared to metal devices have left much to be desired in bioabsorbable orthopedic implant materials. In order to develop a more ideal calcium phosphate based polymer composite material, we have conducted the following studies: i.) Synthesis of Hydroxyapatite nanofibers and microfibers (whisker), ii.) Fabrication and evaluation of HA/PLA composite's structure and processing methods, and iii.) An in-vitro immersion study of composite to simulate degradation behavior in vivo. After systematic evaluation and in depth analysis of the experimental results, it was concluded that: i.) the use of small loading rates of hydroxyapatite nanofiber, such as 5 wt%, significantly improve the mechanical strength and toughness, ii.) maintenance in mechanical strength was observed with 10 wt% hydroxyapatite nanofibers, 30 wt% hydroxyapatite whisker formed by molten salt method, and with 40 wt% hybrid composite of nanofiber and whisker (5 wt% HANF and 35 wt% HA whisker), iii.) in vitro immersion demonstrated hydroxyapatite's viability in a simulated physiological condition maintaining strength after 24 weeks immersion with 5 wt% hydroxyapatite composite, with no substantial physical changes, and iv.) surface modification demonstrated strength retention of 25 wt% Hydroxyapatite hybrid composite in an accelerated immersion study. These substantial improvements in the present study may greatly impact the development of absorbable hydroxyapatite/Polylactic acid (HA/PLA) composite for use in soft tissue fixation and likely experience the same improved biological properties with the high mass fraction of hydroxyapatite composites.