ONLINE ISSN : 1881-1361
PRINT ISSN : 0287-4547

Dental Materials Journal
Vol. 27 (2008) , No. 6 p.827-834

[PDF (758K)] [References]

Preparation of injectable 3D-formed β-tricalcium phosphate bead/alginate composite for bone tissue engineering

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(Received May 2, 2008)
(Accepted June 11, 2008)

Abstract:
A novel, injectable bone tissue engineering material was developed that consisted of β-tricalcium phosphate (β-TCP) beads as the solid phase and alginate as the gel phase. To prepare the instantaneously formed composite scaffold, an aqueous calcium chloride solution was dried on the surface of β-TCP beads and crosslinked with an alginic acid sodium solution, thereby forming stable β-TCP beads and alginate gel which were injectable *via* a syringe. This biodegradable composite was a three-dimensional (3D) material that could be used as an injectable scaffold for bone tissue engineering. In particular, the composite with 2.0 wt% alginate concentration exhibited a compressive strength of 69 kPa in dry conditions, which was significantly higher than that exhibited by 1.0 wt%. Furthermore, mesenchymal stem cells (MSC) were 3D-cultured within the composite and then investigated for osteogenic markers. MSC-loaded composite was subjected to scanning electron microscope (SEM) examination and implanted subcutaneously for *in vivo* experiment. Results showed that the scaffold provided support for osteogenic differentiation. In light of the encouraging results obtained, this novel injectable composite

material may be useful for bone tissue engineering.

Key words:
β-tricalcium phosphate (β-TCP) beads, Alginate, Injectable scaffold

To cite this article:

Tomonori MATSUNO, Yoshiya HASHIMOTO, Seita ADACHI, Kazuhiko OMATA, Yamauchi YOSHITAKA, Yasuyuki OZEKI, Yoshikazu UMEZU, Yasuhiko TABATA, Masaaki NAKAMURA and Tazuko SATOH. Preparation of injectable 3D-formed β-tricalcium phosphate bead/alginate composite for bone tissue engineering . Dent. Mater. J. 2008; 27: 827-834 .

doi:10.4012/dmj.27.827

JOI JST.JSTAGE/dmj/27.827