Preparation and evaluation of portland cement based scaffold for bone tissue engineering

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DEDICATION

To all whom I love

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INTRODUCTION

There is a constant need for bone substitutes due to severe bone injuries, degenerative diseases, and reconstructive surgery. Bone tissue engineering seeks to promote the regeneration of damaged or lost bone tissue through therapies based on a combination of scaffolds, growth factors, and cells. Ideal scaffolds for bone tissue engineering require three-dimensional interconnected porous structures and enough mechanical strength to provide structural support during bone growth and remodeling.(1)

Scaffolds provide physical support on which the cells can grow in three dimensional construct, and it is hoped that the cells will develop into new tissue with the same mechanical properties as a native bone.

Scaffolds are usually made of synthetic or naturally occurring materials responsible for supporting the growth of new tissue. However most of these materials are still far from completely fulfilling both the necessary biological and mechanical function in order to perform as scaffolds for bone tissue engineering. In addition to biocompatibility, load bearing capabilities and an interconnected structure with defined pore size, bone tissue engineering scaffold are also required to exhibit a bioactive behavior which means they should promote a strong osteointegration, and stimulate growth of bone cells.(2)

It has been proposed that some silica-containing materials are more bioactive, degradable and have shown higher bioactivity than calcium phosphate materials, further more silicon has long been recognized to have a role in neonatal bone formation and has been recognized as an agent for promoting the formation of new bone. [3]

A range of hydraulic calcium (alumino) silicate cements is currently being investigated with respect to their potential clinical use in dental and bone-contact applications. For the past decade, mineral trioxide aggregate (MTA), a proprietary formulation comprising 80 wt% Portland cement and 20 wt% bismuth oxide (to confer radiopacity) has been used as a root repair material in dentistry. Its reported biocompatibility and clinical success in the sealing of communications between the root canal system and the surrounding tissues. Such finding has prompted speculation that hydraulic calcium (alumino) silicate cements may also be appropriate for use in orthopedic repair. [4]

In this respect, recent researches has indicated that MTA and ordinary Portland cement pastes can support the production of new hard and soft tissues in *vivo* with minimal inflammatory response. Therefore the aim of this study was to prepare and evaluate a Portland cement based scaffolds for bone tissue engineering application.