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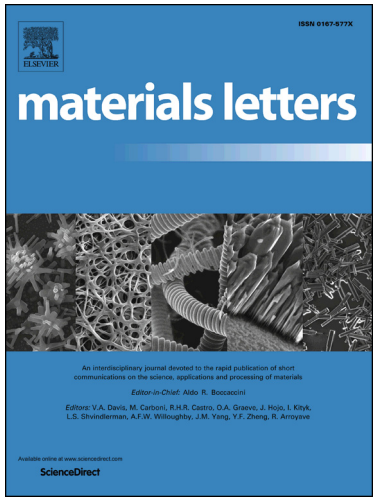

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Pilot Implantation Study Of A Borate-Glass Filled Hydrophilic Bone Cement

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Abstract

Hydrophilic composite-resin cements reinforced with highly degradable borate-glass may provide sustained strontium release to improve local bone quality. An 8 week pilot implantation study in a rabbit femoral defect model was conducted to evaluate the local response to new bone cement materials. The materials demonstrated favorable tissue responses with evidence of direct new bone formation. Counter to the literature, there were no beneficial effects associated with strontium releasing biomaterials. Nevertheless, highly hydrophilic glass filled cements may present benefit through rapid surface mineralization, and in vivo swelling, providing a press fit coupling to bone.

1. Introduction

Systemic strontium administration has been demonstrated to increase new bone formation and decrease bone resorption, resulting in increased bone density and strength[1]. These effects are recognized to be mediated through direct local signaling pathways, and as such antiosteoporotic effects may be possible through the local release of Sr^{2+} from biomaterials[2]. To provide such an effect, a strontium releasing borate-glass reinforced composite-resin bone cement has been investigated for therapeutic potential[3]. The cement comprises two principle differences to conventional resins (e.g. Cortoss); the incorporation of 45% HEMA (increasing hydrophilicity), and the utilization of degradable borate-glass filler (for strontium release). Together, this cement composition may allow for sustained and controlled release of strontium[3, 4].

However, given the substantive differences in composite chemistry, three critical issues arise. Firstly, it is important to understand if the local response after implantation will allow for sustained ion release (i.e. fibrous encapsulation eliminated or minimized). Secondly, if fibrous encapsulation occurs, it is important to establish if it has been mediated by changes to the organic versus inorganic compositional chemistry. Finally,