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Can alendronate-eluting biphasic calcium phosphate (BCP) scaffolds stimulate osteogenic differentiation?

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Introduction: This study was to investigate whether ALN/BCP scaffolds can effectively improve in-vitro osteoblast activity, osteogenic differentiation and to demonstrate whether ALN/BCP scaffolds have great potential for bone regeneration.

Methods & Materials: We developed ALN-eluting BCP (ALN/BCP) scaffolds as local delivery system for improving bone formation. Since ALN has a high binding affinity to the bone mineral hydroxyapatite (HAp), we fabricated ALN/BCP scaffolds by simply mixing BCP scaffolds with ALN. The coating of ALN on BCP scaffolds was confirmed by Scanning Electron Microscopy (FE-SEM), Energy-Dispersive X-ray Spectroscopy (EDS), and Attenuated Total Reflectance-Fourier Transform Infrared Spectroscopy (ATR-FTIR).

Results: An in-vitro release study showed that release of ALN from ALN-eluting BCP scaffolds was sustained for up to 28 days. In-vitro results revealed that MG-63 cells grown on ALN-eluting BCP scaffolds exhibited increased ALP activity and calcium deposition and upregulated gene expression of Runx2, ALP, OCN, and OPN compared with the BCP scaffold alone.

Conclusion: This study suggests that ALN-eluting BCP scaffolds have the potential to effectively stimulate osteogenic differentiation.

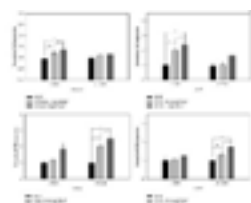


Figure 1: Bar charts showing ALP activity and calcium deposition of MG-63 cells on BCP, ALN/BCP, and ALN/BCP scaffolds at 7 and 28 days. The figure is divided into four quadrants: top-left (ALP activity at 7 days), top-right (ALP activity at 28 days), bottom-left (calcium deposition at 7 days), and bottom-right (calcium deposition at 28 days). Each quadrant shows three bars representing BCP, ALN/BCP, and ALN/BCP scaffolds. Error bars represent standard deviation.

Biography

Deok-Won Lee is an Oral and Maxillofacial Surgery Specialist and Associate Professor of Kyung Hee University College of Dentistry. His expertise is in treating and improving the oral and maxillofacial health and wellbeing of people. His research on dental implant materials creates new pathways for improving healthcare. He is continually building and investigating on adequate material for implantation through in-vivo and in-vitro models based on years of experience in research, evaluation, teaching and administration both in hospital and education institutions.

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