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Osteogenic differentiation enhancement by nano-layered growth and differentiation factor-5 coated onto zirconia

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Introduction: Zirconia (Zr) is also known as a biocompatible material with favorable mechanical properties as well as low plaque adhesion. In this study, we examined the efficacy of Zr coated with growth and differentiation factor-5 (GDF-5) bonded via click reaction as a substrate to support osteogenic differentiation of MC3T3-E1 cells.

Method & Materials: Pristine and surface-modified Zr surfaces were characterized by scanning electron microscopy (SEM) and X-ray photoelectron spectroscopy (XPS), resulting that GDF-5 was successfully coated to the pristine Zr surface. GDF-5 coated to Zr surfaces was released for 28 days in a sustained manner.

Results: New bone formation onto GDF-5 coated Zr (Zr/GDF-5) surface was confirmed by in vitro test including cell proliferation, alkaline phosphatase activity and calcium deposition assays, and in vivo test including real-time polymerase chain reaction (qPCR) assay including osterix (OSX), runt-related transcription factor 2 (Runx 2), COL 1 (type I collagen) and osteocalcin (OC). Cell proliferation, alkaline phosphatase activity, and calcium deposition of MC3T3-E1 cells were significantly enhanced when the cells were cultured on Zr/GDF-5. Additionally, the results of qPCR revealed that genes related with osteogenic differentiation were up regulated when the cells were cultured on Zr/GDF-5.

Conclusion: Our findings demonstrate that Zr/GDF-5 could be used as a material for enhancing the efficacy of osteogenic differentiation.

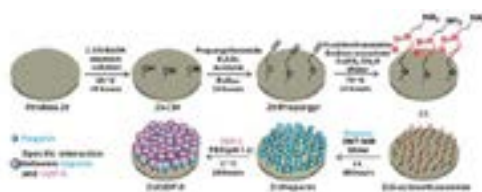


Fig. 1. Synthetic routes for Zr/GDF-5 preparation.

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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