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Osteoblast and osteoclast differentiation between magnesium and machined surfaced titanium

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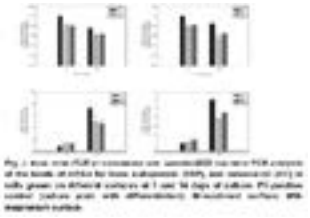
Introduction: This study focused on in vitro cell differentiation and surface characteristics in a magnesium coated titanium surface implanted on using a plasma ion source.

Methods & Materials: 40 commercially made pure titanium discs were prepared to produce Ti oxide machined surface (M) and Mg-incorporated Ti oxide machined surface (MM). Surface properties were analyzed using a scanning electron microscopy (SEM). On each surface, alkaline phosphatase (ALP) activity, alizarin red S staining for mineralization of MC3T3-E1 cells, and quantitative analysis of osteoblastic gene expression, were evaluated. Actin ring formation assay and gene expression analysis of TRAP and GAPDH performing RT-PCR were performed to characterize osteoclast differentiation on mouse bone marrow-derived macrophages (BMMs).

Results: MM showed similar surface morphology and surface roughness with M, but was slightly smoother after ion implantation at the micron scale. M was more hydrophobic than MM. No significant difference between surfaces on ALP activity at 7 and 14 days were observed. Real-time PCR analyses showed similar levels of mRNA expression of the osteoblast phenotype genes; osteopontin (OPN), osteocalcin (OCN), bone sialoprotein (BSP), and collagen 1 (Col 1) in cell grown on MM at 7, 14 and 21 days. Alizarin red S staining at 21 days showed no significant difference. BMMs differentiation increased in M and MM. Actin ring formation assay and gene expression analysis of TRAP showed osteoclast differentiation to be more active on MM.

Conclusion: Both M and MM have a good effect on osteoblastic cell differentiation, but MM may speed the bone remodeling process by activating on osteoclast differentiation.



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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