00389 Immune-modulated Bone Regeneration Using a Rabbit Calvarial Defect Model

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Aims: Reconstruction of bone due to surgically removed or disease-related bony defects is a clinical challenge. It is known that the immune system exerts positive immunomodulatory effects on tissue repair and regeneration. The purpose of this preliminary study was to evaluate the in-vivo efficacy of autologous neutrophils on osteogenesis and angiogenesis by using a rabbit calvarial defect model. In addition, combined effect of neutrophils with beta-tricalcium phosphate (β-TCP) on bone defect healing was also examined.

Methodology: Eighteen rabbits, each with two critical-sized calvarial bone defects (10mm diameter), were randomly divided into three groups (n=36). Group 1: single-application of neutrophils+fibrin carrier vs fibrin carrier alone (Control), Group 2: single-application of neutrophils+ β-TCP+fibrin carrier vs β-TCP+ fibrin carrier alone, Group 3: repetitive application of neutrophils+fibrin carrier vs fibrin carrier alone. Animals were sacrificed and the treatment outcomes were evaluated by micro-CT, histology and histomorphometry analyses at 4 and 8 weeks post operatively.

Result: Micro-CT analysis showed that application of neutrophils significantly induced more bone formation compared to the control at 8 weeks ($P<0.05$). Interestingly, repetitive application of neutrophils significantly increased the amount of new bone formation accompanied by new capillary vascular regeneration as compared with the control ($P<0.05$). In addition, immunohistochemistry results showed that expression of CD31 and OCN increased significantly in neutrophil groups compared to the control at 8 weeks which is an evidence for vessel and new bone formation. However, there was no significant difference in new bone formation in combined application of neutrophils with β-TCP as compared with β-TCP alone ($P> 0.05$).

Conclusion: The present in vivo study provides substantial evidence on the role of autologous neutrophils in promoting new bone formation and vascularization. This new strategy, if proven feasible in subsequent clinical studies, can be applied clinically in the field of oral and maxillofacial surgery, bringing enormous benefits to patients.