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Enhancement of Structural Bone Allograft Incorporation with Artificial Periosteum containing Autologous Mesenchymal Stem Cells

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Purpose: The Purpose of this study was to evaluate the effect of autologous mesenchymal stem cells (MSCs) on structural bone allograft healing.

Methods: Thirty New Zealand white rabbits were divided into two groups. Segmental bone defect was created on the diaphysis of femur, and the defect was reconstructed with structural bone allograft. In experimental group, structural allograft was wrapped around by artificial periosteum(Gelform) containing autologous MSCs, whereas in control group was not containing autologous MSCs. At 4th, 8th, 12th weeks, the femur of rabbits underwent radiographic studies for bone union, and histologic evaluations for bony union with various growth factors. Bone morphogenic protein-2 (BMP-2), BMP-7, vascular endothelial growth factor (VEGF) and receptor activator of nuclear factor-kappa B ligand (RANKL) were measured within the grafted artificial periosteal tissue to evaluate the influence of autologous MSCs on structural bone allograft incorporation.

Results: Bone union was not achieved in both groups at 4th and 8th weeks. At 12th weeks, three out of five femurs in experimental group were united, but no bony union was found in control group. Histologic findings were also confirmed the enhancement of the allograft incorporation in experimental group. All osteogenesis-related factors were increased in experimental group than control group, and the amount was the highest at 4th weeks.

Conclusion: Incorporation of the structural bone allograft could be enhanced if allograft is covered with artificial periosteum containing autologous mesenchymal stem cells.

Key Words: Structural allograft, autologous mesenchymal stem cells, enhancement of bone healing