Improved bone regeneration using cell-coated scaffolds

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Abstract

Critical bone defects resulting from trauma and abnormal skeletal developments, are all severe health challenges. Reconstruction of bone tissue defects is an important challenge in modern medicine. The matrix creates a complex network that determines the form of the tissue. In tissue engineering strategies, scaffolds provide three-dimensional spaces for proliferation and differentiation the cells. Characteristics of scaffolds for bone tissue engineering In general, scaffolds must be biocompatible. For reconstruct tissue defects by tissue engineering , several strategies have been proposed: a) conduct bone regeneration using scaffold, b) transplant autologous cells alone into the defect site, c) the use of scaffold with growth factors such as BMPs, d) the use of scaffolds coated with cells in which the scaffold serves as the carrier onto which cells can adhere and proliferate. In this way, the scaffold support the defect especially during the early stages of transplantation that the repair tissue is not yet formed. Bone marrow-derived mesenchymal stem cells (BM-MSCs) considered as a promising candidate for tissue engineering due to their ability of proliferation, multiple differentiation and ease of harvest. These multipotent cells can be expanded and differentiated to obtain connective tissue cells .The presence of mesenchymal stem cells within scaffolds increase the bone formation because MSCs directly involve in bone formation. Marrow-derived osteoprogenitor cells loaded onto hydroxy apatite or tricalcium phosphate would provide a more effective bone repair compared to cell-free HAC implants. For instance, MSC-ceramic constructs can repair defects in canine mandibolar bone better than scaffold alone. These effects result in enhanced bone formation in the scaffold-cell construct compared to scaffold alone.

Keywords: Tissue Engineering, Scaffold, Mesenchymal Stem Cell, Bone Defects

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