Normal and pathologic compact bone repair with bone tissue engineering in rabbits.

ABSTRACT

Restoration of skeletal integrity especially in cases with osteogenic inhibitory underlying diseases is still a challenging issue. The aim the current study was to investigate the effects of bone tissue engineering comprising of a combination of autologous osteoblasts and corticocancellous bone graft in repairing compact bone critical sized defect in normal and osteoporotic models. Implant of corticocancellous bone graft alone served as group one. Bone marrow-derived mesenchymal stem cell of 6 rabbits were cultured, differentiated into osteoblasts and seeded into scaffold of corticocancellous bone graft and implanted in the normal and osteoporotic rabbits as second and third groups respectively. Up to eight weeks radiographs were taken to evaluate the level of osteogenicity. Rabbits were euthanized on week eight postoperative and the implants were harvested for gross, histological and scanning electron microscope observation. In the implant of bone graft alone, the major bone formation pattern was creeping substitution. New bone formation at margin and osteogenesis at the centre of the defect were observed in the implant of tissue engineering bone in normal model, and bone formation pattern included osteogenesis, osteoconduction, and osteoinduction. New bone formation with very thin bone trabecullae penetrating through the entire defect in third group was the result in the last group; however, the new bone formation pattern was completely osteoporotic. As a conclusion, tissue engineering bone, constructed by corticocancellous bone graft and autogenous marrow-derived osteoblasts was more efficient than graft alone in bone formation capability. New bone regeneration and complete bone healing in normal and pathologic bone was possible only in eight weeks which implies it might be an ideal graft for bone defect repair.