

Treatment of Peri-Implant Defects in the Rabbit's Tibia with Adipose or Bone Marrow-Derived Mesenchymal Stems Cells

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ABSTRACT

Background: Mesenchymal stem cell (MSC) treatment in conjunction with bone graft materials or space filler can be an alternative to autogenous bone grafts in the treatment of peri-implant bone defects.

Purpose: To evaluate the success of bone regeneration capacity of adipose-derived and bone marrow-derived MSCs for the treatment of peri-implant bone defects when applied with a beta-tricalcium phosphate/collagen-based scaffold.

Material and Methods: Forty implants were placed into the tibiae of 10 rabbits bilaterally. Surgical defects created around the implants were treated with one the following treatment modalities: 1) adipose-derived MSC transplanted scaffold + collagen membrane; 2) bone marrow-derived MSC transplanted scaffold + collagen membrane; 3) autogenous bone + collagen membrane; and 4) collagen membrane only. The bone regeneration capacity of each technique was determined by histomorphometry, micro-CT, and measuring the implant stability by resonance frequency analysis.

Results: One limb of one rabbit was excluded because of fracture, and another limb was excluded because of infection. All parameters on 36 implants revealed that both sources of MSC can form equivalently new bone that is comparable with autogenous bone. The defects treated with membrane only had significantly less bone formation compared with other groups.

Conclusion: Both adipose-derived and bone marrow-derived MSC treatments are feasible alternatives to autogenous bone grafts in the treatment of peri-implant osseous defects.

KEY WORDS: dental implants, guided bone regeneration, mesenchymal stem cells, rabbit

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INTRODUCTION

Augmentation of the defects around dental implants is one of the most applied surgical procedures associated with dental implant surgery.¹ Several augmentation techniques and materials have been described in the literature. To date, autogenous bone grafts are considered the best graft materials due to their osteogenic capacity.² However, they require donor sites, and the patients' tolerance is less compared with the other techniques, in which no additional surgical site is created. Utilization of mesenchymal stem cells (MSCs) in conjunction with bone graft materials or space filler may add osteogenic features; thus, they can be alternatives to the autogenous bone grafts in the treatment of peri-implant bone defects.