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RESEARCH

Enhanced Bone Regeneration with a Novel Synthetic Bone Substitute in Combination with a New Natural Cross-linked Collagen Membrane: Radiographic and Histomorphometric Study”*

José Luis Calvo-Guirado, Maria P. Ramírez-Fernández,
Jose E. Maté-Sánchez, Negri Bruno, Pablo Velasquez
Piedad N. de Aza

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[1] José Luis Calvo-Guirado
[1] Maria P. Ramírez-Fernández
[1] Jose E. Maté-Sánchez
[1] Negri Bruno
[2] Pablo Velasquez
[2] Piedad N. de Aza

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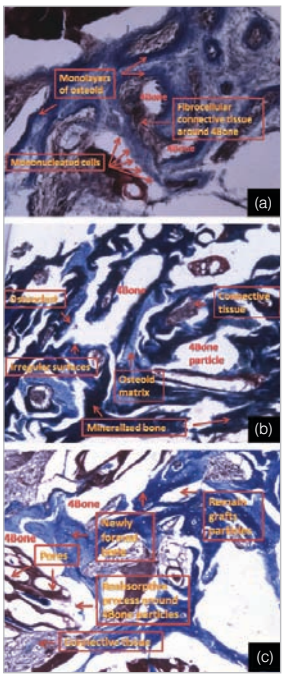

(a) Microscope detail of Group B (T.M. x 250) at 30 days. Monolayers of osteoblasts were seen actively secreting osteoid that bridged the gaps between grafted particles and the surrounding newly formed woven bone. (b) Microscope detail of Group B (T.M. x 250) at 45 days. Grafted bone presents an irregular surface due to osteoclastic activity with greater quantities of immature connective tissue. Higher magnification revealed newly formed bone surrounding and replacing portions of the synthetic graft particles. (c) Microscope detail of Group B (T.M. x 250) at 60 days. In this magnified view, new bone is seen forming along pore surfaces with the mineralized graft. Bone formation is in close contact with granules accompanying the particles' resorptive process. Remodeling of trabecular bone can be seen at this period.

Authors' affiliations

[1] Department of Implant Dentistry, Faculty of Medicine and Dentistry, University of Murcia, Murcia, Spain.

[2] Bioengineering Institute, Miguel Hernandez University, Elche, Spain.

SUMMARY.

Objectives

4BONE™ BCH is a fully synthetic bioactive bone substitute composed of 60% hydroxyapatite (HA) and 40% beta-tricalcium phosphate (β-TCP). This study aimed to investigate the effect of resorbable collagen membranes (4BONE™ RCM) on critical size defects in rabbit tibia filled with this novel biphasic calcium phosphate at 15, 30, 45, and 60 days by radiological and histomorphometric analysis.

Material and methods

Three critical size defects of 6mm diameter were created in both tibia of 20 New Zealand rabbits and divided into three groups according to the filling material: Group A (4BONE™ BCH), Group B (4BONE™ BCH plus 4BONE™ RCM), and Group C (unfilled control group). At each of the four study periods, five rabbits were sacrificed. Anteroposterior and lateral radiographs were taken. Samples were processed for observation under light microscopy.

Results

At the end of treatment, radiological analysis found that cortical defect closure was greater in Group B than Group A, and radiopacity was clearly lower and more heterogeneous in Group A cortical defects than in Group B. There was no cortical defect closure in Group C. Histomorphometric evaluation showed significant differences in newly formed bone and cortical closure in Group B compared with Groups A and C, with the presence of higher density newly formed bone in cortical and medullar zones.

Conclusions

Biphasic calcium phosphate functioned well as a scaffolding material allowing bone ingrowth and mineralization. The addition of absorbable collagen membranes enhanced bone gain compared with non-membrane-treated sites. This rabbit study provides radiological and histological evidence confirming the suitability of this new material for guided tissue regeneration of critical defects.