Journal of Cranio-Maxillo-Facial Surgery 43 (2015) 175–180

Contents lists available at ScienceDirect

Journal of Cranio-Maxillo-Facial Surgery

journal homepage: www.jcmfs.com

Comparison of osteoconductive properties of three different β-tricalcium phosphate graft materials: A pilot histomorphometric study in a pig model

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ARTICLE INFO

Article history:
Paper received 25 March 2014
Accepted 6 November 2014
Available online 15 November 2014

Keywords:
β-tricalcium phosphate
Osteoconductivity
Histomorphometry

ABSTRACT

Aims: The aim of this study was to compare the de novo bone formation ability and osteoconductive effects of three different β-tricalcium phosphate (β-TCP) graft materials. The micro-architectural parameters of the newly formed bone tissues were also compared among the different graft materials.
Material and methods: Eight male Swiss domestic pigs were used in the study. Five bony defects were made with a trephine bur. Three of the defects were filled with Cerasorb®, Kasios® and Poresorb®. The fourth defect was filled with an autogenous bone graft. The last defect remained empty. All subjects were sacrificed after 8 weeks.
Results: When compared to a negative control group, significant healing was observed in all the groups except the Cerasorb group. The osteoconductivity of the Poresorb group was better than that of the other groups ($p < 0.05$). The difference in the osteoconductivity of the Kasios and Cerasorb groups was statistically significant ($p < 0.05$). Comparison of the micro-architectural properties of newly formed bone tissues retrieved from the defects showed that those filled with Poresorb were the best.
Conclusion: β-TCP materials show different results in terms of the volume and characteristics of new bone formation, although they have a similar chemical structure.

1. Introduction

Bone regeneration techniques include surgical interventions performed to improve the quantity and quality of the bone at sites with inadequate bone volume. Autogenous bone grafts and other bone substitutes, including allogeneic, xenogeneic and synthetic biomaterials, are frequently used to induce osseous regeneration in oral and maxillofacial practice (Bernstein et al., 2006).

Currently, autogenous bone grafts are considered the gold standard (Hjorting-Hansen 2002). However, the amount of autogenous bone grafts that can be obtained is limited. Moreover, these grafts have disadvantages, such as morbidity and the need for additional surgical intervention (Noia et al., 2011).

Allografts were developed as an alternative to autogenous grafts. However, they have disadvantages, including demineralization and use of frozen tissue. The use of dehydrated human bone is also controversial. In addition, allografts carry the risk of transmission of infectious diseases (Buser et al., 1998). This risk led to the development of bone-like synthetic materials.

Natural and synthetic bone substitutes are widely used for bone regeneration due to their biocompatibility, osteoinductive/osteoconductive effects and lack of risk for antigenicity. The graft materials serve as a scaffold, and they are replaced by newly formed osseous tissue following graft resorption. These biomaterials provide both mechanical support and osteoinductive/osteoconductive activity to regenerating tissues (Artzi et al., 2004), which are favourable features of bone substitutes.

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http://dx.doi.org/10.1016/j.jcms.2014.11.006
1010-5182/