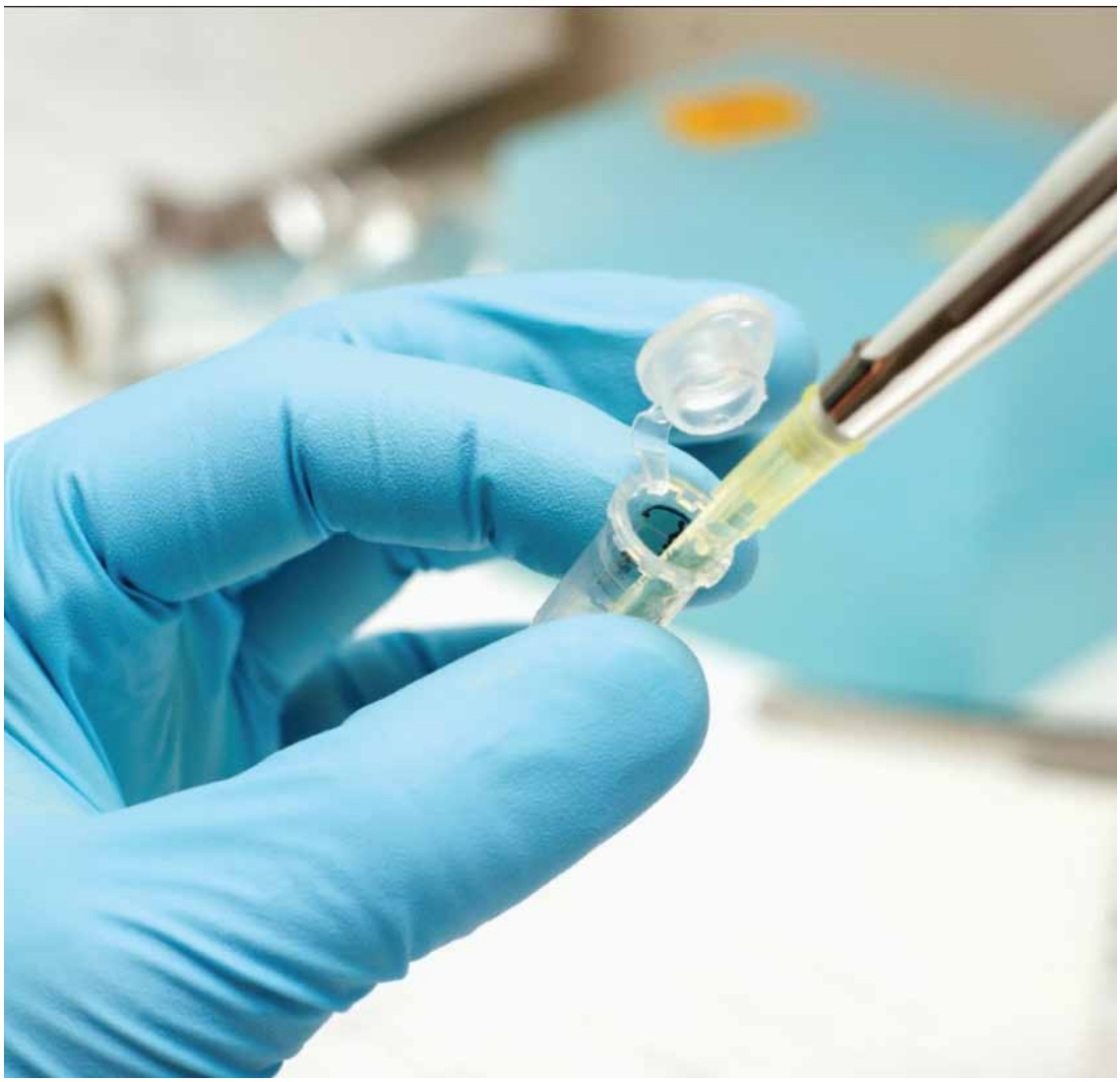
Tests de laboratorio



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REGENERATION SCIENCE

INSPIRED BY NATURE

OsteoBiol® by Tecnoss

LABORATORY TESTS

010

The performance of human periodontal ligament mesenchymal stem cells on xenogenic biomaterials

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ABSTRACT

Periodontal diseases are the most frequent cause of tooth loss, due to the destruction of the tooth supporting tissues. Consequently, the reconstruction of healthy periodontium is a major goal of periodontal therapy.
Mesenchymal stem cells from periodontal ligament (PDL-MSCs) hold great promise for bone regeneration. Most studies regarding the osteogenic differentiation of stem cells from periodontal tissue suggest that PDL cells may have many osteoblast-like properties, including the ability to form calcified nodules *in vitro*. This study *in vitro* investigated the use of autologous mesenchymal stem cells, easily obtained from oral tissues, seeded on a xenogenic porcine bone substitute, consisting of cortical porcine bone particles (OsteoBiol® *Apatos*, Tecnoss®, Giaveno, Italy). This grafting material is a xenogenic bone substitute consisting of sterilized cortical pig bone in the form of particles with a high porosity and with a diameter ranging from 600 to 1000 μm. This biomaterial appears physically identical to human bone and has been reported to be osteoconductive, well integrated in the host site and to show an incomplete resorption.
The results indicated high affinity of the cells towards the three-dimensional biomaterial. This scaffold was able to supply an excellent support for cell structures, with evident cellular proliferation and colonization on the bone substitute. Moreover, the examinations revealed that a considerable part of the surface of the biomaterial was covered and an elaborated form of attachment was evident.

CONCLUSIONS

As demonstrated by several studies, cortical porcine bone derived biomaterial may promote bone formation and can be used for maxillary sinus augmentation because it does not interfere with bone regeneration processes and implants osseointegration. Moreover, this study revealed that porcine bone-derived biomaterial did not interfere with the PDL-MSCs development, demonstrating an osseointegration process within the bone microenvironment. Consequently, it seems reasonable to suggest that the bone regeneration in oral and maxillo-facial surgery could be improved by this kind of hard scaffold, which has been shown to be perfectly biocompatible and able to support cell growth and differentiation.

Material tested

BONE SUBSTITUTE
OsteoBiol® *Apatos*

OsteoBiol® by Tecnoss

Physicochemical characterization of biomaterials commonly used in dentistry as bone substitutes - comparison with human bone

LABORATORY TESTS

026

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ABSTRACT

Xenografts have been regarded as promising alternatives to autografts, thanks to their unlimited supply of available material and because they can reduce morbidity by eliminating the donor site. The main purpose of this study was the characterization of a variety of granulate mineral-based biomaterials, chosen to encompass materials of different origins (bovine, porcine and coralline) and different types (cortical and cancellous bone and mineral based). The biomaterials examined included grafting materials of different origins: bovine (BioOss® and PepGen P-15®), porcine (OsteoBiol® *Gen-Os*®, Tecnoss®, Giaveno, Italy) and coralline (Biocoral®). These samples were tested with no further treatment. The results obtained for these biomaterials were compared with those of human bone. Besides a classical rationalization of chemichal composition and crystallinity, a major emphasis was placed on the measurement of various morphostructural properties, specifically particle size, porosity, density, and surface area. Each material was used in a granular form (easier to accommodate and more quickly resorbed) with the lowest particle size range available, recommended for application in the treatment of oral, periodontal, and maxillo-facial bone defects. Mercury intrusion revealed a significant variation in the samples porosity: 33% for OsteoBiol®, 50% for PepGen P-15®, and 60% for BioOss®. Moreover, it showed that a significant percentage of that porosity corresponded to submicron pores. Biocoral® was not analyzed by this technique as it possesses larger pores than those of the porosimeter upper limit. The density values determined for the calcined samples were close to the theoretical values of hydroxyapatite. However, the values for the collagenated samples were lower, in accordance with their lower mineral content. The specific surface areas ranged from less than 1 m^2/g (Biocoral®) up to 60 m^2/g (BioOss®).
FTIR spectra of OsteoBiol® *Gen-Os*® and natural human bone showed collagen bands clearly visible in addition to those of hydroxyapatite, while diffractograms of these samples represent the dual-phase composition: hydroxyapatite (sharp peaks) and collagen (broad band).

CONCLUSIONS

In evaluating these biomaterials, the Authors detected significant differences in terms of particle size, crystallinity, porosity and pore size distribution, surface area, and mineral content. Consequently, they concluded that *"although these morphological characteristics greatly influence the in vivo behavior of the samples, they are often not taken into consideration when the samples' biological performance is evaluated. This may be responsible for the conflicting results frequently found in the literature. It is believed that the results provided for the materials investigated will be most useful to fully interpret their clinical responses"*.

ORIGINAL ARTICLE
Journal of Biomedical Materials Research
2010 Feb;92(2):409-19

Material tested

BONE SUBSTITUTE
OsteoBiol® *Gen-Os*®

OsteoBiol® by Tecnoss

LABORATORY TESTS

070

Solid-state NMR and IR characterization of commercial xenogeneic biomaterials used as bone substitutes

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ABSTRACT

Thanks to their similarity to human bone tissue, xenogeneic biomaterials, mainly of bovine and porcine origin, are widely used as bone substitutes in the reconstructive surgery.
As in literature only a few works on commercial xenogeneic materials used for bone repair are available, the Authors decided to perform an elaborate characterization of three commercial xenogeneic biomaterials OsteoBiol® *Gen-Os*® (GO), *Apatos* Spongiosa (AS) and *Apatos Cortical* (AC), all from Tecnoss® srl (Giaveno, Italy) originated from porcine bone. Often used in dental surgery, AS and AC are produced from trabecular and cortical porcine bone, respectively. *Gen-Os*® is made of porcine bone, both cortical (25%) and trabecular (75%).
For the purpose of this study, these three xenogeneic biomaterials were characterized by various analytical methods, such as powder X-ray diffraction (XRD), thermogravimetry (TGA), high-resolution solid-state nuclear magnetic resonance (ssNMR) and infrared spectroscopy (FT-IR), focusing on their structural properties and chemical compositions.
The reported spectroscopic analyses are semi-quantitative and aimed at structural comparison of the examined materials. Moreover, as the samples do not require any chemical pre-treatment, those methods are not invasive and do not interfere with the material structure.

CONCLUSIONS

According to this study, it is evident that the main constituents of the analyzed biomaterials were nanocrystalline apatite mineral with the average crystal sizes similar to those in bone mineral. Moreover, they contain organic collagenous matrix composed mainly of collagenous proteins, but with the amino acid composition different than that in pure collagen type I. This difference in the protein structure may be a consequence of the manufacturing process of the raw bone.
The highest levels of water, organic matrix and apatite mineral were found in GO, AS and AC, respectively. The lowest levels of water, organic matrix and apatite mineral were found in AC, AS and GO, respectively.
The Authors conclude that *"solid-state NMR and FT-IR spectroscopies, applied together and accompanied by elaborate curve fitting analysis, provide valuable information on xenogeneic biomaterials"*.

Material tested

BONE SUBSTITUTE
OsteoBiol® *Gen-Os*®
OsteoBiol® *Apatos*